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Studying the Impact of Deferred Debts on Bank Performance by Using Data Envelopment Analysis

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Abstract

Performance evaluation has always been a challenging issue in management.The evaluation of performance especially during two past decades has attracted much attention because of its importance. Today, organizations try to measure the performance comparing with other competitors to be able to reach to a level of performance keeping them in market.

Banks and financial institutions are considered as the most important economic sectors performing the trades and commercial transactions by guiding and conducting the payments and getting the money to spread the markets and develop economic growth and prosperity. Due to the importance of the task, the increase of productivity is a matter of high necessity.

Data envelopment analysis is a nonparametric linear programming technique for evaluating the performance of Decision Making Units (DMU) by multiple inputs and multiple outputs.

In this paper, we focus on the deferred debts and impact of it's on bank performance. So, data envelopment analysis and statistical test are to present relation between deferred debts and efficiency used. The present research is to evaluate the performance of 40 bank branches in Iran. In order to achieve the goal, the performance of bank branches will be assessed by using Data Envelopment Analysis and GAMS software during 2013-2014 and based on the researches conducted.

Keywords: Data Envelopment Analysis, Efficiency, Bank, Malmquist Productivity Index.

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1. Introduction

Banking industry is considered one of the economic factors in all countries and the evaluation of their performance is of high importance. One of the ways for evaluating the performance of the banks or any other financial institution is to assess their productivity. Thus, any increase or decrease in productivity reflects the weakness or strength of the bank system. The first and most important step for improving the productivity is to measure it carefully.

Today, in the economy of countries, either developed or developing, productivity has been changed to a national priority. Productivity leads to economic growth, inflation control and makes possible achieving a high level of standard in people life. Hence, in present conditions, higher productivity and efficient use of existing resources practically is further than just a selection, but it has become a necessity. Examining the features of economic growth in developed and developing countries has represented that the share of labor and capital productivity is sometimes more than the share of investment increase.

Nowadays, sustainable development will be impossible by ignoring productivity rate and the factors affecting it in organizations. If the input of an organization is more than its output, it will be inefficient when facing economic and social crisis. In order to achieve the goal, inevitably,all organizations have to try smartly to find the ways for enhancing the productivity. (Gholamabri, 2014)

Efficiency and productivity are two most basic tools for industrial development, economic growth and social power in any country. It will provide the ability and power needed to address and solve many economic problems.

The significance of this research is where the bank considered as a company listed in Stock Exchange is in connection with a percentage of people in society (as shareholders and depositors) and it’s efficiency contains the proficiency of the shareholders and depositors. In other words, each activity will make optimal use of existing resources as a step in the economic development of the country.

Furthermore, calculating the efficiency scores will make a better identification of efficient and inefficient branches and resolve the causes of inefficiency as a complementary work for quantitative and qualitative development of the bank.

The following sections of this paper are presented as follows. Next section is devoted to a review of the literature.

Definitions, initial concepts and introduction to the basic models of DEA are dealt with in section 3. In section 4, the data collected are analyzed and then the performance of 40 branches of an Iranian bank are evaluated by DEA basic models. The conclusion obtained is finally written in last section.

2. literature

The banking industry has been the object of DEA analysis by a significant number of researchers and probably is the most heavily studied of all business sectors. Among the wide spectrum of modeling techniques in the banking sector Data Envelopment Analysis (DEA) is one of the most successfully used operational research technique in assessing bank performance. Due to its powerful optimizing ability, DEA allows management to objectively identify the best practitioners and the areas in need of improvement within the bank's complex operating situations. Although a considerable number of papers have been published on the banking industry using DEA since the technology was introduced, they mainly focused on studies at the institutional level. Paradi and Zhu found 275 DEA applications in the banking sector between 1985 and 2011, among them 195 studies examined banking institutions as a whole, but only 80 on the branch level. There are three survey papers that reviewed DEA applications in the banking industry. However, all of them focused on the studies that analyzed efficiency at the bank level. Berger and Humphrey in 1997, were the first to review five major efficiency analysis techniques including DEA that were typically used to examine the efficiency of financial institutions in order to make some useful comparisons between their average efficiency levels. Out of the total of 130 studies reviewed by them, there were 57 DEA based papers, 42 focusing on the bank level and 15 on the branch level. Berger in 2007 reviewed over 100 applications of frontier techniques that compared bank efficiencies across nations. Fethi and Pasiouras in 2010 reviewed 196 studies employing operational research and artificial intelligence techniques in the assessment of bank performance. Among the 196 studies, 151 of them used DEA-like techniques to measure bank efficiency and productivity growth, and only 30 studies focused on the branch level (Paradi et al,. 2013). But, in this paper, we focus on the deferred debts and impact of it's on bank performance. So, data envelopment analysis and statistical test are to present relation between deferred debts and efficiency used. Data envelopment analysis (DEA) is a non-parametric method to solve the problem by linear programming approach introduced by Charnes and colleagues in 1978 as CCR model and developed by Banker and colleagues in 1984 as BCC model. This technique is an appropriate method for assessing the efficiency of the units that use multiple inputs to produce multiple outputs. In DEA, there is an existence called Decision Making Unit in which the change of the inputs to outputs makes a single decision maker (DMU). A DMU may be a hospital, bank, university, shop, and so on. Of course, it must be considered that a DMU should have homogenous input and output to make the evaluation, calculation and comparison of efficiency possible and significant. (Cooper et al, 2002). To calculate the efficiency of DMUs by using DEA models, usually the efficiency scores are obtained between the values 0 and 1. When the efficiency of a DMU is closer to 1, it will be more efficient, but being closer to 0 means that it is more inefficient. A DMU is efficient when the efficiency score is just 1. Therefore, one of the most interesting and important topics in DEA concerns is the ranking of efficient units. The most important method presented is what Anderson and Peterson have developed in 1993 that had some deficiencies as well. Then, Jahanshahloo et al (2004), (2006), (2010) and (2013), have presented various methods for evaluating apical efficient units. Also, Gholam abri et al have introduced a model for the ranking of non-apical efficient units in 2013 by which the problems of previous approaches is resolved. In recent years, the use of DEA has been the subject of various fields. Therefore, in this study,the researchers have tried to study the evaluation of the performance and calculation of the efficiency in bank branches.

3. Methodology

DEA is a mathematical programming technique for evaluating or measuring the efficiency of DMUs so that each DMU uses a number of inputs to produce a number output. Consider DMU_j, $(j=1,\dots,n)$, where each DMU consumes m inputs to produce s outputs. Suppose that input and output observed vectors of DMU_j are **Error!** and **Error!** respectively, and let $X_j \geq 0$, $X_j \neq 0$, $Y_j \geq 0$, and $Y_j \neq 0$.

The production possibility set T_c is defined as:

Error!.

The above definition implies that CCR model is as follows, (Charnes et al., 1978):

$$\begin{aligned} &\text{Min} \quad \theta \\ &\text{S.t} \quad \sum_{j=1}^{n} \lambda_j x_{ij} \leq \theta x_{io} \qquad i=1,2,\ldots,m \\ &\qquad \sum_{j=1}^{n} \lambda_j y_{rj} \geq y_{ro} \qquad r=1,2,\ldots,s \qquad (1) \\ &\qquad \lambda_j \geq 0 \qquad j=1,2,\ldots,n \end{aligned}$$

The above model is known as envelopment model of CCR in input nature.

In this model, $0 < \Theta^* < 1$. That is, above linear programming problem has an optimal finite solution.

Moreover, the production possibility set T_v is defined as:

Error!.

The above definition implies that BCC model is as following, (Banker et al., 1984):

$$\begin{aligned} &\text{Min} \quad \theta \\ &\text{S.t} \quad \sum_{j=1}^{n} \lambda_j x_{ij} \leq \theta x_{io} \qquad i=1,2,\ldots,m \\ &\qquad \sum_{j=1}^{n} \lambda_j y_{rj} \geq y_{ro} \qquad r=1,2,\ldots,s \\ &\qquad \sum_{j=1}^{n} \lambda_j = 1 \qquad (2) \\ &\qquad \lambda_j \geq 0 \qquad j=1,2,\ldots,n \end{aligned}$$

Data envelopment analysis models assessing decision making units are unable to discriminate between efficient DMUs. The discrimination of these efficient units is an interesting subject matter. For ranking decision making units, an important model is proposed by Andersen and Petersen (AP) as:

$$\begin{aligned} &\text{Min} \quad \theta \\ &\text{S.t} \quad \sum_{j=1, j\neq o}^{n} \lambda_j x_{ij} \leq \theta x_{io} \qquad i=1,2,\ldots,m \\ &\qquad \sum_{j=1, j\neq o}^{n} \lambda_j y_{rj} \geq y_{ro} \qquad r=1,2,\ldots,s \quad (3) \\ &\qquad \lambda_j \geq 0 \qquad j=1,2,\ldots,n \end{aligned}$$

As it is known, the efficiency score of efficient units will be more than 1 by AP ranking model. The larger the ranking score calculated, the better the performance of this unit and ranking.

Definition 1 (Reference Set). For a DMU_o, the reference set E_o will be:

$E_o=\{j|\lambda^*_j>0$, in some optimal solution to model (1) or (2)$\}$ (Gholam Abri et al., 2013).

Definition 2 (Pareto-Koopmans Efficiency). A DMU is fully efficient, if and only if, it is not possible to improve any input or output without worsening some other input or output, (Jahanshahloo et al., 2011).

Definition 3. A DMU_o is extremely efficient, if and only if it satisfies the following two conditions:

(i) It is efficient(Pareto-Koopmans Efficient).

(ii) $|E_o|=1$. (Gholam Abri., 2013).

In 1953, Sten Malmquist, a swedish economist and statistician introduced the foundations of a productivity index which now is called by his own name. Malmquist DEA-based productivity index evaluates the changes of productivity during the time. It can be divided to 2 components: the first evaluating the change in the technical efficiency and the other evaluating the technology frontier. Here, it is presented between the times "t and t+1". Suppose that input and output observed vectors of DMU_j in period t are **Error!** and **Error!**, respectively. So, in order to calculate Malmquist productivity index, four models of BCC will be considered as follows:

The above definition implies that the BCC model in the period t is as follows:

$$
\begin{aligned}
& D_\circ^t(x_\circ^t, y_\circ^t) = \min\ \theta \\
s.t\ & \sum_{j=1}^{n} \lambda_j x_{ij}^t \le \theta x_{io}^t \qquad i = 1,2,\dots, m \\
& \sum_{j=1}^{n} \lambda_j y_{rj}^t \ge y_{ro}^t \qquad r = 1,2,\dots, s \\
& \lambda_j \ge 0 \qquad j = 1,2,\dots, n
\end{aligned} \tag{4}
$$

Moreover, the BCC model in the period t+1 will be as follows:

$$
\begin{aligned}
& D_\circ^{t+1}(x_\circ^{t+1}, y_\circ^{t+1}) = \min\ \theta \\
s.t\ & \sum_{j=1}^{n} \lambda_j x_{ij}^{t+1} \le \theta x_{io}^{t+1} \qquad i = 1,2,\dots, m \\
& \sum_{j=1}^{n} \lambda_j y_{rj}^{t+1} \ge y_{ro}^{t+1} \qquad r = 1,2,\dots, s \\
& \lambda_j \ge 0 \qquad j = 1,2,\dots, n
\end{aligned} \tag{5}
$$

Continually, the first measure of the mixed periods defined as **Error!** for each **Error!** is calculated as the optimal value to the following linear programming problem:

$$
\begin{aligned}
& D_\circ^{t}(x_\circ^{t+1}, y_\circ^{t+1}) = \min\ \theta \\
s.t\ & \sum_{j=1}^{n} \lambda_j x_{ij}^{t} \le \theta x_{io}^{t+1} \qquad i = 1,2,\dots, m \\
& \sum_{j=1}^{n} \lambda_j y_{rj}^{t} \ge y_{ro}^{t+1} \qquad r = 1,2,\dots, s \\
& \lambda_j \ge 0 \qquad j = 1,2,\dots, n
\end{aligned} \tag{6}
$$

Similarly, the other measure of the mixed periods as **Error!**, is calculated as the optimal value to the following linear programming problem:

$$
\begin{aligned}
& D_\circ^{t+1}(x_\circ^{t}, y_\circ^{t}) = \min\ \theta \\
s.t\ & \sum_{j=1}^{n} \lambda_j x_{ij}^{t+1} \le \theta x_{io}^{t} \qquad i = 1,2,\dots, m \\
& \sum_{j=1}^{n} \lambda_j y_{rj}^{t+1} \ge y_{ro}^{t} \qquad r = 1,2,\dots, s \\
& \lambda_j \ge 0 \qquad j = 1,2,\dots, n
\end{aligned} \tag{7}
$$

Färe et al. (1992) decomposed their Malmquist productivity index (MPI) into two components:

Error!

The first part, **Error!**, evaluates the change in technical efficiency.

The second part, **Error!**, evaluates the technology frontier shift between the period t and t+1.

$MPI > 1$ denotes the productivity growth, $MPI < 1$ denotes the productivity decline and $MPI = 1$ corresponds to the stagnation.

As said before, the bank under study by a capital of 40 trillion riyals recorded, and approximately 2968 branches and kiosks and as the largest private bank all over the country, is a key and vital issue in country's economic structure. So, the efficiency of this organization contains the public interest of the society.

Therefore, in order to calculate the efficiency of 40 bank branches under study, ,input and output variables are determined at first. The selection of input and output variables is the most important step in implementing DEA models. Based on what have been studied, expert's views and financial data available, critical variables as inputs are: area, number of employees, personnel experiences, personnel education and deferred items per branch. Also, output variables include public income, personal income, current accounts remained,deposits remained (non-current accounts) and remained facilities (live) per branch. The variables have been schematically illustrated in table 1 and figure 1. Due to the first study in the presence of undesirable outputs carried out by Liu and Sharp in 1999, these adverse factors (accruals) are considered as input. According to this report, each DMU tries to increase the efficiency by minimizing desirable inputs and undesirable outputs while maximizing favorable outputs and unfavorable inputs. Therefore, since there is just one undesirable output, it is considered as input when evaluating the branches.

Definition 4 (Accruals). Accruals include past receivable payments, deferred items, doubtful payments caused by receivable loans and reliabilities due to opening of the credits paid, doubtful but paid guarantees caused by the credit and guarantees taken.

Inputs	Outputs
1. Space	1. Public income
2. Personnel number	2. Personal income
3. Personnel experience	3. Current accounts remained
4. Personnel education	4. Deposits remained
5. Deferred items	5. Remained facilities

Table1: Input and Output variables used in the evaluation of the branches

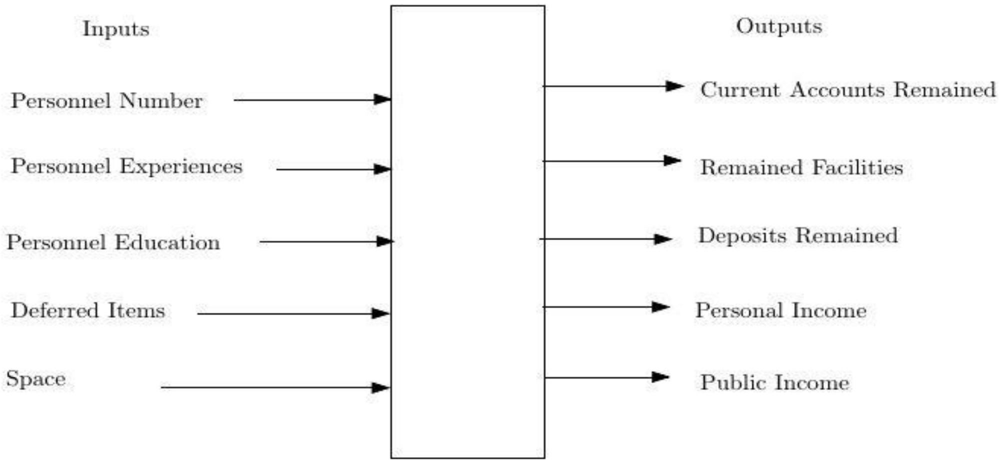

Fig 1. Schematic illustration of inputs and outputs when evaluating the branches

The experience of the personnel that is a range to be converted to numerical scale in input 3 of table 2, 3 based on the personnel experiences including "1-5", "6-10", "11-15", "16-20", "21-25", "26-30" and "30-more", are ranked based on the scale 1, 2, 3, 4, 5, 6, 7 and then represented as the weighted number of personnel experience in numerical scale. The education of the personnel that is a range to be converted to numerical scale in input 4 of table 2, 3 based on the personnel education including "low literate", "diploma", "associate", "BA", "MA", "PhD", are ranked based on the scale 1, 2, 3, 4, 5, 6 and then represented as the weighted number of personnel education in numerical scale.

4. Solving the Model and Analyzing the Data

As mentioned above, input variables include the work place, number of employees,personnel experiences, personnel education and accruals per branch during the years 2013 and 2014 respectively arranged in Tables 2 and 3.

DMUs	Input1	Input2	Input3	Input4	Input5	Output1	Output2	Output3	Output4	Output5
1	350	16	67	67	109002	4271	23178	106591	474721	115066
2	141	15	68	52	60239	911	17220	114241	968744	92665
3	85	8	32	26	29748	3515	8899	78281	98711	46127
4	96	13	61	43	81233	20084	19351	105257	227875	54902
5	86	10	37	41	632	405	6179	54249	132429	47168
6	147	10	44	31	54929	626	13830	47055	152889	72673
7	545	22	104	84	94797	14663	85912	374193	354307	433469
8	205	18	86	69	69880	7699	599264	110252	138386	115099
9	350	17	76	60	15316	2823	45881	511481	360623	249736
10	156	10	46	31	63628	2264	66070	133145	174546	245976
11	108	15	75	51	27589	7099	43259	171073	150453	174806
12	217	12	56	40	52067	1842	23930	107893	85785	102062
13	342	10	40	36	43710	801	14238	306955	209356	59399
14	513	15	66	56	55660	1162	44794	244167	351460	150818
15	372	12	52	43	19832	670	18794	99797	136316	95829
16	230	34	151	126	1661204	446704	581038	239773	1251220	6768510
17	350	14	65	48	75655	43177	24384	115818	1456910	267962
18	500	29	129	110	475866	15236	163977	1774471	925569	683576
19	605	22	99	85	130357	5971	205667	145286	365248	238581
20	350	32	135	119	936649	66869	484996	362670	1249774	2429181
21	138	13	53	45	84112	1227	35221	182281	156208	113016
22	262	10	44	36	7026	444	6704	71526	121131	51204
23	190	15	63	57	6810	827	36443	231509	210818	146687
24	223	8	32	30	905	378	2204	12288	92584	14016
25	220	12	52	38	9593	577	14874	23293	108649	66647
26	193	11	48	35	13364	529	4744	36002	101979	27252
27	160	15	69	44	5578	1970	20137	62102	147690	111198
28	269	13	54	45	9067	830	17633	50516	208761	97473
29	443	26	112	104	174400	18766	64894	387338	599079	320557
30	175	18	85	67	54954	3711	68718	175026	660054	336275
31	290	11	51	36	82332	1722	31351	50566	205991	102344
32	90	14	65	50	7162	760	11191	179690	231544	73487
33	221	10	43	35	70915	10612	14240	48703	178366	64369
34	144	10	43	33	12258	804	11837	113509	77828	67952
35	422	21	95	82	14730	2664	34620	197507	312336	200842
36	170	14	59	43	5479	443	41698	179791	162590	44912
37	210	10	43	36	10971	742	7656	32321	102804	40036
38	258	10	42	30	2951	537	6356	19939	122182	40029
39	45	8	33	26	2775	944	8063	191903	163299	59688
40	300	11	45	39	41085	1500	32242	68884	138899	93172

Table 2: input and Output matrix in 2013.

DMUs	Input1	Input2	Input3	Input4	Input5	Output1	Output2	Output3	Output4	Output5
1	350	16	67	67	111812	3901	29797	166456	318652	156345
2	141	15	68	52	59484	8402	18253	165004	369375	93210
3	85	8	32	26	1718	6115	11358	47066	99537	61719
4	96	13	61	43	28477	16769	19112	252982	285398	113358
5	86	10	37	41	1287	913	9543	65750	184815	60940
6	147	10	44	31	51542	1157	12717	97105	315378	67606
7	545	22	104	84	17258	23782	97089	250980	502635	511965
8	205	18	86	69	60957	386993	25389	136361	289554	172541
9	350	17	76	60	17604	5907	44856	374805	416770	184797
10	156	10	46	31	73750	4580	54850	92111	175332	286749
11	108	15	75	51	7360	59607	49874	139302	216827	234366
12	217	12	56	40	47406	5747	22198	139093	133389	83519
13	342	10	40	36	31302	5737	12691	104254	179711	73481
14	513	15	66	56	58054	7563	34557	308180	832914	187685
15	372	12	52	43	2267	3761	16239	75484	219178	96442
16	230	34	151	126	1607121	237156	518547	335770	2669835	6810981
17	350	14	65	48	76029	12102	51301	312317	1659185	278910
18	500	29	129	110	248599	21410	168124	2231436	1741192	1572440
19	605	22	99	85	84699	8471	153714	166343	536143	205209
20	350	32	135	119	454792	236401	498208	363876	1403113	2431497
21	138	13	53	45	72610	10702	26487	204083	356229	101184
22	262	10	44	36	7552	1462	10300	87162	337759	66251
23	190	15	63	57	5832	3742	26757	208199	469982	139374
24	223	8	32	30	2446	983	3649	24013	161885	22980
25	220	12	52	38	8397	2066	11916	43186	163090	57317
26	193	11	48	35	12548	1126	4964	48809	127069	27062
27	160	15	69	44	2668	3263	22738	470031	247805	169028
28	269	13	54	45	6737	2084	18394	85401	254133	104628
29	443	26	112	104	103062	79593	77129	274557	809229	326269
30	175	18	85	67	30624	20302	87627	143935	922685	265198
31	290	11	51	36	46685	6959	22558	57743	226523	129860
32	90	14	65	50	9576	1770	15186	403657	383686	91094
33	221	10	43	35	73708	6448	14810	97178	233343	55171
34	144	10	43	33	8998	4263	15560	119148	87437	75122
35	422	21	95	82	18518	27780	49484	171022	562529	352021
36	170	14	59	43	2692	1312	8645	205982	275765	49031
37	210	10	43	36	15035	1866	8462	50799	117256	43237
38	208	10	42	30	1474	1191	7711	51814	169677	49325
39	258	8	33	26	146	3771	12108	200207	169788	94531
40	300	11	45	39	18612	4077	33997	134714	209166	146746

Table 3: Input and Output matrix in 2014

DMUs	EF-BCC 2013	AP-BCC 2013	EF-BCC 2014	AP-BCC 2014	MALM 2013-2014
1	0.623	0.623	0.572	0.572	1.021
2	1	1.649	0.597	0.597	0.499
3	1	1.048	1	1.039	4.149
4	0.818	0.818	0.75	0.75	1.689
5	1	3.578	0.898	0.898	1.286
6	0.853	0.853	0.908	0.908	1.791
7	0.731	0.731	1	3.530	2.277
8	1	245.266	1	26.364	1.072
9	1	6.141	0.908	0.908	0.872
10	1	1.025	1	1.102	0.877
11	0.926	0.926	1	2.254	4.07
12	0.697	0.697	0.706	0.706	1.185
13	0.999	0.999	0.837	0.837	0.576
14	0.682	0.682	0.747	0.747	1.393
15	0.688	0.688	0.744	0.744	2.6
16	1	1.101	1	2.887	0.663
17	1	25.998	1	2.982	1.201
18	1	1.262	1	3.311	1.55
19	0.57	0.570	1	1.026	1.013
20	1	1.481	1	2.664	1.309
21	0.677	0.677	0.727	0.727	1.442
22	0.799	0.799	0.956	0.956	2.461
23	1	1.156	1	1.939	1.322
24	1	1.250	1	1.027	1.347
25	0.697	0.697	0.684	0.684	1.224
26	0.742	0.742	0.745	0.745	1.286
27	1	1.018	1	7.301	2.237
28	0.751	0.751	0.686	0.686	1.253
29	0.553	0.553	0.64	0.64	2.056
30	1	1.281	1	1.963	1.319
31	0.792	0.792	0.781	0.781	1.36
32	0.924	0.924	1	1.569	1.68
33	0.854	0.854	0.833	0.833	1.109
34	0.808	0.808	0.816	0.816	1.464
35	0.831	0.831	0.952	0.952	2.139
36	0.661	0.661	0.853	0.853	1.287
37	0.799	0.799	0.795	0.795	2.302
38	0.879	0.879	0.866	0.866	1.814
39	1	2.523	1	13.286	5.504
40	0.778	0.778	0.900	0.900	1.822

Table 4: The Results of BCC and Anderson-Peterson Models and Malmquist Productivity Index During 2013-2014

In addition, output variables include personal income, public income, current account remained, deposit remained and the facilities remained (Live). Each branch is set for the years 2013 and 2014 respectively in tables 2 and 3. In this paper, BCC model is used to evaluate the performance of the branches for more diversity and better results. Therefore, the efficiency of 40 bank branches under study is calculated by using BCC and Anderson-Peterson models and GAMS software. Also, the changes in the productivity of the branches in 2014 are represented by comparing with what obtained in 2013. They are shown in table 4.

As seen in table 4, the results of BCC model represent that, among all bank branches evaluated in 2013, 15 branches (listed in the rows 2, 3, 5, 8,9, 10, 16, 17, 18, 20, 23, 24 , 27, 30, and 39) have the efficiency score 1 and so efficient. But, the rest of the branches are inefficient. Also, in 2014, about 16 branches(the rows 3, 7, 8, 10, 11, 16, 17, 18, 19, 20, 23, 24, 27, 30, 32 and 39) have the efficiency score 1 and then efficient in 2014. The rest branches are inefficient. In the above table, Anderson-Peterson model is used for ranking the branches in the years 2013 and 2014. Respected to the score obtained, the ranking of the banks are as follows:

In 2013, the branches in rows 8, 17, 9, 5, 39, 2, 20, 30, 18, 24, 23, 3, 10 and 27 respectively have the highest scores in efficiency among all branches evaluated.

In 2014, the branches in rows 8, 39, 27, 7, 18, 17, 16, 20, 11, 30, 23, 32, 10, 3, 24 and 19 respectively have the highest score in efficiency among the branches assessed.

In the table above (Column related to the results of Malmquist productivity index model) it is considered that, except 5 branches (the rows 2, 9, 10, 13 and 16), all other branches (35 branches) have grown in 2014 compared to the performance in 2013. Furthermore, as discussed past, debts is considered as undesirable output and 5th input. By a little attention in the results of the years 2013 and 2014, it has a direct but negative effect on the efficiency scores of the branches. That is, the more the deferred liabilities of a branch, the higher the efficiency score and the less the deferred debts and the more the efficiency score of the branch. For example, the branch in the row 29 have the highest deferred debts that is exactly the same branch by lowest efficiency score 0.553 in 2013.

4.1. Relationship between Deferred Debt and Branch Efficiency (Statistically)

To identify the magnitude and the relationship between deferred debts and efficiency, correlation coefficient should be used. It is necessary, before selecting the type of correlation coefficient, to judge about the normality of the distribution by the help of Sample Kolmogorov-Smirnov (KS).

Table 5: shows that the size of significance for the efficiency scores in 2013 and 2014 is smaller than 0.05. That is, the distribution of efficiency scores is not normal in the years 2013 and 2014. So, Spearman correlation coefficient should be used.

4.2. Relationship between Deferred Debts and Efficiency of Branches in 2013 Correlations

Table 6: Using Spearman correlation coefficient by SPSS, the statistics have shown that the size of the correlation coefficient (-0.144) is between two variables under the study. This means that there is an inverse relationship between deferred debts and efficiency score of the branches. In other words, the branches by more deferred debts have smaller efficiency score.

4.3. Relationship between Deferred Debts and Efficiency of Branches in 2014 Correlations

Table 7: Applying Spearman correlation coefficient method by the help of SPSS software has represented that the size of correlation coefficient is -0.63 between two variables studied. This means that an inverse relationship exists between deferred liabilities and efficiency score of the bank branches. In other words, the branches by more deferred debts have smaller efficiency score.

One-Sample Kolmogorov-Smirnov Test	BCC 2013	BCC 2014
N= Number of DMU	40	40
Normal Parameters Mean	0.85330	0.87255
Std. Deviation	0144025	0.134096
Most Extreme Differences Absolute	0.244	0.229
Positive	0.154	0.171
Negative	-0.244	-0.229
Kolmogorov-Smirnov Z	1.544	1.449
Asymp.Sig. (2-tailed)	0.017	0.030

Table 5: Statistical Results

Correlations	
Correlation Coefficient	-0.144
N= Number of DMU	40

Table 6: The Relationship in 2013

Correlations	
Correlation Coefficient	-0.63
N= Number of DMU	40

Table 7: The Relationship in 2014

5. Conclusion

Efforts for improving the effective use of various resources like labor, capital, materials, energy and information are the purpose of all production and service activities. Human capital plays a vital role in industrial and economic development. Today, workforce is no longer considered as a quantitative factor in the development. But, the quality and efficiency of the workforce is highly regarded. Key issue in increasing the efficiency of labor is not to create the wealth. However, it is to make capacities as the creator of the wealth. The increase of capacity is due to the human factor.

As said before, this study is to estimate and evaluate the efficiency of a leading bank in the country. Thus, to get the goal, the data and statistics of the years 2013 and 2014 are used. As a result, after evaluating these branches, 15 branches of 40 branches in 2013 are efficient and 16 branches of 40 branches in 2014 are efficient. So, 12 branches are efficient in both the years under study. But, as mentioned previously, because the basic models DEA are unable to rank efficient units, Anderson and Peterson model is used for ranking efficient units. The results are written in Table 6. 8th branch has the first ranking in both 2 years by a considerable distance to other branches. In addition, to determine the progression or regression of the units, Malmquist productivity indexes are used and the results are considered in last column of the table.

Also, this research pays a considerable attention to doubtful debts (overdue) of the branches. It is clear that this the indicator is introduced as an undesirable output (desired input). The findings represent that the greater the deferred debts of a branch, the smaller the efficiency score, and the smaller the deferred debts of a branches, the greater the branch the efficiency score. Statistical analysis also confirm the results obtained.

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