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Performance Evaluation of Banks Using DEA (Case study: Guilan Saderat Bank Branches)

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Abstract

Performance evaluation has been developed in the form of management schools along by managerial thought development. Banks and financial institutes are one of the most important economic sections to each country which by receipts and payments directing and organizing facilitate business and commercial transactions and develop markets and economic growth and as the main pillars in directing and managing dispersed funds toward production units and regulate cash flow, have specific place in economic growth and inflation control. Therefore, it is necessary for banks to be aware about their branches efficiency and take revision techniques into account for their future planning. In this paper BCC and CCR models (output-oriented) have been used to evaluate the efficiency of 29 sample Saderat bank branches in Guilan Province.

Keywords: Data Envelopment Analysis (DEA), Efficiency, Bank Branches.

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1. Introduction

Performance evaluation has been developed in the form of management schools along by managerial thought development. Performance appraisal began with F.W. Taylor around the end of the nineteenth century. According to scientific management theory, measurement of tasks and processes provided useful information on which to base improvements in working methods, plant designs, etc (Amaratunga and Baldry, 2002).

There are various factors which improve sustainability and competitiveness situation of a company in a world wide open space e.g. long-term planning, correct definition of objectives, researches, innovation and creativity in the organization, products and services quality, human resource training and continuous appraisal, technology management, etc.

Current era which researchers call it postmodern, owns the characteristics of continuous change and complex structures. Under such a situation only managers can perform successfully who have updated and integrated information on their organization performance and can make on time and correct decisions to improve their organization continuously based on current changes (Saremi and Malaei, 2003). Therefore, What today is referred as the main problem of management is how to face and how to react against environmental changes.

On the other hand, banks and financial institutes are one of the most important economic sections to each country which by receipts and payments directing and organizing facilitate business and commercial transactions and develop markets and economic growth (Hassanzadeh, 2008).

Banks as the main pillars in directing and managing dispersed funds toward production units and regulate cash flow, have specific place in economic growth and inflation control.

Therefore, performance evaluation (efficiency) of each bank is necessary. In this way, top managers have to logically answer the questions about bank productivity and it is impossible without evaluating the efficiency of their branches. In addition, bank management always have to revise and improve bank services, evaluation, budgeting, innovation in services, competing with other banks, and finally increasing efficiency among their branches based on economic circumstances in now and future time. Therefore, it is necessary for banks to be aware about their branches efficiency and take revision techniques into account for their future planning (Saremi and Malaei, 2003).

Therefore, the questions to the research are:

- Is it possible to distinguish between Saderat Bank efficient and inefficient branches in Guilan province?
- Can we define reference units for inefficient ones in order to improve them and make them efficient?

2. Literature review

DEA is a non-parametric method which evaluates relative efficiency of DMUs in comparison with each other. In this technique there is no need to know the production function form and there is no limitation in amount of inputs and outputs (Mehrgan, 2008). The primary DEA model developed by Charens, Cooper, and Rodez in 1978 (Cooper and Seiford, 2006). They added mathematical programming to Farel's non-parametric method that was developed to evaluate the efficiency of DMUs containing two inputs and one output. The developed model by three above called CCR model.

In 1984 BCC model identified by Banker, Charenz, and Cooper in order to develop the CCR model and revise it (Saremi and Malaei, 2003). Bank efficiency as a service-providing unit, is calculating by the ratio of the minimum possible cost to the minimum accomplished cost in order to specify the distinct amount of output in comparison to other units in banking industry (Hassanzadeh, 2008).

So far, DEA (Data Envelopment Analysis) is used to evaluate the efficiency, effectiveness, productivity, and finally to rank different scopes such as banks

(Saremi and Malaei, 2003), hospitals (Al-Shammary, 1999), tourism (Bosseti et al., 2004), logistics (Min and Joo, 2006), post offices (Borenstein, 2004), R&D units (Lee et al., 2009), and schools and universities (Dharmapala and Saber, 2007). Some of the researches in bank industry are shown in table 1.

Table1- some of current researches in bank industry by applying DEA method

Authors	Inputs	Outputs
Staub et al. (2009)	Financial credit Interest expense Capital Staffs	Deposits Loans Investments
Hassan et al. (2009)	Fixed assets Total investments	Total loans Other incomes from assets
Lin et al. (2009)	Number of staff Interest expense Deposit operating amount Current deposit operating amount	Loan operating amount Earning Operating revenue Interest revenue
Mokhtar et al. (2008)	Total deposits Total overhead expenses	Total earning assets
Bdour et al. (2008)	Staffs Total assets Total operating expenses	Total deposits Net direct credits Operating income
Kumar and Gulati (2008)	Physical assets Labour Loanable funds	Net interest income Non- interest income
Mostafa (2007)	Assets Capital	Net profit ROA ROE
Sufian (2007)	Total deposits Fixed assets	Total loan Other income
Ramanathan (2006)	Fixed assets Deposits Short-term deposits ROA Personnel expenses	Loans Other incomes
Wu (2006)	Labor General expenses	Deposits Incomes Loans

3. Methodology

In this paper in order to evaluate the efficiency of bank branches, two radial DEA models have been applied.

Using BCC and CCR output-oriented models 29 branches of Guilan Saderat bank have been evaluated and ranked in a one year period (2009).

There are some steps to the model that are expressed bellow:

Step1. Identifying effective factors to bank branches performance and choosing inputs and outputs to the research**,**

Step 2. Collecting Inputs and Outputs Data,

Step 3. Evaluating bank branches performance by DEA**,**

Step 4. Performing AP evaluation method to rank efficient DMUs,

Step 5. Final ranking, and

Step 6. Identifying reference branches for inefficient branches.

The explanation of each step is as below:

Step 1. There were so many indicators to evaluate the performance of bank branches regarding to researches.

However, after collecting bank experts opinions, Staffs' costs and non-staff's cost were selected as inputs and resources, expenses, remained owes, commission, income, and profit as the outputs. The inputs and outputs are shown in figure 1.

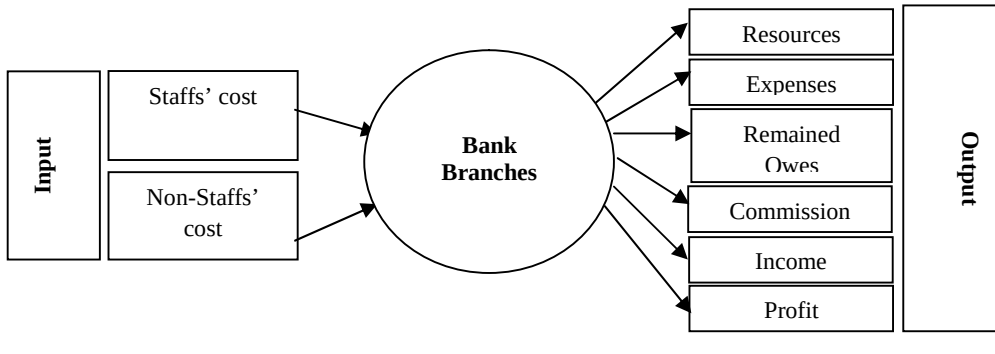

Figure 1: Inputs and Outputs of the model.

Step 2. All data were collected by using bank data base and branches documents.

Step 3. In this level bank branches were evaluated by using CCR and BCC both output-oriented forms:

CCR output-oriented model (enveloped form):

$$Max\ Y_0 = \theta - \varepsilon(\sum_{r=1}^{s} s_r^+ + \sum_{i=1}^{m} s_i^-)$$

St: $\sum_{j=1}^{n} \lambda_j y_{rj} - s_r^+ = \theta y_{r0} \qquad (r = 1, \dots, s)$

$\sum_{j=1}^{n} \lambda_j x_{ij} + s_i^- = x_{i0} \qquad (i = 1, \dots, m)$

$\lambda_j, s_r^+, s_i^- \geq 0 \quad (j = 1, \dots, n)$

BCC output-oriented model (enveloped form):

$Max\ Z = \theta$

St: $\sum_{j=1}^{n} \lambda_j x_{ij} \leq x_{i0} \qquad (j = 1, \dots, m)$

$\sum_{j=1}^{n} \lambda_j y_{rj} \leq \theta y_{r0} \qquad (r = 1, \dots, s)$

$\sum_{j=1}^{n} \lambda_j = 1 \qquad (j = 1, \dots, n)$

$\lambda_j \geq 0 \quad (j = 1, \dots, n)$

The results are shown in table 2 and 3.

Table 2- solving the model by using CCR output-oriented

DMUj	Score	DMUj	Score
1	0.642	**16**	1
2	0.425	**17**	0.812
3	0.79	**18**	0.74
4	0.686	**19**	0.706
5	0.424	**20**	1
6	0.387	**21**	0.699
7	0.648	**22**	0.778
8	0.831	**23**	1

9	1	**24**	1
10	1	**25**	1
11	0.89	**26**	1
12	0.623	**27**	0.956
13	0.926	**28**	0.904
14	0.77	**29**	0.831
15	0.725		

Table 3- solving the model by using BCC output-oriented

DMUj	Score	DMUj	Score
1	0.642	**16**	1
2	0.425	**17**	0.812
3	0.79	**18**	0.74
4	0.686	**19**	0.706
5	0.424	**20**	1
6	0.387	**21**	0.699
7	0.648	**22**	0.778
8	0.831	**23**	1
9	1	**24**	1
10	1	**25**	1
11	0.89	**26**	1
12	0.623	**27**	0.956
13	0.926	**28**	0.904
14	0.77	**29**	0.831
15	0.725		

Step 4. Performing AP evaluation method to rank efficient DMUs. As it has shown in table 2 and table 3 the amount of branches with score 1 is more than one. Therefore, in order to rank among efficient branches, AP model has applied. (Table 4)

Table 4- Results of ranking efficient DMUs using AP model

DMUj	CCR	Rank	BCC	Rank	DMUj	CCR	Rank	BCC	Rank
4	-	-	1.003	13	**23**	1.27	6	1.27	8
8	-	-	2.11	3	**24**	1.08	8	1.08	10
9	2.94	1	2.94	1	**25**	1.41	4	1.05	23
10	1.25	7	1.19	9	**26**	1.4	5	1.4	7
11	-	-	1.07	11	**27**	-	-	1.68	4
16	1.55	3	1.55	6	**28**	-	-	2.21	2
20	1.57	2	1.57	5					

Step 5. Final ranking.The final ranking of Guilan Saderat bank branches after applying AP model are shown in tables 5 and 6.

Table 5- Results of bank branches ranking using CCR model

DMUj	Score	Rank	DMUj	Score	Rank
1	0.642	25	**16**	1	3
2	0.425	27	**17**	0.812	15
3	0.79	16	**18**	0.74	19
4	0.686	23	**19**	0.706	21
5	0.424	28	**20**	1	2
6	0.387	29	**21**	0.699	22
7	0.648	24	**22**	0.778	17
8	0.831	14	**23**	1	6
9	1	1	**24**	1	8
10	1	7	**25**	1	4
11	0.89	12	**26**	1	5
12	0.623	26	**27**	0.956	9
13	0.926	10	**28**	0.904	11
14	0.77	18	**29**	0.831	13
15	0.725	20			

Table 6- Results of bank branches ranking using BCC model

DMUj	Score	Rank	DMUj	Score	Rank
1	0.958	16	**16**	1	6
2	0.914	17	**17**	0.853	19
3	0.791	24	**18**	0.742	27
4	1	13	**19**	0.707	29
5	0.814	21	**20**	1	5
6	0.761	26	**21**	0.717	28
7	0.807	23	**22**	0.896	18
8	1	3	**23**	1	8
9	1	1	**24**	1	10
10	1	9	**25**	1	12
11	1	11	**26**	1	7
12	0.811	22	**27**	1	4
13	0.993	14	**28**	1	2
14	0.842	20	**29**	0.968	15
15	0.725	25			

Step 6. Identifying reference branches for inefficient branches.

Tables 7 and 8 show the reference branches for inefficient units.

Table 7- Reference branches for inefficient DMUs in CCR model

DMUj	Reference DMU	Ref. amount	DMUj	Score	Ref. amount
1	23	0.17	**15**	9	0.23
	24	0.09			
	25	0.1		10	0.05
2	23	0.17		23	0.32
	24	0.09		24	0.21
	25	0.11		25	0.06
3	9	0.24	**16**	-	-
	23	0.46	**17**	9	0.38
	24	0.14		16	0.38
	25	0.01		23	0.52
4	10	0.25		24	0.02
	24	0.36		25	0.37
	25	0.03	**18**	23	0.45
5	9	0.02		24	0.04
	23	0.39		25	0.32
	24	0.03	**19**	16	0.02
	25	0.27		23	0.7
6	23	0.5		25	0.44
	25	0.25		26	0.18
7	23	0.21	**20**	-	-
	24	0.12	**21**	23	0.45
	25	0.13		24	0.04
8	23	0.71		25	0.32
	25	0.45	**22**	9	0.35
	26	0.19		16	0.35
9	-	-		23	0.51
10	-	-		24	0.01
11	23	0.18		25	0.35
	24	0.09		26	0.02
	25	0.11	**23**	-	-
	26	0.02	**24**	-	-
12	23	0.51	**25**	-	-
	25	0.25	**26**	-	-
13	23	0.23	**27**	-	-
	24	0.07			
13	25	0.04	**28**	16	0.25
14	9	0.25		23	0.41
	16	0.35		25	0.29
	23	0.49	**29**	10	0.27
	25	0.39		24	0.41
	26	0.04		25	0.03

Table 8- Reference branches for inefficient DMUs in BCC model

DMUj	Reference DMU	Ref. amount	DMUj	Score	Ref. amount
1	4	0.46	**14**	4	2.63
	8	5.13			
	10	2.44		8	2.15
	11	0.57		16	1.68
	24	4.02		20	0.59
	25	1.02		23	1.58
	26	0.12		25	1.92
	27	2.94		27	1.25
	28	3.78		28	1.29
2	4	0.94	**15**	4	1.13
	8	2.92		8	4.26
	20	1.56		10	1.83
	23	0.15		16	0.12
	24	1.16		24	3.23
	25	1.34		25	0.83
	27	1.62		27	2.31
	28	2.31		28	3.03
3	4	3.29	**16**	-	-
	8	4.36	**17**	4	2.62
	10	1.20		8	2.15
	20	1.7		16	1.68
	23	2.32		20	0.60
	24	2.06		23	1.58
	26	0.87		25	1.91
	27	2.68		27	1.25
	28	1.73		28	1.29
4	-	-	**18**	4	4.29
5	4	1		8	6.84
	8	0.49		9	6.54
	20	0.55		10	3.78
	23	0.08		16	2.66
	24	0.21		24	8.27
	25	0.26		26	6.28
	27	0.34		27	6.24
	28	0.32	**19**	4	3.30
6	4	2.57		8	1.85
	8	2.24		16	1.19
	10	0.53		20	2.23
	16	1.77		23	1.37
	23	1.05		24	0.21
	24	0.68		25	2.54
	25	2.23		26	1.20
	27	1.28		27	1.52
	28	1.80		28	1.81

	4	1.46	**20**	-	-
	8	2.79		4	0.89
	23	1.93		8	0.39
7	24	0.04		10	0.28
	25	1.13	**21**	23	0.11
	27	1.34		24	0.41
	28	1.66		25	0.01
8	-	-		27	0.23
9	-	-		28	0.17
10	-	-		4	1.06
11	-	-		8	2.18
	4	1.11		16	0.88
	8	0.42	**22**	20	1.07
	16	0.46		24	0.71
12	23	1.68		25	2.22
	24	0.42		27	1.28
	25	0.01		28	2.27
	27	0.62	**23**	-	-
	28	0.22	**24**	-	-
	4	1.68	**25**	-	-
	9	3.95	**26**	-	-
	16	0.94	**27**	-	-
	20	0.55	**28**	-	-
				4	0.79
				8	3.20
13				10	0.38
				20	1.38
	23	2.92	**29**	24	1.60
				25	1.21
				27	1.81
				28	2.47

4. Conclusions

Calculated efficiency scores by using DEA technique are always between 0 and 1. This means that DMUs with score 1 are evaluated as efficient and the others lower than 1 are evaluated as inefficient DMUs.

As it has shown in table 2, The application of CCR model in sample of 29 branches identified 8 branches (27.5%) are efficient and 21 branches (72.5%) are inefficient in 2009 while using BCC method identified 13 branches (44.4%) are efficient while 16 branches (55.6%) are inefficient in the same year.

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