Research Journal of Finance and Accounting www.iiste.org
ISSN 2222-1697 (Paper) ISSN 2222-2847 (Online)
Vol.6, No.13, 2015

Efficiency Analysis of Foreign-Capital Banks in Turkey by OCRA and MOORA

Aşır Özbek
Vocational School, Kırıkkale University , 7. km. Ankara Yolu, Kırıkkale, Turkey

Abstract
Banks, as financial institutions bridging investors and depositors, play important roles in the development of the national economy. Efficient operation of the banking sector is necessary not only for the strategic objectives of the banks but also investors, and the national economy itself. The national economy of a country is seriously affected by inefficiency of the banking system. Therefore, measurement of efficiency is an important issue and should continuously be carried out. In this study, the efficiency of 9 foreign-capital banks in Turkey between 2005 and 2014 is evaluated by the operational competitiveness rating (OCRA), multi-objective optimization by ratio analysis (MOORA) and simple additive weighting (SAW) method. The criteria weights were determined on a scale ranging from 1 to 9. All three methods revealed that Finansbank (FB) and Denizbank (DB) had the best performance, while HSBCB and INGB ranked after them.
Keywords: Bank Performance, Simple Additive Weighting, Multi-Objective Optimization by Ratio Analysis, Competitiveness Operational Rating, Foreign-Capital Banks.

1. Introduction
There is a serious competition among businesses in this global world. This is a race in which each business needs to make constant progress to get ahead by improving themselves. The banking sector is inevitably located in the center of this race. It is directly or indirectly affected by successes and failures of businesses. Banks have a central role in the economy. They act as the middleman between those who supply funds and those who demand funds. If they cannot play their roles effectively, fund resources, funded businesses and individuals, and the public as well as the banks themselves are seriously affected. For instance, because of the poor financial structure of the banking sector, during the crisis in November 2000 and in February 2001, Turkey suffered a loss of approximately US$45 billion. People in the country also suffered as a result. An effective and consistent banking system plays an important role in keeping the positive sentiment in the economy. Therefore, banks should find a way to constantly work with high efficiency for the sake of the stability of the national economy as well as the banking sector itself.

The banking sector in Turkey showed great structural changes between 2000 and 2010. The impact of the November 2000 and February 2001 crises had worsened the financial conditions and the profitability indicators. In order to establish a more stable structure for the banks with a low profitability and efficiency, a program called "Banking Sector Restructuring Program" was introduced in 2001. Among the objectives of this program were restructuring the state-owned banks, analyzing the banks taken over by the Savings Deposit Insurance Fund (SDIF), and increasing the efficiency in the sector by rehabilitating the private banking system by strengthening the supervisory and regulatory framework (www.bddk.org.tr).

In June 2014, there were 50 banks in total in the Turkish banking sector including 33 deposits banks, 13 development and investment banks, and 4 participation banks. With 12 136 branches and 215 933 employees, total assets were about US$700 billion, with US$25 billion of interest income and US$14 billion of interest expense. Net profit of the sector in June 2014 was approximately US$5 billion. The total loan amount was US$4.1 billion (www.bddk.org.tr).

There have been lots of national and international studies dealing with the measurement of bank performances. Most of them were carried out by the data envelopment analysis (DEA). However, there are studies that employed other methods than DEA. For instance, there are models that used multi-criteria decision making (MCDM) and statistical methods. This study focuses on the measurement of the performance of 9 foreign-capital banks between 2005 and 2014.

The rest of this paper will include section 2, which shows the literature review, section 3, which presents the methodology, and section 4, which introduces data and discussion of the results. Conclusions are shown in section 5.

2. Literature Review
In the light of the literature review, it was seen that many methods, separate or integrated, were employed to measure the performance of the banking sector. Though notably data envelopment analysis (DEA) or similar methods were used, there are also studies that applied MCDM-based methods as well as statistical methods. Some of the studies are given in Table 1.

Table 1. Literature Review

Method	Author(s)
AHP / FAHP	Frei & Harker (1999); Phuong Ta & Yin Har (2000); Stankevičienė & Mencaitė (2012); Ishizaka & Nguyen (2013); Mandic *et al.* (2014)
Balanced Scorecard	Kim & Davidson (2004); Weifeng & Huihuan (2008); Wu *et al.* (2009); Jiang & Liu (2013)
DEA/OCRA	Zaim (1995); Bauer *et al.* (1998); Parkan & Wu (1999); Yıldırım (2002); Günay &T ektaş (2006); Camanho & Dyson (2006); Stavarek (2006); Portela & Thanassoulis (2007); Erdem & Erdem (2008); Kao & Liu (2004); Pasiouras (2008); Lin *et al.* (2009); Andries (2011); Avkiran (2011); Thagunna & Poudel (2012); Ayadi & Ellouze (2013); Akeem & Moses (2014); Özbek (2015)
GRA	Ho (2006); Girginer&Uçkun (2012); Özçelik&Öztürk (2014)
İstatistikselYöntemler	Zopounidis *et al.* (1995); Canbas *et al.* (2005); Ametefe *et al.* (2011); Chitan (2012); Vardar (2013); Kaaya & Pastory (2013); Kiptui (2014); Lee & Kim (2013); Anthony *et al.* (2014); Daly & Zhang (2014); Ibrahim (2014); Abata (2014)
PROMETHEE	Mareschal & Brans (1991); Mareschal & Mertens (1992); Doumpos & Zopounidis (2010)
TOPSIS/FTOPSIS	Seçme *et al.* (2009); Mahrooz *et al.* (2013), Akkoç & Vatansever (2013)

3. Methodology

3.1. Simple Additive Weighting

Simple additive weighting (SAW) is probably the simplest and best known MCDM method, which was often used formerly. The criteria, primarily the values, should be numerical and comparable for the application of this method (Hwang & Yoon, 1981; Pimerol & Romero, 2000; Chang & Yeh, 2001; Stanujkic *et al.*, 2013). The SAW method uses a simple aggregation procedure.

The general SAW procedure is described as below (Changa & Yeh, 2001; Stanujkic *et al.*, 2013):

Step 1: Creating the Initial Decision Matrix

An initial decision matrix is created by evaluating the decision alternatives according to the criteria. The decision matrix is formulated as indicated in Equation (1).

$$X_{ij} = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix} \tag{1}$$

Step 2: Creating the Standard Decision Matrix

The decision matrix can be standardized by many different methods. The linear scale transformation (the Max method) is used in this study in order to normalize the decision matrix; the Equation (2) with the benefit criteria and the Equation (3) with the cost criteria.

$$r_{ij} = \frac{x_{ij}}{x_j^{max}}\ ,\ \ i = 1,2,\ldots,m;\ j = 1,2,\ldots,n \tag{2}$$

$$r_{ij} = \frac{x_j^{min}}{x_{ij}} \tag{3}$$

where r_{ij} $(0 \leq r_{ij} \leq 1)$is defined as the normalized performance rating of alternative A_i on attribute C_j.

Step3: Calculation of the Performance Values

The general preference value of each alternative V_i is provided by the Equation (4)

$$V_i = \sum_{j=1}^{n} w_j r_{ij}, i = 1, \ldots, m \tag{4}$$

The greater the value V_i the more preferred the alternative A_i.

3.2. The Multi-Objective Optimization by Ratio Analysis

The multi-objective optimization by ratio analysis (MOORA) method is a new MCDM method, applied to solve many structural, economic, and administrative problems. It can be seen in a many studies published in journals, such as Brauers and Zavadskas (2006, 2009), Brauers *et al.* (2008), Kalibatas and Turskis (2008), Brauers and

Ginevicius (2009), Ginevicius *et al*. (2010a), and Chakraborty (2011). The MOORA method is composed of two components: (a) the ratio system and (b) the reference point approach.

The general MOORA procedure is described as below (Brauers *et al*., 2008; Stanujkic *et al*., 2013):

Step 1: Creating the Decision Matrix

The first matrix of the method is a matrix of responses of different alternatives on different objectives. The Equation (5) gives the matrix created as indicated. Where: x_{ij} the response of alternative j on objective or attribute i; $i = 1, \dots, n$ is the number of objectives or attributes; $j = 1, \dots, m$ is the number of alternatives.

$$X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix} \quad (5)$$

Step 2: Normalization of the Matrix

MOORA method employs vector normalization procedure for normalization without transformation of cost to benefit type criteria. The following Equation (6) is used to calculate the normalized performance ratings in MOORA method:

$$x_{ij}{}^{*} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^{2}}} \quad (6)$$

$x_{ij}{}^{*}$ is a dimensionless number which symbolizes the normalized response of alternative j on objective i. Dimensionless numbers have no specific unit of measurement, and are obtained, for instance, by deduction, multiplication or division. The normalized responses of the alternatives on the objectives belong to the interval [0; 1]. However, sometimes the interval could be [–1; 1] (Brauers *et al*., 2008).

Step 3: Calculation of the Performance Values

Optimization is carried out by adding these responses for maximization and by subtracting them for minimization. The sum of the performance values of minimization is subtracted from the sum of the normalized performance values of maximization, as shown in Equation (7).

$$y_i^{*} = \sum_{j=1}^{g} w_j x_{ij}^{*} - \sum_{j=g+1}^{n} w_j x_{ij}^{*} \quad (7)$$

where: $i = 1, \dots, g$ as the objectives to be maximized; $i = g + 1, \dots, n$ as the objectives to be minimized; y_i^{*} the normalized assessment of alternative j with respect to all objectives. w_j symbolizes the criteria weights. An ordinal ranking of y_i^{*} shows the final preference. The first alternative in this y_i^{*} ranking is taken as the best alternative.

3.3. Operational Competitiveness Rating

Developed by Parkan in 1994, the operational competitiveness rating (OCRA) is a simple and convenient method. It is used to solve performance and efficiency analysis problems in the measurement of the relative efficiency of the *Product Units* (PU) producing similar outputs by using similar inputs. OCRA has been implemented in various areas successfully, such as investment banking, performance measurement of service buildings of public institutions, industrial enterprises, hotels and food production facilities (Peters & Zelewski, 2010).

The general OCRA procedure is described as below (Parken & Wu, 2000; Chatterjee & Chakraborty, 2012):

Step 1: Computation of preference ratings with respect to input criteria

During the first step, OCRA method only focuses on the scores received by various alternatives for the input attribute without taking the scores received for the beneficial attribute into account. The non-beneficial or input criteria with lower values are more preferable. The following Equation (8) is used to calculate the aggregate performance of *ith* alternative with respect to all the input attribute:

$$i^{k} = \sum_{m=1}^{M} a_m \frac{\max\limits_{n=1,\dots,K}(X_m^n) - X_m^k}{\min\limits_{n=1,\dots,K}(X_m^n)}, \quad k = 1, \dots, K \quad (8)$$

The relative performance of the *kth* PU or the preference for the alternative *k* is measured by the rating i^{k}. X_m^k is the performance score of the alternative *k*, which can be seen on, for example, the widely used five or nine-point scale for input criterion *m*. The subindex *m* in (8) refers to input criterion $m = 1, \dots, M$ and *k* refers to the alternative $k = 1, \dots, K$. The calibration constant a_m (relative importance of *jth* criterion) is used to increase or reduce the impact of this difference on the rating i^{k} with respect to *jth* criterion.

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Step 2: Computation of preference ratings with respect to output criteria.

Inputs are not included in this step. The aggregate performance or the preference of the decision maker for alternative k, on all the output criteria is measured as follows.

$$o^k = \sum_{h=1}^{H} b_h \frac{Y_h^k - \min_{n=1,\dots,K} Y_h^n}{\min_{n=1,\dots,K} Y_H^n}, \quad k = 1, \dots, K \qquad (9)$$

The subindex h in (9) refers to output$h = 1, \dots H$. Y_h^k is the performance score the alternative k receives for the output criterion h using the same scale as the input scores. The alternative with the highest score for an output criterion is the most preferred one. b_h is calibration constant or weight importance of *jth* output criteria. The alternative with the highest score for an output criterion is the most preferred one.

$$\sum_{m=1}^{M} a_m + \sum_{h=1}^{H} b_h = 1 \qquad (10)$$

Step 3: Calculation of the linear preference rating for the input criteria

The ratings i^k are scaled linearly so as to assign a zero rating to the least preferable alternative by

$$I^k = i^k - \min_{n=1,\dots,K} i^n, \qquad \forall k = 1, \dots, K \qquad (11)$$

I^k represents the aggregate preference rating for alternative k with respect to the input criteria.

Step 4: Calculation of the linear preference rating for the output criteria

In order to obtain a zero rating for the least preferable alternative, he ratings computed by (12) are scaled linearly:

$$O^k = o^k - \min_{n=1,\dots,K} o^n, \qquad \forall k = 1, \dots, K \qquad (12)$$

O^k is the preference rating of alternative k with respect to the output criteria.

Step 5: Computation of overall preference ratings

By scaling the sum $I^k = O^k$, the overall preference rating for alternative k is obtained, and this way, the least preferable alternative receives a rating of zero:

$$E^k = (I^k + O^k) - \min_{n=1,\dots,K} (I^n + O^n), \qquad \forall k = 1, \dots, K \qquad (13)$$

4. Data and Discussion

There are 19 foreign-capital deposits banks in Turkey as of 2015. This study only deals with 9 of them due to such reasons as some banks' stopping banking activities between 2005 and 2014, the establishment of new foreign-capital banks, continuous shrinking or showing no growth of some banks. There are also some banks that serve as a single branch. Therefore, such banks were not evaluated not to have any effect on the result. The banks included in the study are the ones showing growth trends and operating continuously between 2005 and 2014. Banks that are involved are: Alternatifbank (AB), Arab Turkish Bank (ATB), Burganbank (BB), Citibank (CB), Denizbank (DB), Finans Bank (FB), HSBC Bank (HSBCB), ING Bank (INGB), and Turkland Bank (TB).

The proposed model measures the performances of the banks using the same criteria by SAW, MOORA, and OCRA separately. The flow diagram of the model is shown Figure1.

The criteria used in the model were created in the light of the literature review. The data set of the model was taken from the book titled "Our Banks" published by the Banks Association of Turkey (TBB), related to the years 2005-2014 (tbb.org.tr). Many different methods can be used to determine the criteria weights.

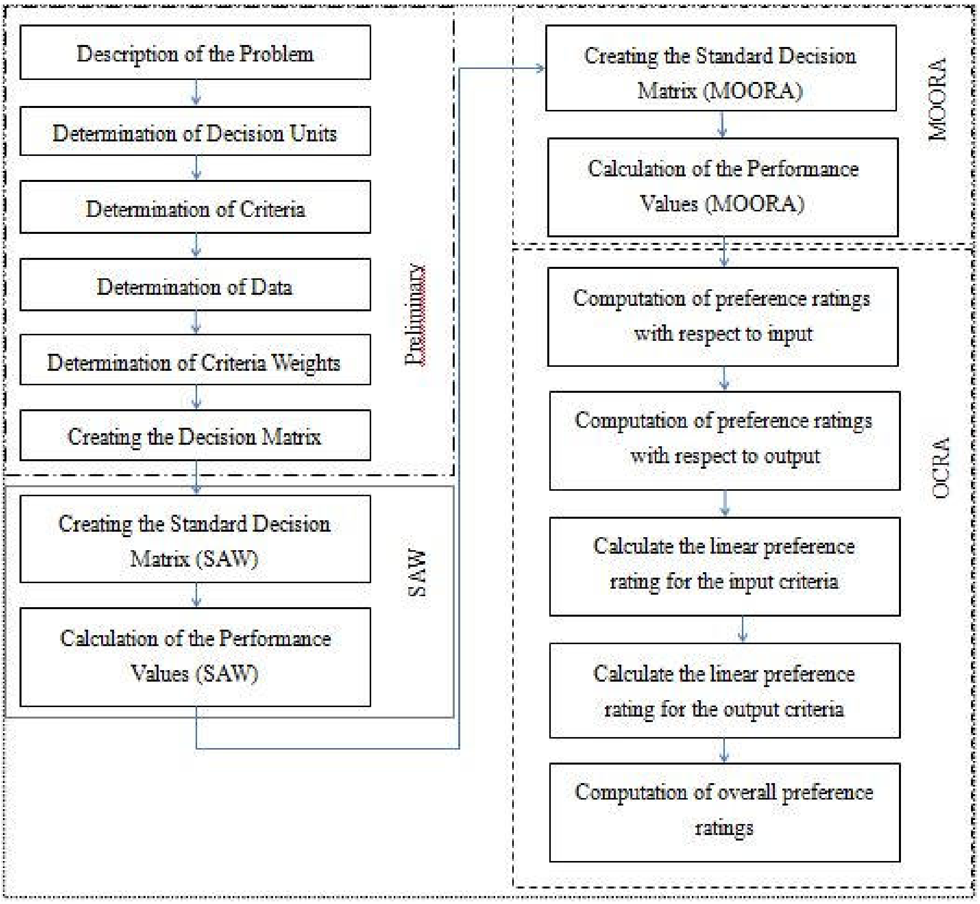

Figure 1. Flow Chart

In our study, the criteria weights were determined using a scale from 1 to 9: 1 for the lowest performance and 9 for the best performance. Criteria and weights used in the model by the specified scale are shown in Table 2.

Table 2.Criteria Weights

Deposits	Capital	Labor	Loans	Interest Income	Non-Interest Income
0,139	0,111	0,083	0,250	0,222	0,194

4.1. The Application of the SAW Method

Table 3 shows the performance values resulting from the application of the SAW method. The graphical representation of the performances is given in Figure 2. Figure 2 indicates that the best performance was shown steadily by FB. The second increasingly best performance was shown by DB. HSBCB and INGB showed the 3rd and 4th best performances respectively despite the decline in their efficiency.

Table 3. SAW-Performance Ratings

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
AB	0,6946	0,4210	0,5111	0,6094	0,4782	0,4676	0,4879	0,4849	0,5363	0,4819
ATB	0,1016	0,0972	0,0949	0,1113	0,1081	0,1070	0,1201	0,1271	0,1186	0,1178
BB	0,6171	0,3166	0,3273	0,3995	0,3470	0,3539	0,3868	0,3679	0,3634	0,3945
CB	1,7286	1,2659	1,3087	1,3108	0,8193	0,8186	0,8517	0,7714	0,2185	0,2200
DB	5,5920	3,1440	3,6882	4,1939	3,4516	3,4267	3,8676	3,8137	4,6007	4,6688
FB	7,3376	4,6133	5,2135	5,7915	4,5633	4,7353	4,4572	4,5961	5,1011	4,6889
HSBCB	4,7440	2,8956	3,2793	3,9003	2,8157	2,5576	2,4546	2,2709	2,2419	2,0460
INGB	5,1526	3,0747	3,3035	3,6027	2,6865	2,2949	2,0880	2,0234	2,1368	2,2314
TB	0,3007	0,1519	0,2091	0,2561	0,2015	0,2054	0,2028	0,2032	0,2116	0,2492

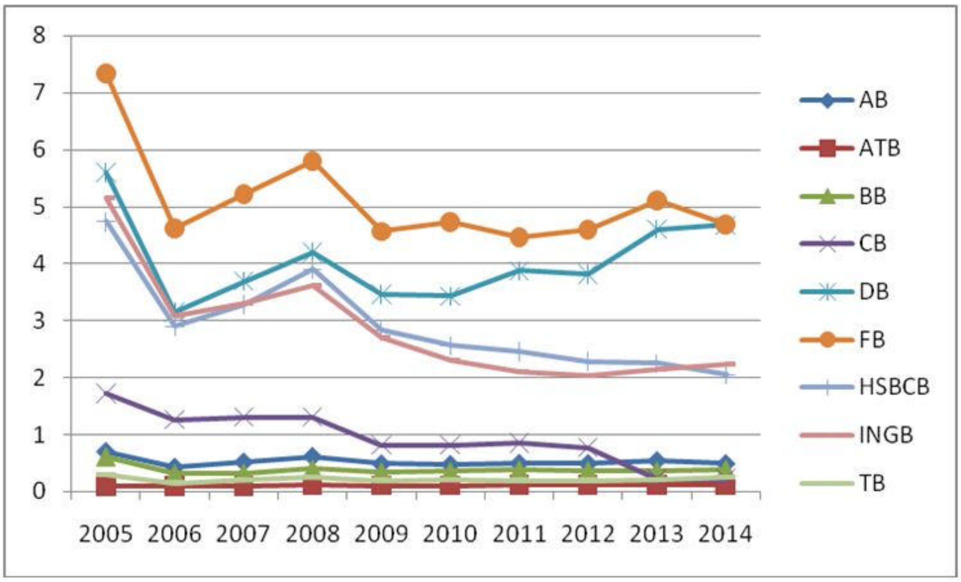

Figure 2. SAW-Performance Ratings

4.2. The Application of the MOORA Method

Performance values provided by the application of this method are given in Table 4. The graphical representation of the performances is shown in Figure 3. Figure 3 indicates that the best stable performance is shown by FB. The second increasingly best performance was shown by DB. INGB and HSBCB came the 3rd and 4th respectively although their performances lost speed in time.

Table 4. MOORA-Performance Ratings

AB	0,2903	0,3056	0,3003	0,3786	0,3698	0,3704	0,3093	0,3369	0,3362	0,3702
ATB	0,0659	0,0492	0,0387	0,1084	0,0907	0,0895	0,1449	0,1682	0,1369	0,1344
BB	0,1235	0,1331	0,2182	0,2473	0,2602	0,2262	0,2433	0,2237	0,2111	0,2744
CB	0,6566	0,6450	0,6008	0,5601	0,4826	0,4208	0,3702	0,3844	0,2960	0,3101
DB	1,6220	1,4911	1,5079	1,7123	1,8643	1,9657	2,0079	2,0580	2,1909	2,2414
FB	2,5569	2,9418	2,8181	2,7467	2,7975	2,9361	2,9062	2,9061	2,7961	2,7776
HSBCB	1,7618	1,4519	1,7259	1,6634	1,4779	1,3033	1,3535	1,1689	1,2080	1,1333
INGB	1,7346	1,3857	1,3964	1,4236	1,3832	1,1519	1,1356	1,2414	1,2252	1,2178
TB	0,0886	0,0767	0,1195	0,1591	0,1635	0,1872	0,1939	0,1997	0,2263	0,2679

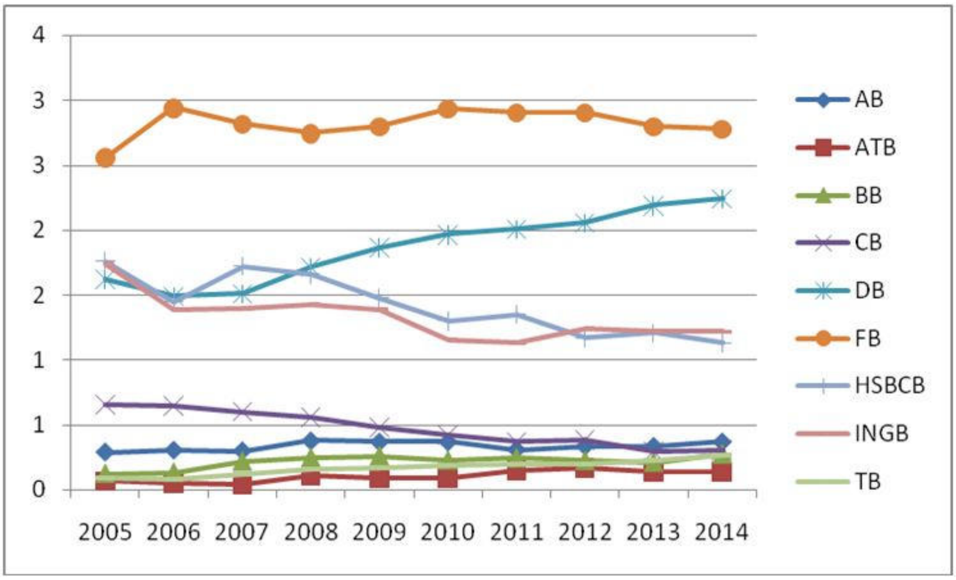

Figure 3. MOORA-Performance Ratings

4.3. The Application of the OCRA Method

The performance indicators of the banks are shown in Table 5. The graphical representation of the efficiency of the banks is given in Figure 4. According to the analysis of Table 5 and Figure 4, DB was found to be showing the highest efficiency. It can also be seen that DB continuously enhanced the performance. The second best banks are FB, HSBCB and INGB. While FB increased its efficiency constantly, the other two banks HSBCB and INGB showed a decline in their performances. Compared to these banks, the other five banks showed a lower performance indeed. AB shows a very slight movement, but this performance is not considered to be sufficient.

Table 5.Computation of Overall Preference Ratings

AB	5,81	8,49	7,85	8,85	10,24	12,80	12,66	17,55	19,41	24,03
ATB	3,60	3,77	3,66	4,82	4,40	4,57	3,07	7,83	3,17	2,49
BB	3,40	4,48	5,31	6,20	6,21	6,84	8,61	8,56	12,41	14,93
CB	6,58	7,68	9,90	10,30	9,97	9,03	10,12	14,96	10,97	14,14
DB	10,86	44,97	54,93	71,32	79,27	94,70	117,71	145,76	183,90	216,40
FB	20,51	45,24	41,87	51,30	51,42	59,77	79,44	103,28	107,60	135,17
HSBCB	31,19	43,34	53,10	60,21	55,16	55,27	73,42	81,67	91,81	100,52
INGB	30,66	40,53	45,64	56,74	56,94	56,16	66,36	84,60	95,78	113,08
TB	1,75	0,82	0,17	0,00	1,45	2,76	3,31	4,72	9,93	12,38

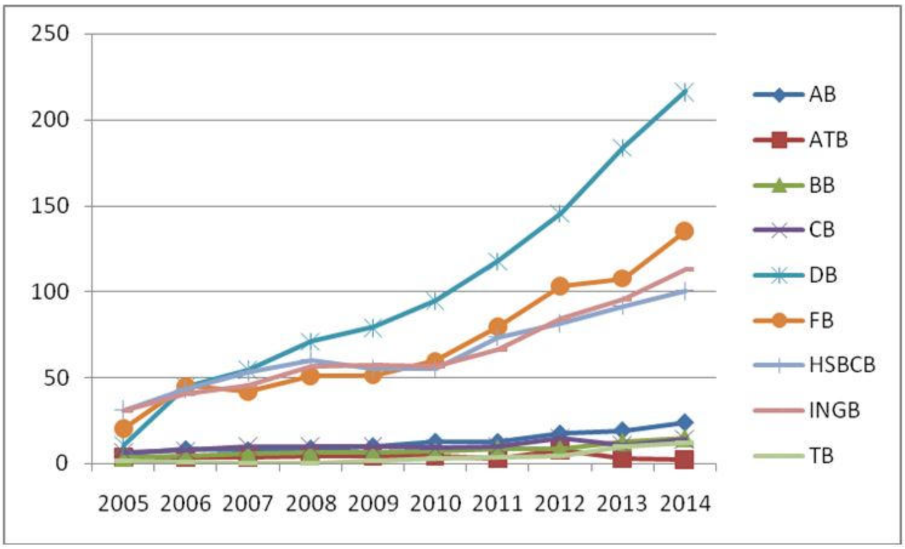

Figure 4. Computation of Overall Preference Ratings

5. Conclusions

It is essential that banks operate efficiently for the national economy and the clients. Therefore, banks should periodically evaluate their performances and try to improve themselves constantly. Banks with low performance indicators should rectify this situation immediately. Otherwise, they will face financial difficulties, which will adversely affect the country's economy.

In this study, the performances of foreign-capital banks were measured by SAW, MOORA and OCRA according to 6 criteria: *Deposits, Capital, Labor, Loans, Interest Income and Non-Interest Income.* According to the results of all the three methods, the first two banks with the highest efficiency were found to be FB and DB. However, the performance growth rate of DB is higher than FB. FB shows a stable growth rate. This may not be sustainable in the long term. DB and FB were followed by HSBCB and INGB according to the performance indicators. Though HSBCB and INGB showed a better performance than the rest of the banks, their efficiency was decreasing over the years. This means that they are likely to experience difficulties in a future crisis. It is believed that the other 5 banks operate inefficiently. The study revealed that DB is the only bank that continuously increased its efficiency and improve its performance. Although HSBCB and INGB were among the ones on the top of the list, their performance decreased over the years. Another notable point is that CB's performance deteriorated continuously. The other point is that AB shows a little improvement. The conclusion is that AB, ATB, BB, CB and TB must urgently find ways to improve themselves to be able to compete.

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