

Ranking the Banks through Performance Evaluation by Integrating Fuzzy AHP and TOPSIS Methods: A Study of Iranian Private Banks

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Abstract *Because of the Increasing competition between enterprises in the current competitive market, the importance of continuous performance evaluation in the marketplace has increased. It has become increasingly important for banks, because as a key component of the financial system, banks allocate funds from savers to borrowers in an efficient manner to support economic activities. Along with the increase of the number of private banks in Iran in recent years, competition among banks for banking activities has increased. On the other hand the presence of the private banks in the stock exchange market led to an increased sensitivity to the banks' financial performance by their shareholders. In this study, first we identified the criteria and their coefficients used for financial performance evaluation of private banks using fuzzy AHP method. After that, we evaluated financial performance of Iran private banks and ranked them using the information of the financial statements at the end of Solar Hijri year 1393 (March 2015) and TOPSIS method.*

Key words Performance evaluation, finance, fuzzy set, fuzzy AHP, TOPSIS, Iran private banks

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1. Introduction

The services sector is increasingly playing a crucial role in the global economy and the growth and development of countries. The banking industry as a service sector is inevitably located in the center of global rivalry. It is directly or indirectly affected by successes and failures of businesses.

For the local communities, banks provide access to funding and financial services to both local business and citizens. On a larger scale, banks offer similar access to credit and financial services to large businesses, local governments, and in some cases international customers. Investments made by national banks are spread widely across the nation; therefore have influence on economic development across an entire country or geographic region.

The specific role of banks in economic development varies, depending on scope. Primarily, the participation of banks in economic development focuses on providing credit and services to generate revenues, which are then invested back into a local, national, or international community. The specific roles banks play in the economic development of a small community differ from the role banks play in national or international economic development.

Banks act as the mediator 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. Thus the importance of banking and financial services in the world services industry cannot be underemphasized.

Any positive or negative events encountered in banking sector affect other sectors through banking activities. Therefore the state of the banking sector is monitored by researchers, academicians and regulatory and supervisory authorities. Because of today's competitive financial atmosphere, banks and financial institutions have to continually evaluate their performance and follow new technologies and improve their service quality to attract customers and preserve their market share.

Performance measurement is a process which shows the efficiency and effectiveness of the activities. As for performance measure is an indicator of the efficiency and effectiveness of the activities in

terms of quantity. A set of these indicators which show the efficiency and effectiveness of the activities is known performance measurement system (Neely, 2005). In performance measurement, identifying the performance measurement criteria and their features have crucial role in reaching the goals of company. Atkinson *et al.* (1997) state that performance criteria should have following characteristics:

- Performance element must be measured independently.
- Measures must be significant and understandable from the viewpoint of user.
- Measures are consistent with the strategic goals of the company.
- Measures are consistent with the competitive strategies of the company.
- Measurement methods must be steady and reliable.
- Performance measures must be re-evaluable and changeable if necessary.
- Measures must be reviewed and accepted by the all people from their perspectives

Researchers use various performance measurement approaches. Ratio analysis is the most widely used methods in the performance measurement and comparison (Wen, 2008; Al-Taleb and Al-Shubiri, 2010; Pathak, 2003; Uwuigbe and Fakile, 2012; Aebi *et al.*, 2011). Another method used in the measurement of banking performance is CAMELS ratios. CAMELS consists of six components: capital adequacy, asset quality, management, earnings, liquidity and sensitive to market list. Dincer *et al.*, (2011) measured the financial performance of state, private and foreign banks by using CAMELS ratios during the 2008 Global Crisis. Mittal and Dhade (2009) investigated the awareness and perception level of bank employees for CAMEL ratios.

Data Envelopment Analysis (DEA) is one of the most commonly used models to measure bank performance (Tsolas, 2010; Aikhathlan and Malik, 2010; Sultan *et al.*, 2011) Multiple criteria decision making methods are also used by researchers to measure and evaluate the banking performance. Secme *et al.*, (2009) measured the performance of commercial banks operating in Turkey. They used fuzzy AHP and TOPSIS model to determine the weights of main and sub-criteria and evaluate the performance.

Due to the increasing privatization of banks in Iran, the relative success of private banks is very important. Being informed of the success level of private banks, can help customers make decisions on the use of banking services as well as purchase the bank's shares.

This study will evaluate the financial performance of Iran private banks, presenting in Tehran Stock Exchange in 2015, and rank them using Fuzzy AHP and TOPSIS methods.

2. Literature review

2.1. Fuzzy Set Theory

The concept of fuzzy set is introduced firstly by Zadeh (1965) as a class of objects with a continuum of grades of membership. Such a set is characterized by a membership function which assigns to each object a grade ranging between zero and one (Zadeh, 1965).

Fuzzy set is used to define and transform to notable values of human judgment under uncertainty and dynamic system modeling. Since human judgment and behavior are so complex and not be estimated in certain numerical values, usage of certain values to define service and production system in real world does not give appropriate results (Zeydan and Colpan, 2009).

A fuzzy number \tilde{A} on R to be a triangular fuzzy number (TFN), if its membership function $\mu_{\tilde{A}}(x)$: $R \rightarrow [0,1]$ is equal to following Eq(1):

$$\mu_{\tilde{A}}(x) = \begin{cases} (x-l)/(m-l), & l \leq x \leq m \\ (u-x)/(u-m), & m \leq x \leq u \end{cases} \quad (1)$$

From Eq. (1), l and u mean the lower and upper bounds of the fuzzy number \tilde{A} , and m is the modal value for \tilde{A} (as Fig. 1). The TFN can be denoted by $\tilde{A} = (l, m, u)$.

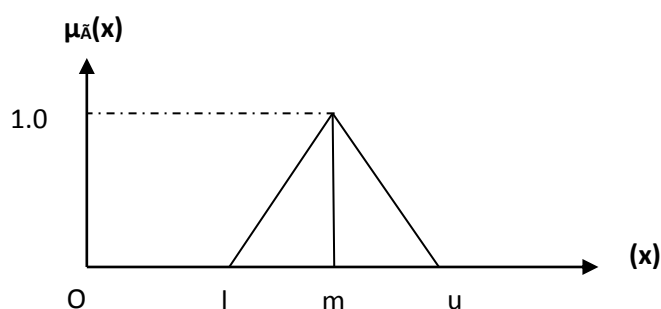


Figure 1. The membership function of the triangular fuzzy number

The operational laws of TFN $\tilde{A}_1 = (l_1, m_1, u_1)$ and $\tilde{A}_2 = (l_2, m_2, u_2)$ are defined as following Chia-Chi (2010):

Sum of the fuzzy numbers:

$$\tilde{A}_1 \oplus \tilde{A}_2 = (l_1, m_1, u_1) \oplus (l_2, m_2, u_2) = (l_1 + l_2, m_1 + m_2, u_1 + u_2) \quad (2)$$

Multiplication of the fuzzy numbers:

$$\tilde{A}_1 \otimes \tilde{A}_2 = (l_1, m_1, u_1) \otimes (l_2, m_2, u_2) = (l_1 l_2, m_1 m_2, u_1 u_2) \quad \text{for } l_1, l_2, m_1, m_2, u_1, u_2 > 0 \quad (3)$$

Subtraction of the fuzzy numbers:

$$\tilde{A}_1 \ominus \tilde{A}_2 = (l_1, m_1, u_1) \ominus (l_2, m_2, u_2) = (l_1 - u_2, m_1 - m_2, u_1 - l_2) \quad (4)$$

Division of the fuzzy numbers:

$$\tilde{A}_1 \oslash \tilde{A}_2 = (l_1, m_1, u_1) \oslash (l_2, m_2, u_2) = (l_1 / u_2, m_1 / m_2, u_1 / l_2) \quad \text{for } l_1, l_2, m_1, m_2, u_1, u_2 > 0 \quad (5)$$

Reciprocal of the fuzzy numbers:

$$\tilde{A}^{-1} = (l_1, m_1, u_1)^{-1} = (1/u_1, 1/m_1, 1/l_1) \quad \text{for } l_1, l_2, m_1, m_2, u_1, u_2 > 0 \quad (6)$$

2.2. Fuzzy Multi Attribute Decision Making (MADM)

Determination of the decision in the case of Multi-Attribute Decision Making (MADM) is resolved by selecting the best alternative out of several alternatives. Some method can be used to solve the MADM problem, including:

1. Simple Additive weighting method (SAW);
2. Weighted Product (WP);
3. Eliminate Et Choices by Translating to Reality (ELECTRE);
4. Analytic Hierarchy Process (AHP);
5. Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)(Kusumadewi, 2006).

If the data is not crisp, i.e., it is vague, the MADM methods should be extended to fuzzy calculation. The developed methods are called Fuzzy Multi Attribute Decision Making (FMADM). The essence of FMADM is to determine weights for each attribute, followed by a ranking process which selects the alternative bank that has performed the best criteria (Wimatsari, 2013). In this study, the weights for the criteria are determined by the pair-wise comparison of AHP, but the subjective evaluation made by the experts is not monotones, and therefore the pair-wise measures have been quantified by fuzzy numbers.

3. Objectives and methodology of research

This study aims to achieve the following objectives:

The main objective of this research is the financial performance evaluation of Iran private banks presenting at Tehran Stock Exchange in 2015 (21 banks), using multi-criteria decision-making.

This main purpose is divided into two secondary purposes:

– Prioritizing of the financial metrics used for the evaluation of financial performance of private banks, using data of their financial statements and Group Fuzzy Analytic Hierarchy Process (GFAHP) method. In this respect, this study is a survey research and this work is done through polling of 30 banking financial experts.

– Ranking the Iran private banks (21 banks) based on the financial indicators and their coefficients using TOPSIS. Financial information is obtained from financial statements of private banks at the end of Solar Hijri year 1393 (March 2015). In this respect this study is applied research.

Research methodology in this study is as below:

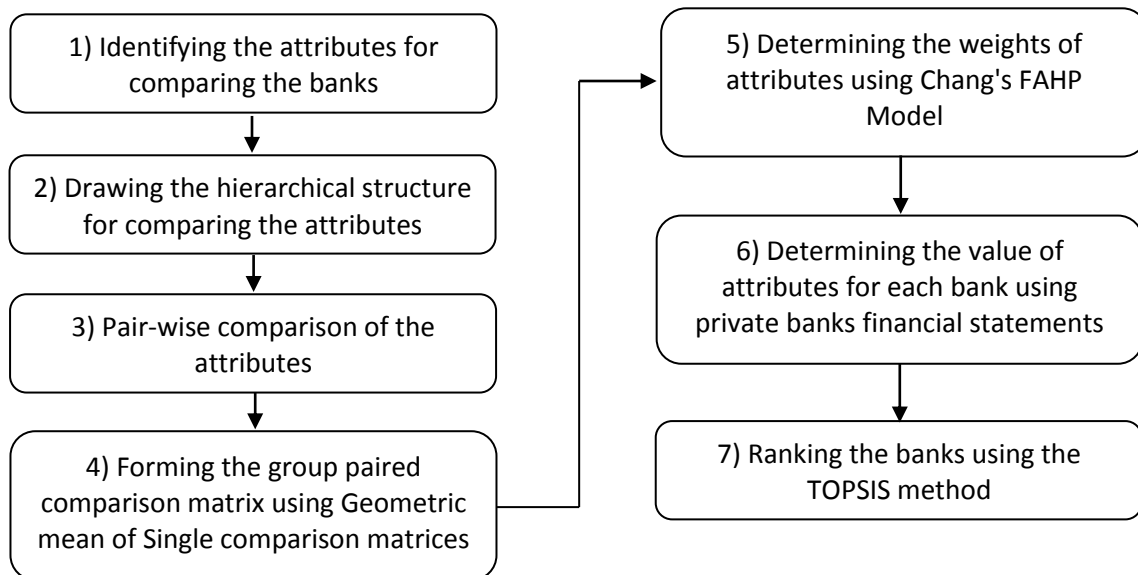


Figure 2. Research methodology and Process

In the following, analytical methods used, are explained:

3.1. Fuzzy AHP Method

AHP (Analytic Hierarchy Process) is firstly introduced by Myres and Alpert in 1968 and developed by Saaty in 1977 as a model and then used in the solution of complex decision problems. AHP helps to identify the most appropriate alternative by providing to form hierarchical structure that include target, main criteria, sub-criteria and alternatives and evaluating the many alternatives in terms of many quantitative and qualitative criteria, together.

AHP is the most comprehensive application which is used in multi-criteria decision making, planning, resource allocation and solution of the problems (Saaty and Vargas, 2000).

AHP is designed to select the best alternative among the different alternatives, which are evaluated by using several criteria, in a both rational and heuristic manner. In this process, decision maker presents simple pair wise comparison judgments. These judgments are then used in the development of all priorities to rank the alternatives.

Through AHP, the importance of several attributes is obtained from a process of paired comparison, in which the relevance of the attributes or categories is matched two-on-two in a hierarchic structure. In the hierarchical structure of decision problem, the simple figure, which has three levels, is used. The goal of the decision problem is at the top level. Decision criteria and decision alternatives to be evaluated, take part at the second and third levels, respectively (Saaty and Vargas, 2000).

AHP has been extensively applied by academics and professionals, mainly in engineering applications involving financial decisions associated to non-financial attributes (Saaty, 1996)

FAHP (Fuzzy AHP) represents a systematic approach to selecting alternatives and solving problems using the concept of fuzzy set theory (Zadeh, 1965) and the AHP method, which are implemented through the use of triangular (or trapezoidal) fuzzy numbers (Chang, 1996).

Triangular fuzzy numbers are applied in order to determine the priority of different decision variables, while the extended FAHP method is used to determine the final priority of weights based on triangular fuzzy numbers.

The steps of the Chang's (1996) extent analysis can be summarized as follows:

Step 1: The values of fuzzy extensions for the i^{th} object are given in Expression (7):

$$S_i = \sum_{j=1}^M M_j^i \otimes_{gi} [\sum_{i=1}^n \sum_{j=1}^m M_j^i]^{-1} \quad (7)$$

Where M_{jgi} ($j=1, 2, \dots, m$) are triangular fuzzy numbers.

In order to obtain the expression $\otimes [\sum_{i=1}^n \sum_{j=1}^m M_j^i]^{-1}$, it is necessary to perform additional fuzzy operations with m values of the extended analysis, which is represented by Expressions (8) and (9):

$$\sum_{i=1}^n \sum_{j=1}^m M_j^i \otimes_{gi} = (\sum_{j=1}^m l_i \sum_{j=1}^m m_i \sum_{j=1}^m u_i) \quad (8)$$

In other words, it is necessary to calculate the inverse vector using Expression

$$[\sum_{i=1}^n \sum_{j=1}^m M_j^i]^{-1} = (\frac{1}{\sum_{j=1}^m u_i}, \frac{1}{\sum_{j=1}^m m_i}, \frac{1}{\sum_{j=1}^m l_i}) \quad (9)$$

Step 2: The degree of possibility for $M_2=(l_2, m_2, u_2)$ and $M_1=(l_1, m_1, u_1)$ is defined by Expression (10):

$$V(M_2 \geq M_1) = y \geq x[\min(\mu_{M_1}(x), (\mu_{M_2}(y)))] \quad (10)$$

It can be represented in the following manner by Expression (11):

$$V(M_2 \geq M_1) = \text{hgt}(M_1 \cap M_2) = \mu_{M_2}(d) = \begin{cases} 1 & \text{If } m_2 \geq m_1 \\ 0 & \\ \frac{l_1 - u_2}{(m_2 - u_2) - (m_1 - l_1)} & \text{If } l_1 \geq u_2 \end{cases} \quad (11)$$

Where d is the ordinate of the highest intersection point D between μ_{M_1} and μ_{M_2} . (Figure 3)

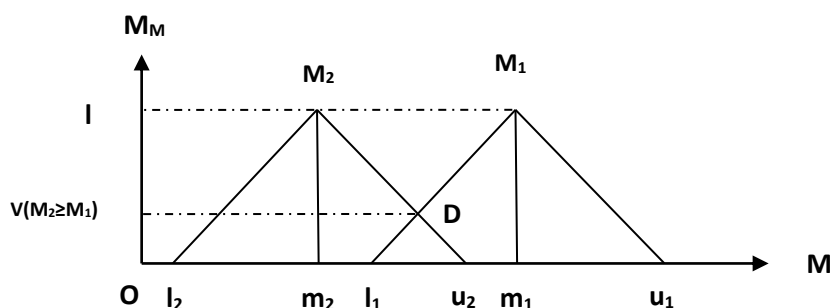


Figure 3. The intersection between M_1 and M_2

In order to compare M_1 and M_2 , values of both $V(M_1 \geq M_2)$ and $V(M_2 \geq M_1)$ are needed.

Step 3: The degree of possibility for a convex fuzzy number to be greater than the k convex numbers. M_i ($i = 1, 2, \dots, k$) can be defined by Expression (8):

$$V(M \geq M_1, M_2, \dots, M_k) = V[(M \geq M_1) \dots (M \geq M_k)] = \min V(M \geq M_i), i=1,2,3,\dots,k \quad (12)$$

Let us assume that Expression (13) is true:

$$d'(A_i) = \min V(S_i \geq S_k) \quad \text{for } k = 1, 2, \dots, n; k \neq i. \quad (13)$$

The weight vector is obtained by Expression (14):

$$W' = (d'(A_1), d'(A_2), \dots, d'(A_n))^T \quad (14)$$

Where A_i ($i = 1, 2, \dots, n$) consists of n elements.

Step 4: Through normalization, the weight vectors are reduced to Expression (15):

$$W = (d(A_1), d(A_2), \dots, d(A_n))^T \quad (15)$$

Where W does not represent a fuzzy number (Kahraman *et al.*, 2006).

3.2. TOPSIS Method

TOPSIS method was introduced for the first time by Yoon and Hwang and was appraised by surveyors and different operators. TOPSIS is a decision making technique. It is a goal based approach for finding the alternative that is closest to the ideal solution. In this method, options are graded based on ideal solution similarity. If an option is more similar to an ideal solution, it has a higher grade. Ideal solution is a solution that is the best from any aspect that does not exist practically and we try to approximate it. Basically, for measuring similarity of a design (or option) to ideal and non-ideal levels, we consider distance of that design from ideal and non-ideal solution (Bhutia, 2012).

3.3. FAHP-TOPSIS hybrid method

In this study, we integrated two well – known method, FAHP-TOPSIS methods. To rank a set of alternatives, the FAHP-TOPSIS Hybrid method as outranking relation theory was used to analyze the data of a decision matrix. We assume m alternatives and n decision criteria. Each alternative is evaluated with respect to n criteria. All the values assigned to the alternatives with respect to each criterion form a decision matrix.

The procedure for AHP-TOPSIS Hybrid method in the ranking model has been given as follows:

Let $A = \{A_1, A_2, \dots, A_m\}$ be a set of alternatives and $C = \{C_1, C_2, \dots, C_n\}$ be a set of criteria. We modify the selection process to a nine-step, FAHP-TOPSIS hybrid procedure, presented as follows:

Step 1: Identify the Alternative.

We provide a list of alternatives denoted by $A = \{A_1, A_2, \dots, A_m\}$

Step 2: Identify the criteria.

The criteria could be denoted by $C = \{C_1, C_2, \dots, C_n\}$.

Step 3: Determine the weight of criteria based on the opinion of experts (W_i) by using FAHP method.

The decision group or decision makers are given the task of forming individual pair-wise comparisons by using scale of five or nine levels. This study linguistic scale of importance is as below for pair-wise comparison judgments (Table 1).

Table 1. Linguistic Scale of Importance (Ksenija *et al.*, 2014)

Linguistic Scale of Importance	Triangular Fuzzy Numbers	Reciprocal value of triangular fuzzy numbers
Equal	(1,1,1)	(1,1,1)
Weak	(1/2,1,3/2)	(2/3,1,2)
Fairly strong	(3/2,2,5/2)	(1/2,1,3/2)
Very strong	(5/2,3,7/2)	(2/7,1/3,2/5)
Absolute	(7/2,4,9/2)	(2/9,1/4,2/7)

We used Group Fuzzy AHP method in this study and 30 finance experts comprised the criteria. To continue the process, individual opinions should be merged. We used the geometric mean also for l_{ij} , m_{ij} and u_{ij} which delivers satisfying fuzzy group weightings. Geometric mean operations are commonly used within the application of the AHP for aggregating group decisions (Davies, 1994):

$$l_{ij} = (\prod_{k=1}^k l_{ijk})^{1/k}, \quad m_{ij} = (\prod_{k=1}^k m_{ijk})^{1/k}, \quad u_{ij} = (\prod_{k=1}^k u_{ijk})^{1/k}$$

Step 4: Determine the decision matrix

$$D = \begin{bmatrix} C_{11} & \cdots & C_{1n} \\ \vdots & \ddots & \vdots \\ C_{m1} & \cdots & C_{mn} \end{bmatrix} \quad (16)$$

C_{ij} is a value indicating the performance rating of each alternative with respect to each criterion.

Step 5: Determine the normalized decision matrix

$$r_{mn} = \frac{C_{mn}}{\sqrt{\sum_{m=1}^M C_{mn}^2}} \quad (17)$$

Step 6: Determine the weighted normalized decision matrix

$$V_{mn} = w_m \times r_{mn}, \quad n = 1, 2, \dots, N, \quad m = 1, 2, \dots, M \quad (18)$$

Here w_i represents the weight of the i^{th} criterion.

Step 7: Determine the positive and negative ideal solution.

In this step, the positive ideal solution (PIS) and negative ideal solution (NIS) have to be determined. A^+ is PIS and A^- is NIS.

Then A^+ and A^- are equal to:

$$A^+ = \{v_1^+, v_2^+, \dots, v_n^+\} = \{(\max_{mn} | m \in M'), (\min_{mn} | m \in M'')\} \quad (19)$$

$$A^- = \{v_1^-, v_2^-, \dots, v_n^-\} = \{(\min_{mn} | m \in M'), (\max_{mn} | m \in M'')\} \quad (20)$$

Where M' is associated with benefit criteria and M'' is associated with cost criteria.

Step 8: Determine the separation measures between the alternatives.

The separation measures, d_i^+ and d_i^- , of each alternative from PIS and NIS, are calculated.

$$d_n^+ = \sqrt{\sum_{m=1}^M (v_{mn} - v_m^+)^2}, \quad n = 1, 2, \dots, N \quad (21)$$

$$d_n^- = \sqrt{\sum_{m=1}^M (v_{mn} - v_m^-)^2}, \quad n = 1, 2, \dots, N \quad (22)$$

Step 9: Determine the final ranking.

In the final step, the relative closeness coefficient of an alternative is defined as follows:

$$CC_n^+ = \frac{d_n^-}{d_n^+ + d_n^-}, \quad n = 1, 2, \dots, N \quad (23)$$

(Daneshvar et. Al., 2014)

Thus, TOPSIS minimizes the distance to the ideal alternative while maximizing the distance to the nadir alternative (reverse extreme performance on each criterion). There are a number of specific procedures that can be used for developing weights, and for distance measures. Additionally, different conventions can be applied to defining best performance and worst performance (Olson, 2004).

4. Data Analysis: Ranking the Iran private banks using FAHP an TOPSIS

After explaining the processes of FAHP and TOPSIS models, now we can use these models for ranking the private banks through the following phases:

Phase I: Identifying the parameters for comparing the banks

In this study, to compare the Iran private banks, a number of financial attributes are selected based on opinions of some finance and banking experts and similar studies like the ones done by Amile *et. al.* (2012), Ozbek (2015), Akkoc (2013), Mandic *et.al.* (2014). These financial attributes include:

Equity: Equity is used in accounting in several ways. Often the word equity is used when referring to an ownership interest in a business. Examples include stockholders' equity or owner's equity. Occasionally, equity is used to mean the combination of liabilities and owner's equity. For example, some restate the basic accounting equation from Assets=Liabilities + Owner's Equity to Assets = Equities.

Equity criterion is the basis for evaluating the performance of banks.

Portfolio: A grouping of financial assets such as stocks, bonds and cash equivalents, as well as their mutual, exchange-traded and closed-fund counterparts. Portfolios are held directly by investors and/or managed by financial professionals. In this study Portfolio includes callable deposits and loans, the interest and fees, given loans and deposits, securities and other investments

Sources: Criterion Sources include average sources such as transaction deposits, other deposits and borrowings, obligations under the securities, obligations for interests, fees and the valuation of derivatives. Proper use of these sources of funding affects the profitability of the banks.

Liquid asset: An asset is said to be liquid if it is easy to sell or convert into cash without any loss in its value. By definition, bank notes and checking accounts are the most liquid assets. Given the fact that banks, by their nature of activities, often take risks in business transactions, it is important when analyzing the efficiency of banks to take into account the criterion of Liquid Assets. (Ksenija *et al.*, 2014)

Cash: Cash is the most liquid asset a company can own. A company's cash account in its chart of accounts includes all currency and coins owned by the company as well as all deposits in the bank including checking accounts and savings accounts. Cash is recorded as a current asset on the balance sheet. Even though cash can be saved for future periods, it is still considered a current asset because it can be used in one period. Long-term assets like vehicles cannot be completely used during one accounting period. Cash (cash and cash equivalents) is the most liquid part of the assets, and also synthesized reflection of the impact of business activities of the bank in statement of cash flows (from operating activities and financing activities and investing) on the amount of cash and cash equivalent (Ksenija *et al.*, 2014).

Net Interest Income (NII+): The difference between the revenue that is generated from a bank's assets and the expenses associated with paying out its liabilities. A typical bank's assets consist of all forms of personal and commercial loans, mortgages and securities. The liabilities are, of course, the customer deposits. The excess revenue that is generated from the spread between interest paid out on deposits and interest earned on assets is the net interest income.

Core Business Income (CBNI+): Core Business Income is an important criterion that includes Net Interest Income and income from fees and commissions net of indirect write-offs.

Earnings before tax (EBT): Earning before tax is a very important criterion for evaluating the performance of banks relative to the invested capital (Ksenija *et al.*, 2014).

Phase II: Determining the importance of attributes using Group FAHP

To determine the weights or importance of financial attributes, fuzzy AHP (FAHP) is used. For this purpose, first hierarchical structure was drawn as Figure 4:

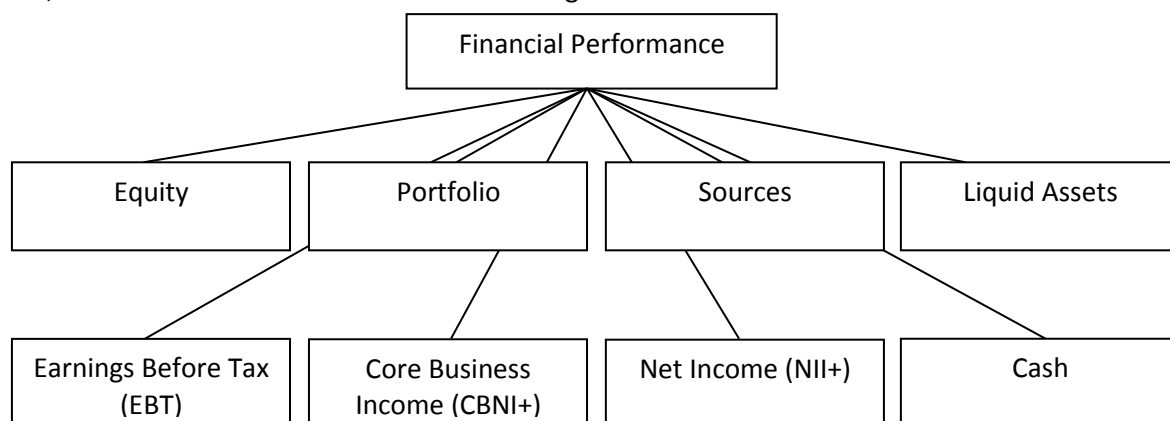


Figure 4. The hierarchical structure of attributes used to evaluating the banks

scale of importance in comparison process. Fuzzy AHP method uses a scale that is composed of linguistic variables whose values are not numbers but words. Linguistic variables can be specified and mapped to fuzzy numbers. A scale of five linguistic terms has been used: Equally, Weak, Fairly Strong, Very Strong and Absolute as shown in Table1. When comparing linguistic criteria, financial experts select a linguistic variable that best suits the importance of particular criteria. Then, each variable in the scale is mapped to a triangular fuzzy number, which means that each variable is defined by three values. Then, the group paired comparison matrix formed using geometric mean of Single comparison matrixes. Afterwards the priority vector of financial parameters was calculated as bellow table using Chang's FAHP process, explained in section 3.1.

Table 2. Group FAHP comparison matrix of eight attributes and their priority

Criteria	Equity	Portfolio	Sources	Liquid Assets	Cash	(NII+)	(CBNI+)	(EBT)	Priority Vector
Equity	(1, 1, 1)	(1.22, 1.41, 1.58)	(0.87, 1.41, 1.94)	(1.94, 2.45, 2.96)	(1.58, 1.73, 1.87)	(1.87, 2, 2.12)	(1.22, 1.41, 1.58)	(1.22, 1.41, 1.58)	0.266
Portfolio	(0.63, 0.71, 0.82)	(1, 1, 1)	(1.58, 1.73, 1.87)	(1.22, 1.41, 1.58)	(1.58, 1.73, 1.87)	(1.22, 1.41, 1.58)	(1.58, 1.73, 1.87)	(1.22, 1.41, 1.58)	0.211
Sources	(0.52, 0.71, 1.15)	(0.53, 0.58, 0.63)	(1, 1, 1)	(1.58, 1.73, 1.87)	(1.58, 1.73, 1.87)	(1.22, 1.41, 1.58)	(1.22, 1.41, 1.58)	(1.22, 1.41, 1.58)	0.174
Liquid Assets	(0.34, 0.41, 0.52)	(0.63, 0.71, 0.82)	(0.53, 0.58, 0.63)	(1, 1, 1)	(0.87, 1.41, 1.94)	(0.71, 1, 1.22)	(0.71, 1, 1.22)	(0.71, 1, 1.22)	0.069
Cash	(0.53, 0.58, 0.63)	(0.53, 0.58, 0.63)	(0.53, 0.58, 1.15)	(0.52, 0.71, 1.15)	(1, 1, 1)	(0.71, 1, 1.22)	(0.71, 1, 1.22)	(0.71, 1, 1.22)	0.053
(NII+)	(0.47, 0.5, 0.53)	(0.63, 0.71, 0.82)	(0.63, 0.71, 0.82)	(0.82, 1, 1.41)	(0.82, 1, 1.41)	(1, 1, 1)	(1.22, 1.41, 1.58)	(0.45, 0.71, 1)	0.069
(CBNI+)	(0.63, 0.71, 0.82)	(0.53, 0.58, 0.63)	(0.63, 0.71, 0.82)	(0.82, 1, 1.41)	(0.82, 1, 1.41)	(0.63, 0.71, 0.82)	(1, 1, 1)	(1.22, 1.41, 1.58)	0.066
(EBT)	(0.63, 0.71, 0.82)	(0.63, 0.71, 0.82)	(0.63, 0.71, 0.82)	(0.82, 1, 1.41)	(0.82, 1, 1.41)	(1, 1.41, 2.24)	(0.63, 0.71, 0.82)	(1, 1, 1)	0.092

As the above table shows, financial attributes, used in this study, are Equity, Portfolio, Sources, Liquid Asset, Cash, NII+, CBNI+ and EBT. Coefficient of these parameters is 0.266, 0.211, 0.174, 0.069, 0.053, 0.069, 0.066 and 0.092, respectively. So Equity and Portfolio have the highest and Cash and Core Business Income (CBN+) have the lowest priority in evaluating of financial performance of banks.

Phase III: Ranking the banks using TOPSIS

In this phase, we ranked the 21 Iran private banks using the importance coefficients of financial parameters determined by group FAHP and financial data of banks. The values of financial data have been obtained from the financial statements at the end of fiscal year 1393 (Solar Hijri year) march 2015 (as shown in Table 3). (The Solar Hijri calendar is based on the number of full rotations of the earth around the sun (around 365 days) since the migration of the Prophet Muhammad from Mecca to Medina. It is most commonly used in Iran)

Table 3. Value of the basic financial criteria of Iranian private banks for the Solar Hijri year 1393 (March 2015)

Parameter	Equity	Portfolio	Sources	Liquid Assets	Cash	NII+	CBNI+	EBT
Coefficient	0.266	0.211	0.174	0.069	0.053	0.069	0.066	0.092
Tejarat	61,405,025	1,334,641,570	756,053,954	142,784,203	7,338,951	-3,213,545	3,791,103	6,042,099
Sarmayeh	5,402,205	195,787,881	124,647,035	19,898,892	473,043	10,583,652	11,202,348	56,927
Iran Zamin	4,025,025	77,300,432	66,863,199	7,465,945	296,199	4,207,247	4,674,044	-120,358
Pasargad	67,528,074	702,759,037	362,656,337	120,770,317	2,270,517	15,558,335	21,045,261	13,952,482
Saman	10,801,928	306,917,102	202,050,497	70,554,873	1,872,745	2,465,270	3,571,560	1,011,340
Karafarin	14,885,922	171,387,186	94,410,057	27,391,640	814,811	5,262,237	5,903,201	4,321,646
Eghtesad Novin	18,936,788	606,288,009	312,999,951	58,832,977	1,662,751	8,109,328	10,126,638	3,928,750
Mehr Eghtesad	16,676,472	749,017,887	404,392,437	42,673,295	799,364	6,160,490	6,901,010	1,592,254
Sina	13,964,171	237,258,694	130,084,995	41,714,906	741,932	3,575,167	4,597,858	2,571,020
Resalat	264,873	64,425,166	39,195,424	5,294,369	224,541	0	60,514	-195,991
Khavamiyaneh	5,081,453	49,511,830	25,174,451	4,334,504	122,249	1,115,428	1,330,568	961,268
Post Bank	2,168,782	71,469,222	42,379,813	7,768,245	565,212	838,840	2,343,319	-1,292,582
Saderat Iran	95,099,462	1,503,621,955	964,466,195	198,635,522	11,874,143	-2,639,988	3,887,562	8,187,378
Day	7,957,737	157,874,114	106,571,351	30,349,810	738,802	-298,847	46,485	2,398,375
Ayandeh	7,960,657	489,599,405	350,064,239	33,712,617	602,289	2,560,054	2,892,036	-1,118,962
Gardeshgari	4,166,437	96,622,861	81,538,024	13,312,277	344,986	20,013	45,299	-878,519
Ghavamini	6,276,671	892,179,887	434,490,227	55,835,897	785,483	14,628,047	14,834,349	926,518
Shahr	10,960,478	279,749,339	184,801,888	48,253,552	1,331,290	121,009	1,289,785	1,794,314
Hekmat Iranian	4,660,766	25,406,061	15,302,126	6,940,446	357,243	714,091	946,853	398,769
Parsian	27,788,768	815,021,823	509,349,781	140,108,759	2,222,658	-6,746,083	-4,753,126	975,049
Mellat	1,449,984,220	2,029,912,293	1,239,867,459	280,884,375	15,666,708	5,610,302	23,981,572	19,177,595

(Source: Elicited from Portal of Iran Securities and Exchange Organization: <http://www.codal.ir/Search.aspx>)

Afterwards, the required analysis was performed to evaluate the financial performance of Iran private banks. Finally banks were ranked on the basis of their financial performance through TOPSIS method as described in the previous sections. Table 4 presents the closeness grades and ranks of the private banks.

Table 4. Total closeness grades and ranks of the Iran private banks

Banks	d+	d-	Cci	Rank
Mellat	0.01	0.32	0.98	1
Saderat Iran	0.25	0.13	0.34	2
Tejarat	0.26	0.11	0.29	3
Parsian	0.28	0.07	0.20	4
Ghavamian	0.29	0.07	0.19	5
Pasargad	0.28	0.06	0.18	6
Mehr Eghtesad	0.29	0.06	0.17	7
Eghtesad Novin	0.31	0.05	0.13	8
Ayandeh	0.30	0.04	0.12	9
Saman	0.30	0.03	0.08	10
Shahr	0.30	0.02	0.07	11
Sarmayeh	0.31	0.02	0.06	12
Sina	0.31	0.02	0.06	13
Karafarin	0.31	0.02	0.05	14
Day	0.31	0.01	0.04	15
Iran Zamin	0.31	0.01	0.03	16
Gardeshgari	0.31	0.01	0.03	17
Post Bank	0.31	0.01	0.024	18
Khavarmianeh	0.31	0.01	0.022	19
Hekmat Iranian	0.32	0.01	0.020	20
Resalat	0.31	0.01	0.020	21

As specified in the table above Mellat, Saderat Iran, Tejarat and Parsian have the highest ranking among Iran private banks. On the other hand, Resalat, Hekmat Iranian Khavarmianeh and PostBank have the lowest ranking among private banks.

5. Conclusions

Due to the economic globalization and expansion of activities beyond the borders, enterprises are forced to seek continuous improvement of their performance. To gain higher market share is the key feature of competitive market. Among other economical and financial firms, banks have a special importance. Banks as financial supplier of firms play special role in the economic success of their businesses. On the other hand the weakness of firms and economic recession led to revenues decline and savings reduction naturally. Savings reduction in itself will lead to a reduction in banks deposits and their performance. So paying attention to the performance of banks in any country including Iran is a very important issue.

In recent years, privatization of banks and their development has been very important.

Now, 21 private banks present in Iran stock exchange market. These banks are in competition with state-owned banks in Iran financial market. On the other hand, Iran government sought to resolve the international sanctions. Solving these sanctions may lead to the entry of foreign banks into domestic market. Success in such a competitive market requires continues monitoring and comparing performance with competitors'. In this paper, we tried to study and compare the financial performance of private banks in Iran. In this regard, banks performance evaluation attributes and their importance were identified using the opinions of 30 banking financial experts. To do so, we used FAHP model. It was concluded that in the evaluation process of Iran private banks, the criteria of Equity and Portfolio are the most significant parameter with a weight vector of 0.266 and 0.211 followed by the criteria of Sources and EBT with a vector of 0.174 and 0.092, Liquid Asset and NII+ with vectors of 0.069, and finally CBNI+ and Cash with 0.066 and 0.053. Then the performance of these banks was also evaluated, using information of the financial statements of private banks and using TOPSIS method. TOPSIS method simultaneously considers both PIS and NIS distances, so that eventually an ideal option is obtained, that is, the closest to PIS and the farthest from NIS.

As a result, Mellat ($CC_i = 0.98$), Saderat Iran ($CC_i = 0.34$), Tejarat ($CC_i = 0.29$), and Parsian ($CC_i = 0.29$) have the highest ranking among Iran private banks. The competitive ability of the first three banks (Saderat Iran, Tejarat and Pasargad) is higher than others. Of course the top two banks (Mellat, Saderat Iran, Tejarat) were state-owned already and governmental support had strengthened them.

On the other hand, Resalat ($CC_i = 0.02$), Hekmat Iranian ($CC_i = 0.02$), Khavarmianeh ($CC_i = 0.022$) and PostBank ($CC_i = 0.024$) have the lowest ranking among private banks. The performance of these banks is very weak as compared to other banks. If they are looking to continue their activities in this market, they should seek to improve their financial performance; otherwise, they will fail and get eliminated from this competitive market.

As well, it is recommended that other researchers study the financial performance of state-owned banks. Undoubtedly, comparing the performance of both state-owned and private banks can fully explain the banking sector competitive market.

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