Performance Evaluation and Ranking of Turkish Private Banks Using AHP and TOPSIS

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Abstract. Measuring performance and determining the key factors of performance have been an important research topic in different sector in recent years. The main goal of this study is to evaluate the performance ranks of the private banks in Turkey due to the fact that performances of private banks are important at the stage of economic growth. In this research, the private banks in Turkey ranked by TOPSIS method using weights of capital ratios obtained from AHP. The performance ranks of private banks sorted according to their TOPSIS scores for the period 2009-2013. In this study, capital ratios of Turkish private banks are placed in a hierarchical decision structure to establish pair-wise comparisons between the model parameters which are based on the subjective judgment of a group of experts. In order to find the performance order of the private banks in Turkey according to capital ratios, calculated criteria and sub-criteria weights for each banks by using AHP to use in TOPSIS method. Performance scores of private the banks obtained by TOPSIS method related with banks’ capital ratios of AHP weights. Consequently, the performances and also the sector share of the private banks weren't changed for analyzed period.

Keywords: AHP, TOPSIS, Turkish private banks, capital ratios, performance ranking

1 Introduction

Performance measurement for business success is a result of globalization and increasing competition in the business environment. In general, measurement of performance is traditionally important for strategic decision-makers. Performance measurement has great deal of attention by the researchers in the past decades (Kagioglou et al., 2001; Bassioni et al., 2004). Competition in the banking sector as well as in all sectors force banks to measure performances and use resources effectively. Commercial banks have great role for determining the allocation of resources in different economic sectors.

A variety of decision making methods and tools are available to measure performance ranks of financial companies. In general, MCDM (Multi Criteria Decision Making) methodologies are well–s suited to the complexity of economic decision problems and robustness of financial analysis for business decisions (Balzentis et al. 2012). TOPSIS (Technique for Order Preference by Similarity to an Ideal Solution), AHP (Analytical Hierarch Process) and in collaboration of both techniques have been utilized as efficient tools in many finance and economy fields by financial regulators.

In this study, the combination of AHP and TOPSIS was chosen as a suitable methodology to measure performance ranks of private commercial banks. The performance ranks of Turkish private banks obtained by using TOPSIS method based on the AHP weights of capital ratios that take into account company-level capital ratios that allows us to use quantitative information to rank private banks in Turkish banking sector. In Turkish banking sector, totally 26 sub-ratios covered with 7 main financial
ratios are evaluated by governmental institution for banks. The study showed that highly weighted sub-ratios of banks are in accordance with their performance orders.

2 Literature Survey

Traditionally, bank performance evaluation is based on the analysis of financial ratios. However, nonfinancial performance criteria have been recognized significantly and taken into account to fully satisfy bank operations’ efficiency (Seeme et al., 2009, Toloie-Eshlaghy et al., 2011, Amile et al., 2013, Islam et al., 2013).

Financial performance of foreign banks operating in Turkish banking sector is measured by TOPSIS method for the years 2003-2013 (Gundogdu, 2015).

Akkoç and Vatansever (2013) measured financial performance of 12 banks in Turkey using AHP and TOPSIS methods and the research results are similar for both methods.


Yılmaz (2013) analyzed the efficiency of the 30 commercial banks in Turkey by using DEA (Data Envelopment Analysis) for the period 2007-2010.

Onder and Hepsen (2013) combined AHP and TOPSIS methodologies and used for the ranking of 3 state banks, 9 private banks and 5 foreign banks of Turkish banking sector during 2002-2011 using 57 ratios based on subjective and objective opinions of financial actors.

Gilbert et al. (1985) formally introduced capital ratios in regulation and applied in a different way. Bank regulators have relied on capital ratios for a very long time in formally or informally ways. Bank regulators have not always used capital ratios in the same way. Capital ratios have long been a valuable tool for assessing the safety of banks. The informal use of ratios by bank regulators and supervisors goes back well over a century.

3 Methodology

3.1 Analytical Hierarchy Process

The AHP is an intuitively easy method for formulating and analyzing decisions (Saaty, 1980). Numerous applications of the AHP have been used since its development and it has been applied to many types of decision problems (Zahedi, 1986). Researchers interested in more detail could refer to the most recent book by written (Saaty & Penivati, 2008).

In cases where many alternatives need to be evaluated the AHP ratings approach is often used. This approach requires that a series of ratings or intensities to be developed for each criterion (for example, excellent, very good, good, fair, and poor).

In AHP decision elements of each component are compared pair-wise with regard to their importance in the direction of their control criterion and components are also compared pair-wise and in respect of their contribution to the achievement of the objective.
The relative important values are determined with a scale of from 1 to 9, where a score of 1 represents equal importance between the two elements and a score of 9 indicates the extreme importance of one element (row component in the matrix) compared to the other one (column component in the matrix) (Meade and Sarkis, 1999; Saaty, 2009). The basic approach for deriving weights with AHP is obtained by way of pair-wise relative comparisons. In general, a nine-point numerical scale is recommended for the comparisons (Saaty, 1980) given in Table 1.

Table 1: Fundamental Scale

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>equal importance</td>
</tr>
<tr>
<td>3</td>
<td>moderate importance of one over another</td>
</tr>
<tr>
<td>5</td>
<td>strong or essential importance</td>
</tr>
<tr>
<td>7</td>
<td>very strong or demonstrated importance</td>
</tr>
<tr>
<td>9</td>
<td>extreme importance</td>
</tr>
<tr>
<td>2, 4, 6, 8</td>
<td>intermediate values</td>
</tr>
<tr>
<td>Use reciprocals for inverse comparisons</td>
<td></td>
</tr>
</tbody>
</table>

An AHP analysis uses pairwise comparisons to measure the impact of items on one level of the hierarchy on the next higher level. At each level, the pairwise comparisons are organized into a matrix and the weights of the items being compared are determined by computing the maximum eigenvalue of the matrix. A weighted averaging approach is used to combine the results across levels of the hierarchy to compute a final weight for each alternative.

In AHP, consistency index (C.I.) and consistency ratio (C.R.) to verify the consistency of the comparison matrix. are defined as

$$C.I. = \frac{\lambda_{\text{max}} - n}{(n-1)}, \quad C.R. = \frac{C.I.}{R.I.}$$

where $R.I.$ represents the average consistency index over numerous random entries of same order reciprocal matrices. If $C.R. \leq 0.1$, the estimate is accepted; otherwise, a new comparison matrix is solicited until $C.R. \leq 0.1$.

Another important advantage of the AHP is that it allows for inconsistency in judgment. The consistency ratio provides a numerical assessment of how inconsistent these evaluations might be. If the calculated ratio is less than 0.10, consistency is considered to be satisfactory (Meade, 1996). The geometric mean of all evaluations is also used to obtain the required pair-wise comparison matrix (Lin et al., 2009).

3.2. TOPSIS Method

The TOPSIS method developed by Hwang and Yoon (1981) basically depending on closest distance to positive-ideal solution and most distance to negative-ideal solution.

TOPSIS method procedure steps as follows:
1. Step: The Constitution of Decision Matrix (A): Alternatives are positioned as decision points on rows and evaluation criteria about decision positioned on columns in the decision matrix. In the \( A_{mxn} \) decision matrix, \( m \) and \( n \) represent decision point number and evaluation factor numbers respectively (Rao 2008).

\[
A_{mxn} = \{a_{ij} | i \in (1, 2, ..., m) \text{ and } j \in (1, 2, ..., n)\}
\]

2. Step: Normalized Decision Matrix (R): Normalizing by square root of the sum of the squares scores or features belong to decision matrix criteria, calculated from A matrix by applying following equation (Opricovic and Tzeng, 2004).

\[
r_{ij} = \frac{a_{ij}}{\sqrt{\sum_{k=1}^{m} a_{kj}^2}} \quad \text{where} \quad (r_{ij} \in R \text{ and } i:1,2,\ldots,n: \text{criteria numbers, } j:1,2,\ldots,m: \text{alternative numbers})
\]

3. Step: Weighted Normalized Decision Matrix (V): In this step firstly weighted values are determined \( (w_j: \text{for each } j \text{, criteria, relative weight values of elements of normalized decision matrix}) \) according to purpose, (Monjezi et al., 2010). V matrix is formed by multiplying elements in the R matrix each column with \( w_j \) value. It is obtained as follows

\[
V = \{V_{ij} | w_j a_{ij} | i \in (1, 2, ..., m) \text{ and } j \in (1, 2, ..., n)\} \quad \text{where} \quad \sum_{j=1}^{n} w_j = 1
\]

4. Step: Construction of Positive Ideal (\( A^+ \)) and Negative Ideal (\( A^- \)) Solutions: The biggest ones which are the weighted factors of the column values in the V matrix selected in order to get the ideal solution set, in other words (smallest value is selected if related evaluating factor have direction of minimization). Positive ideal (\( A^+ \)) and negative ideal (\( A^- \)) solutions sets obtained from V matrix as follows respectively,

\[
A^+ = \left\{ \max_{i} v_{ij} | j \in J \right\}, \left\{ \min_{i} v_{ij} | j \in J' \right\}, \text{ represented by } A^+ = \left\{ v^+_1, v^+_2, \ldots, v^+_n \right\}
\]

\[
A^- = \left\{ \min_{i} v_{ij} | j \in J \right\}, \left\{ \max_{i} v_{ij} | j \in J' \right\}, \text{ represented by } A^- = \left\{ v^-_1, v^-_2, \ldots, v^-_n \right\}
\]

In both formulas, J demonstrates the benefit (maximization) and J' demonstrates the cost (minimization) value.

5. Step: Calculation of Distance Between Alternatives: Distance between alternatives is obtained by n sized Euclidean Distance Approach. Distance from Positive Ideal (\( S^+ \)) and Negative Ideal (\( S^- \)) Solutions for each alternative are calculated by formulas which are given below respectively.

\[
S^+_i = \sqrt{\sum_{j=1}^{n} (v_{ij} - v^+_j)^2} \quad \text{and} \quad S^-_i = \sqrt{\sum_{j=1}^{n} (v_{ij} - v^-_j)^2}
\]

6. Step: Calculation of Relative Closeness to the Ideal Solution: Distinction measurements are used to calculation of relative closeness (\( C^*_i \)) to the ideal solution has shown in the following, (Olson 2004).

\[
C^*_i = \frac{S^-_i}{S^-_i + S^+_i} \quad \text{where} \quad 0 \leq C^*_i \leq 1
\]
7. Step: Closeness of the Alternatives to the Ideal Solution: Closeness of the alternatives to the ideal solution is sorted according to the value $C_i^*$, alternative which have highest $C_i^*$ is chosen.

4 Implementation and Results

4.1. Implementation

In Turkish banking sector, financial ratios are categorized as Capital Ratios, Assets Quality, Liquidity, Profitability, Income-Expenditure Structure, Share in Group and Share in Sector and totally 26 sub-ratios related with the ratios.

Turkish governmental institution, namely Turkish Bank Association, evaluates ratios for each private and governmental banks. The ratios considered in this research are Shareholders’ Equity / Total Risk Weighted Assets, Shareholders' Equity / Total Assets and (Shareholders' Equity - Permanent Assets) / Total Assets which are sub-ratios of Capital Ratios which are obtained from Turkish Bank Association open source (www.tbb.org.tr).

In this study, the application of AHP, the relative importances or weights of the criteria weighing each attribute by experts are determined and arranged in a hierarchy.

**Expert Choice©** software was used to evaluate pairwise-comparison judgments and obtained criteria and sub-criteria weights. The consensus of the groups was calculated using the geometric mean of individual judgments.

<table>
<thead>
<tr>
<th>Capital Ratios</th>
<th>AHP Combined Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shareholders’ Equity / Total Risk Weighted Assets</td>
<td>0.715</td>
</tr>
<tr>
<td>Shareholders' Equity / Total Assets</td>
<td>0.067</td>
</tr>
<tr>
<td>(Shareholders' Equity - Permanent Assets) / Total Assets</td>
<td>0.218</td>
</tr>
</tbody>
</table>

In cases where inconsistency is above 10% during the assessment of prioritizing one criterion than the other one so the consistency of the judgments is tracked to validate for decision process.

4.2 Results

AHP weighted scores are utilized by TOPSIS method for each year for the period 2009-2013 to obtained performance ranks of private banks of Turkish banking sector.

Performance ranking results of private banks of Turkish banking sector for the period of 2009 - 2013 years evaluated TOPSIS method based on AHP capital ratios weights are given Table 3.

<table>
<thead>
<tr>
<th>No</th>
<th>Bank Name</th>
<th>2009</th>
<th>Bank Name</th>
<th>2010</th>
<th>Bank Name</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Deutsche Bank</td>
<td>0.921</td>
<td>Deutsche Bank</td>
<td>0.882</td>
<td>Deutsche Bank</td>
<td>0.956</td>
</tr>
<tr>
<td>2</td>
<td>Arap Türk Bankası</td>
<td>0.604</td>
<td>Arap Türk Bankası</td>
<td>0.724</td>
<td>Turkish Bank</td>
<td>0.922</td>
</tr>
<tr>
<td>3</td>
<td>Turkish Bank</td>
<td>0.410</td>
<td>Turkish Bank</td>
<td>0.454</td>
<td>Arap Türk Bankası</td>
<td>0.515</td>
</tr>
<tr>
<td>4</td>
<td>Burgan Bank</td>
<td>0.297</td>
<td>Akbank T.A.Ş.</td>
<td>0.353</td>
<td>Turkland Bank</td>
<td>0.345</td>
</tr>
<tr>
<td>5</td>
<td>Tekstil Bankası</td>
<td>0.294</td>
<td>Tekstil Bankası</td>
<td>0.334</td>
<td>Akbank T.A.Ş.</td>
<td>0.282</td>
</tr>
</tbody>
</table>
In this research shows that the banks such as Deutsche Bank, Citibank and Arap Türk Bankası owned by foreign investors have better performance rank than national private banks. Study also shows that performance ranks of private banks in consistency with banks’ raw data of Shareholders’ Equity / Total Risk Weighted Assets weights.

On the other hand, there is almost no change performance rank of Turkish private commercial banks for investigated period.
5 Conclusions
Measurement of banking sector simultaneously contribute to being in competition as an early warning indicator. Banks could not to replicate the failures revealed in the past and make foresight and strategies by analyzing their performance

Financial ratios evaluated by AHP and performance ranks of the banks have been determined via the TOPSIS model and the performances of Turkish private commercial system have been analyzed within the scope of the model. In this study, AHP method was utilized to determine the sub-criteria of the performance evaluation hierarchy and weighted ratios used by TOPSIS method combining to rank private commercial banks in Turkey.

In this research, both AHP, main criteria and sub-criteria weights prioritizing and TOPSIS priority of banks directly engagement with the performance based on their raw data. Study show that the higher the capital adequacy ratio, the higher the level of protection available to depositors. Basically, a large bank needs a larger amount of capital than a small bank.

This research also provides very valuable information to the supervisor, decision makers and global and local investors who are responsible from prevention of bank failures.

References


