Comparing and Ranking Superior Companies Based on Stock Indexes and Ranking Based On Indices Derived From the Experts’ Views Using the Hybrid Fuzzy Delphi and AHP-TOPSIS Approach at Tehran Stock Exchange

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Abstract
The main objective of this paper is to provide a new approach to rank 50 superior companies at Tehran Stock Exchange. The study is based on indices derived from the experts’ views using the Fuzzy Delphi and AHP and TOPSIS hybrid approach to rank the companies during 1389-1392. The sample of study is 30 managers and experts from Tehran Stock Exchange based on Cochran formula. First, through the Fuzzy Delphi method, four indices from 17 indices (number of shares traded, the average number of issued shares, P/E, EPS) were selected as the most important criteria for ranking companies at Tehran Stock Exchange according to the experts’ views. Then, by using AHP, weights of these indices are obtained. These obtained weights are considered as inputs in TOPSIS method and the rankings of 50 companies at Tehran Stock Exchange will be obtained by TOPSIS. Financial data were collected from Rahavard Novin Software and the stock exchange site. The results showed that the obtained ranking is different from the stock ranking.

Keywords: Corporate Governance, Earnings Management, Financial Performance, Stock Exchange

Introduction
Ranking accepted companies in stock exchange, shows their situation and is considered as a benchmark for investment. This increases competition and efficiency and also development. In this article, fifty top companies listed in Tehran Stock Exchange during five years from 1389 to 1392 are ranked through a hybrid approach of Fuzzy Delphi AHP_ TOPSIS. In recent years, many developed countries have provided economic development and financial institutions and businesses by developing capital markets and their stock, by directing capital investment and population (Ketabi, 1384). On the other hand, investors are trying to make more profit by investing in more successful and top companies to achieve expected returns (Saremi, 1358). Development of capital markets led to creating and developing financial services. These institutions publish some general information about the economic and commercial conditions, as well as consulting investors in various levels. Larger financial services institutions provide ranking services (Figora, Gersu, 2006). Ranking means sorting companies base on ability, quality, efficiency and productivity. This practice is important not only for investors but also for shareholders, financial creditors, etc. (Tehran, Pazhuhesh 27704015, 1377). Researches show that the Tehran Stock Exchange has poor performance. Thus, ranking listed companies in order to meet the needs of investors to select the best companies to invest and prevent inappropriate decisions by them, is of particular importance (Tofigh, 1378) because these studies provides the opportunity, that investors and users of information choose efficient companies more easily.
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and have more reasonable investment (Pourzand, Mansouri, 1379), And in other words it is used as a benchmark for investors to invest with greater reliability (Omrani and others, 1387).

**Theoretical framework**

Stock Exchange as part of the capital market and economic area of countries is considered as an indicator in determining the society's demand for information (Mehrani et al., 1383), which provides financing opportunities for listed companies, and investors can invest and earn a return (Khata Lu, 1384). But it should be noted that investors do extensive surveys to make investment and stock exchange decisions of companies shares, because they convert their cash assets to shares. The information institutions can contribute to the decision-makers in their decisions by providing timely, accurate and relevant information (Mehrani et al., 1383). Investors, managers and providers, each consider criteria for measuring the performance of business unit. The analysis of financial ratios is an effective solution and is the first step for evaluating and ranking companies (Gholizadeh, 1383). Rankings as a mirror show their status, and play a crucial role in decision-makings relating to trade, investment and finance for companies. (Mehran et al., 1383). To rank companies and economic institutions, we need a comprehensive ranking models based on financial performance evaluation. Of course, it is also important that in the ranking model, criteria and appropriate mathematical techniques should be used. In general, ranking provides clearer economic activities by providing clear and useful statistics and information about the business, and provides an opportunity for investors to have optimal investment, which ultimately leads to increased competition in the market and development of the capital market. In addition it helps managers, credit providers, policy makers, owners, competitors, researchers and etc. to understand the scale of the financial and economic structure of industries and businesses better (Janani and others, 1389).

**The research model**

The model used in this paper to resolve the discussed issues, evaluates the importance of these indices in ranking companies of Stock Exchange, using the TOPSIS.

![Figure 1: conceptual model](image)

1) number of traded shares
2) the average number of issued shares
3) P / E
4) EPS

**Research Methodology**

Generally, we can say that this article is a descriptive research from data collection point of view. Since the results of this paper can be used practically, the objectives and the nature of research indicate that it is applied research. Statistically, as the sample is used in the article and the sample is used to generalize the findings and conclusions to the community, it is a descriptive study. The method is applicable and exploratory. The study population includes all individuals of brokerage, investment fund, the company's capital at Tehran Stock Exchange which is 67 persons. Based on Cochran formula, it consists of 30 managers and experts at Tehran Stock Exchange. Formulas that are used to determine the sample size generally use information such as investigating variable variance and data collection cost. The simplest and well known formula to determine the sample size is Cochran formula. The formula is proposed for simple random sampling. The formula is as follows:
\[
\begin{align*}
n &= \frac{Nt^2p(1-p)}{Nd^2 + t^2p(1-p)}
\end{align*}
\]

N: population

t: t-student test: error = (0.05), reliability = 0.95 (t= 1.96)
P: studied traits owning ratio (p-1)
d: half-Cl (10%)
n: sample size

**Data analysis method**

Fuzzy Delphi method is used for data analysis method and AHP is used to determine the weights of economic indices and TOPSIS method is used to rank the performance of the companies.

Rankings indices are determined using Fuzzy Delphi method, first. Then, these obtained weights are considered as inputs in TOPSIS method and the rankings of 50 companies at Tehran Stock Exchange will be obtained by TOPSIS. All stages of coding, data entry and statistical calculations are done by computer using excel. Ranking means sorting companies base on ability, quality, efficiency and productivity.

Fuzzy Delphi: The purpose of fuzzy Delphi method is to access the most reliable consensus of experts on a particular subject, which is done through questionnaire and surveying experts’ views, according to the received feedback from them.

AHP: The AHP is one of the MADM compensatory methods, which is used to decide and choose an option from multiple options, according the factors that the decision-maker determines. AHP converts complex issues on the basis of their mutual effects and makes them simple, and solve them.

TOPSIS: it is one of the best models of decision-making. M options are assessed by N indices. The method is based on the concept that option should be the nearest one to the positive ideal solution (best possible one) and should be far away from the negative ideal solution (worst possible one).

Data collection in the non-experimental studies is done through survey and correlation and through complete community enumeration or sampling and selection of a representative sample of the population. Sampling is selecting members of the sample group from defined members of a society based on the principles and specific rules (Metani, 1386). The study sample consists of 30 managers and experts of Tehran Stock Exchange based on Cochran formula.

Formulas for determining the sample size generally used information such as variance and cost data collection are under investigation. The simplest and well known formula to determine the sample size is Cochran formula. The formula is proposed for simple random sampling. The formula is as follows:

\[
\begin{align*}
n &= \frac{Nt^2p(1-p)}{Nd^2 + t^2p(1-p)}
\end{align*}
\]

N: population

t: t-student test: error = (0.05), reliability = 0.95 (t= 1.96)
P: studied traits owning ratio (p-1)
d: half-Cl (10%)
n: sample size

For descriptive data based on the properties of the variables, the frequency, percentage, tables, mean and standard deviation are used and for determining and ranking top 50 companies at the Tehran Stock Exchange from 1389 to 1392 the Delphi method, AHP and TOPSIS are used.

In this study, since we used multi-criteria decision-making techniques (AHP and TOPSIS) to verify the reliability of the answers of respondents, an index called the inconsistency rate is also used. A device that determines the inconsistency rate determines inconsistency, and shows the extent in which the priorities of comparisons can be trusted. If the inconsistency rate is less than 0.10, comparisons consistency is acceptable. Otherwise comparisons should be revised.

Consistency rate obtained from paired comparison study is equal to\( C = \frac{2.988 - 3}{2} = -0.005 \), and with the obtained results the consistency ratio (less than 0.1) is calculated.

\[
CR = \frac{-0.005}{0.58} = -0.01
\]
The consistency rate is -0.01 which is less than 0.10, so comparisons consistency is acceptable. In this step, respondents were asked to rate the importance of indices derived from study literature based on linguistic variables including very low, low, medium, high and very high. These indices include: the number of shares traded, the stock value, the number of business days, the number of transactions, the company’s stock market value, the average number of shares issued, Q Tobin, the ratio of P / E, The amount of dividends per share, earnings per share, market price per share, growth rate of earnings per share, the company's capital value, the balance sheet value of the company's assets, the company's annual sales, running projects and projects under construction and the products' export. The following table shows Fuzzy Delphi linguistic variables converted to quantitative variables.

<table>
<thead>
<tr>
<th>linguistic variables</th>
<th>quantitative variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>very low</td>
<td>(0, 0.1, 0.1)</td>
</tr>
<tr>
<td>low</td>
<td>(0, 0.1, 0.3)</td>
</tr>
<tr>
<td>medium</td>
<td>(0.1, 0.3, 0.5)</td>
</tr>
<tr>
<td>high</td>
<td>(0.5, 0.7, 0.9)</td>
</tr>
<tr>
<td>very high</td>
<td>(0.7, 0.9, 1)</td>
</tr>
</tbody>
</table>

Questionnaires were presented again to the respondents with the mean comments. Respondents were asked to review according to the average calculated in the first round, and rethink if they might want to. In the next stage the difference between first defuzzification and second Delphi rounds is evaluated. And if there is a difference less than 0.2 between the two averages, fuzzy Delphi stops. Otherwise, the questionnaires will be offered to the respondents for the third.

<table>
<thead>
<tr>
<th>indices</th>
<th>defuzzification mean difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>number of traded shares</td>
<td>0</td>
</tr>
<tr>
<td>traded shares value</td>
<td>0</td>
</tr>
<tr>
<td>the number of business days</td>
<td>0</td>
</tr>
<tr>
<td>the number of transactions</td>
<td>0</td>
</tr>
<tr>
<td>the company's stock market value</td>
<td>0</td>
</tr>
<tr>
<td>the average number of shares issued</td>
<td>0</td>
</tr>
<tr>
<td>Q Tobin</td>
<td>0</td>
</tr>
<tr>
<td>the ratio of P / E</td>
<td>0</td>
</tr>
<tr>
<td>The amount of dividends per share</td>
<td>0</td>
</tr>
<tr>
<td>earnings per share</td>
<td>0.066749</td>
</tr>
<tr>
<td>market price per share</td>
<td>0.003031</td>
</tr>
<tr>
<td>growth rate of earnings per share</td>
<td>0</td>
</tr>
<tr>
<td>the company's capital value</td>
<td>0</td>
</tr>
<tr>
<td>the balance sheet value of the company's assets</td>
<td>0</td>
</tr>
<tr>
<td>the company's annual sales</td>
<td>0</td>
</tr>
<tr>
<td>projects</td>
<td>0</td>
</tr>
<tr>
<td>products' export</td>
<td>0.061259</td>
</tr>
</tbody>
</table>
As can be seen, first defuzzification and second Fuzzy Delphi rounds’ mean for each index is less than 0.2. So, the Fuzzy Delphi stops. Due to the importance of indices based on the obtained defuzzification average in the second round, the traded shares, the average number of shares issued, P / A and earnings per share are of the highest importance from the standpoint of respondents in ranking 50 superior companies at Tehran Stock Exchange. Thus, the four indices are used for ranking.

**Analytical Hierarchy**

In accordance with the views of 67 individuals from brokerage, investment fund, the company’s financing and stock exchange hall; paired comparisons for the number of shares traded, the average number of shares issued, P / E ratio and earnings per share or (EPS) were carried out as indices of Ranking the top 50 companies of stock exchange. First, these criteria were compared, and their importance to each other was obtained using Analytical Hierarchy Process, respectively. The importance of each criterion according to the geometric mean of paired comparisons by 67 individuals of from brokerage, investment fund, the company’s financing and stock exchange hall is available in Table 3.

### Table 3: geometric comparisons test means

<table>
<thead>
<tr>
<th>number of traded shares</th>
<th>the average number of issued shares</th>
<th>P / E</th>
<th>EPS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>6 5/7</td>
<td>4/7</td>
</tr>
<tr>
<td>the average number of issued shares</td>
<td>1/7</td>
<td>1</td>
<td>1/2</td>
</tr>
<tr>
<td>P / E</td>
<td>1 5/7</td>
<td>1 5/6</td>
<td>1</td>
</tr>
<tr>
<td>EPS</td>
<td>6 1/4</td>
<td>4 7/9</td>
<td>2 8/9</td>
</tr>
</tbody>
</table>

In the next step, to determine the importance (weight) of each criterion, the geometric mean of each is calculated. And abnormal weight associated with each criterion will be gained. To obtain the criterions' normal weight, of each criterion weight is divided to the total weight of abnormal criterions. Criteria of earnings per share and P / E ratios are of the most important indices for ranking companies at stock exchange from the perspective of from brokerage, investment fund, the company's financing and stock exchange hall. Now we rank companies during 1389-1392 through the stock indices weights obtained using the AHP method described above. We used TOPSIS method. The first step is to create a decision matrix to rank stock companies (including 50 options, 4 indices). In this step, we use the collected data from Rahavard Novin Software and the stock exchange library. Analysis of the rankings in 1391 is listed below, and other years are calculated in the same way. According to the information of the four indices for the top 50 companies in 1391, the weighting matrix is done in the second step. For this purpose, a weight should be given to each indicator. The weights are the weights obtained from the hierarchical analysis. The weights in the obtained matrix from the previous step are multiplied. The third step is to determine the positive and negative ideal solution. Since the four considered indices are positive. The maximum of each column is considered as the positive ideal solution and the minimum of each column is considered as the negative ideal solution.

\[
A_+ = \{717156700.2, 182378350, 9.116, 1865.92\}
\]

\[
A_- = \{2075631.04, 700, -7.22, 388.08\}
\]

The fourth step is to obtain the distance. The distance between each N-dimensional option is extracted through Euclidian method. This means that we determine the distance of option i from positive and negative ideal options. For this purpose, the distance of each option from positive and negative ideal options is calculated using Euclidian method. The fifth step is to calculate the relative closeness to the ideal solution. In this step, according to the distance from the positive and negative ideal options, closeness of these options to the ideal solution is calculated. And in the sixth step, the options are ranked based according to the relative closeness.
Each option with higher closeness coefficient has higher priority as well. It can be seen that Saipa, Mobarakeh Steel and Pasargad Bank ranked first to third in the rankings according the indices gained from the experts’ views. Below is a chart which shows ranking of options in terms of closeness coefficient.


Conclusion
The subject of this study is comparing and ranking superior companies based on stock indices and ranking based on indices using the hybrid Fuzzy Delphi and AHP-TOPSIS Approach according to its 67 persons as the population.
Of the 67 respondents, 49 were male and 18 were female and the majority of respondents (about 28%) are 41 years and older. About 45% of respondents had 11 to 15 years of work experience. Also, 46% respondents of the sample have master’s degree.

<table>
<thead>
<tr>
<th>criterions’ normal weight</th>
<th>criterions</th>
<th>weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>number of traded shares</td>
<td>0.16</td>
<td></td>
</tr>
<tr>
<td>the average number of issued shares</td>
<td>0.07</td>
<td></td>
</tr>
<tr>
<td>P / E</td>
<td>0.20</td>
<td></td>
</tr>
<tr>
<td>EPS</td>
<td>0.56</td>
<td></td>
</tr>
<tr>
<td>sum</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
Then we determined the reliability of the responses to make sure they are relatively consistent. The amount is equal to -0.01 which is less than 0.1, so the reliability of responses (comparison test) is acceptable. The results of the Fuzzy Delphi showed that out of 17 indices (number of traded shares, traded shares value, the number of business days, the number of transactions, the company’s stock market value, the average number of shares issued, Q Tobin, the ratio of P / E, The amount of dividends per share, earnings per share, market price per share, growth rate of earnings per share, the company’s capital value, the balance sheet value of the company’s assets, the company’s annual sales, running projects and projects under construction and the products’ export), four indices (number of shares traded, the average number of issued shares, P / E, EPS) were selected according to the experts’ views as the most important criteria for ranking companies at Tehran Stock Exchange. Then, by using Analytical Hierarchy Process, the four indices were assigned weights based on paired comparisons.

References