

Ranking Stock Exchange Companies With a Combined Approach Based on FAHP-FTOPSIS Financial Ratios and Comparing Them With Tehran Stock Exchange Rankings

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Abstract:

Ranking of companies listed on the exchange represent their status and considered a criterion for investment. Also, it increases market's competition, development and efficiency. In this study, the fifty superior companies listed in Tehran Stock Exchange were ranked based on financial ratios (liquidity, operational, leverage and profitability) using FAHP- FTOPSIS hybrid approach during the years 2013 . Initially, capital markets authorities and universities' financial masters perspectives about effect of ratios were collected by questionnaire and weighting with FAHP technique and then companies were ranked based on ratios using the FTOPSIS technique. The results indicate that there is a weak correlation between two groups of ranking. In fact, results show that the stock exchange's selected top companies necessarily do not have higher rankings in terms of financial ratios and the firms' financial Statements are weak approximation for firms' superiority likelihood in the stock exchange.

Key words: Ranking, Financial Ratios, AHP–TOPSIS, 50 Superior Companies, Tehran Stock Exchange

1. Introduction

In the recent years, many developed countries by expanding financial markets pave the ground to finance institutes and enterprises (Madura 2006), and by directing people's savings and surplus liquidity towards productive investment have played a critical role in economic development and formation of capital (Donyaei et al.,2011). In fact, people by investment in successful manufacturing, business and commercial units may achieve their expected profit (Madura 2006).

Development of stock exchange and OTC has resulted in generation and expansion of financial services which at different levels provide investors with consultation services and rank companies and stock exchanges (O'Hara & Vetere,1993).

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Ranking can reveal weaknesses and strengths of the companies as well as opportunities and threats for them. In fact, it is a full-length mirror reflecting their state of affairs. This tool has very crucial role in decisions regarding companies' trading, investments and financing (Conner, 1973). In developed countries, ranking institutes provide a list of superior firms but in Iranian capital market, the prevalent and valid ranking is ranking of the stock exchange which concerns the top 50 listed companies in Tehran Stock Exchange and based on a combination of shares' liquidity, a firm's impact on the market and its situation in terms of financial ratio superiority is periodically assessed in the framework of the following triple criteria and a hexonal of indicators using harmonic mean: a) Amount of share trading in the trading hall includes number and value of traded shares. b) Share trading frequency in the trading hall includes number of days and trading times. c) Indicator's scale variables of impact on the market include mean number of issued shares and mean current value of firm's share during the under study period. In this research, for prioritization and ranking of the top-50 listed companies based on their financial ratios and then comparing it with the ranking of the stock exchange, (FAHP) technique in the hand of each key indicator (liquidity, leverage, operation and profitability ratios) was employed, while a relative weight was assigned to each sub-indicator. Next, using Technique for Order Preferences by Similarity Ideal Solution (FTOPSIS) the under study firms were ranked based on each one of these indicators. Finally, the obtained ranking was compared with the ranking provided by the stock exchange and based on the stock exchange's indices and then their correlation was examined. In fact, we will use the FTOPSIS method for final ranking and FAHP to determine the importance of the criteria in the top-50 listed companies in terms of liquidity, operational, leverage and profitability ratio. Recently, many researchers have been used several models and techniques for superior decision-making models via easy in calculation, using of real data, optimization capabilities, contingency and others. Purpose of this research is comparison ranking of the top 50 listed companies on Tehran Stock Exchange based on the firms' financial ratios (including liquidity, leverage, activity and profitability ratios) using FAHP-FTOPSIS method and ranked according to the stock exchange's indicators and reveal degree of convergence and correlation between two ranking methods.

2. Theoretical background thread

Stock Exchange Company is defined as part of the capital market and economic environment defined and index for assessing community demand which provides companies financing opportunities to earn a return on that investment (Keshvari, 2008) But it should be noted that investors used many investigation for evaluation of investment decisions, buy and sell shares of

companies. They converted the assets to stocks. The informative entities provide accurate and relevant information for contribute to the decision (Mohanram, 2005). Investors, managers and providers focused on benchmarks to measure the performance of business unit and analysis of financial ratios. But, a suitable method in the first step is evaluating and ranking of companies (Piotroski,2000).

Ranking of companies as mirror view of companies condition plays a crucial role in decisions relating to trade, investment and corporate finance (Mohanram, 2005).Therefore, in ranking of companies and financial institutions, it should be used the ranking models based on financial performance. However, it is also important that suitable ranking models, criteria and mathematical techniques should be used for this matter. Overall, companies' ranking showed clear and useful information about the business and economic activities. Besides, this subject provides suitable opportunity for investors, managers, creditors, policy makers, owners, competitors which increased competition in the market and capital market development and better understanding in financial and economic structure of industries and enterprises (Thomas,1993).

Studies on indices of successful companies indicate a significant relationship between firms ranking based on performance measurement criteria and financial criteria (Johnson & Soenen, 2003). Another study in S&P index revealed that such factors as share price, sales, and profit margin suggested higher rating of favorable factors for high ranking firms (Polonchek & Krehbiel, 1994). Following the prior research, Omran and Ragab (2004) examined presence of a linear relationship between share return and financial ratios and then investigated presence of a linear relationship between share return and financial ratios (Omran & Ragab, 2004) .They found that the ratio return on equity (ROE) was significant for all models.

Hassanzadeh et al (2010) in their study found that there is a significant association between firms' financial ratios and bank managers' decision on granting them credit (Hassanzadeh & et al, 2010). Lev and Thiagrajan (1993) following Penman's studies and using financial ratios concluded that fundamental signals are associated to share return (Lev & Thiagrajan, 1993). In addition, recent findings suggest that although financial information plays a crucial role in prediction of return on investment (ROI), yet the effect of each financial factor depends on market condition and under this condition this effect is not stable (Knif & Miranda, 2000). Besides, other studies indicate that financial statements and financial ratios are used for distinction of successful companies from unsuccessful ones (Piotroski, 2000; Mohanram, 2005; Michou, 2007). Their results indicate that companies with a higher book-to- market value have a higher return on average.

3. Research Methodology:

This research is of descriptive-correlation type in which top-fifty listed companies for the period 2009-2011 were examined by census. The research statistical data was gathered by referring to the Securities and Exchange Organization (SEO) and using Rahavard-e-Novin software. The top-50 listed companies on TSE are presented in the table in each one of the under study years according to their industry.

Table 1. Top-50 listed companies on tse in each one of the under study years per industry

Industry type	2013-14
Financial brokers, investment & holding	19
Cement, lime, chalk & metal ore extraction	6
Automobile manufacturing & base metals	18
Food and chemical products	4
Pharmaceutical materials& products	3
Miscellaneous industries	50
Total (Number)	50

In present research, for the purpose of ranking based on financial ratios, a questionnaire was composed by means of which weight of financial ratio in the ranking is obtained. Once the questionnaire's validity has been confirmed, its reliability using inconsistency rate was found to be 0.06 which was smaller than 0.1 and hence approved. Next, the questionnaire was handed out to 20 experts and respective officials of the capital market as well as professors of finance and accounting from various universities and they were asked to give their opinion on the question as to what extent each one of the financial ratios should be considered as a critical indicator in firms ranking. Given the type, purpose, hypotheses and questionnaire of the research, a 1-to-9-hour scale was employed to form the matrix of paired comparisons in order to evaluate weight of the indicators and to rank companies using FAHP and FTOPSIS techniques. In the next step, using FAHP technique and Expert Choice software, the indicators were assigned weight and then profiting from FTOPSIS technique under TOPSIS (2005) software the firms were ranked. The next step uses the FAHP technique to help software EXCEL, weighted indices, and then the companies were rated by FTOPSIS techniques.

Weight ratio FAHP technique:

For weight maintenance and generalization of the experts involved in the four financial ratios in present study, it applied the fuzzy analytic hierarchy process (FAHP). In this investigation, firstly the comments of several of the teachers involved in the capital markets were used. Then, after calculating of arithmetic mean, paired comparison matrix was achieved (Table.2). After the modeling and

development of decision tree (hierarchical structure), paired comparisons matrix indicators (financial ratios) were prepared based on importance and priority of index. Inconsistency rate of matrix was calculated and finally due to priority and ranking of the top five industries, the relative weight index in EXCEL software was determined as follows:

Table 2. Matrix of paired comparisons of research's chief criteria in expert choice

Chief criteria	Liquidity ratio	operational ratio	Leverage ratio	Profitability ratio
Liquidity ratio	(1,1,1)	(2,2/5,3)	(1,3/2,2)	(1,3/2,2)
operational ratio	(1/3, 2/5, 1/2)	(1,1,1)	(2/5,1/2,2/3)	(1/2, 2/3,1)
Leverage ratio	(1/3,2/3,1)	5/2)2 .3/2((1,1,1)	(1,3/2,2)
Profitability ratio	(1/3,2/3,1)	(1,3/2,2)	(1/2, 2/3,1)	(1,1,1)

First step) for each of the paired comparisons matrix rows that have been prepared so that the SK is a triangular fuzzy number is calculated as follows:

0.044	0.053	0.072
5.000	6.500	8.000
2.233	2.567	3.167
3.833	5.167	6.500
2.833	4.667	5.000

Sk			
S1	0.221	0.344	0.576
S2	0.099	0.136	0.228
S3	0.169	0.273	0.468
S4	0.125	0.247	0.360

$$S1=(5, 6.5, 8) *(0/044, 0/053, 0/072)=(.221, .344, .576)$$

$$S2=(2.23, 2.56, 3.16)*(0/044, 0/053, 0/072)=(.099, .136, .228)$$

$$S3=(3.83, 5.16, 6.5)*(0/044, 0/053, 0/072)=(.169, .273, .468)$$

$$S4=(2.83, 4.66, 5)*(0/044, 0/053, 0/072)=(.125, .247, .360)$$

step2) Calculation of Si, the magnitude relative to each other can be obtained as follows:

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

So that:

$$W(x_i) = \text{Min}\{V(S_i \geq S_k)\}, \quad k=1, 2, \dots, n$$

Table 3: Calculation of magnitude compared to the Si

Si	Sj	S1	S2	S3	S4
S1			1.000	1.000	1.000
S2		0.034		0.299	0.481
S3		0.778	1.000		1.000
S4		0.589	1.000	0.878	

$$V(S1 \geq S2) = 1$$

$$V(S1 \geq S4) = 1$$

$$V(S2 \geq S3) = 0.778$$

$$V(S3 \geq S1) = 0.778$$

$$V(S3 \geq S4) = 1$$

$$V(S4 \geq S2) = 1$$

$$V(S1 \geq S3) = 1$$

$$V(S2 \geq S1) = 0.034$$

$$V(S2 \geq S4) = 0.481$$

$$V(S3 \geq S2) = 1$$

$$V(S4 \geq S1) = 0.589$$

$$V(S4 \geq S3) = 0.878$$

Step.3) Calculation of the matrix weights in pair wise comparisons according to step.2

Weighted non-norm indicators	
S1>Si	1.000
S2>Si	0.034
S3>Si	0.778
S4>Si	0.589

Finally, inadequate weight vector of the non-normalized indices were determined by:

$$W = (1, 0.034, 0.778, 0.589)$$

Step.4) Normalizing of weight vector value which achieved in step.3 (Normalized weight vector values is showed in Table.3) : $w_i = \frac{w_i}{\sum w_i}$

Based on the above calculations, cash-weight ratio has highest impotency as the top priority (0.417). Gearing weight ratio is in second priority (0.324). Activities ration is in lowest weight (0.014). The multi-parameters of the fuzzy weights were shown in table 4-7.

Table4. the weight of financial and stock market indices as fuzzy (effective indices, weighted fuzzy preference)

Priority	Fuzzy weighted	index of preference
1	0.417	Liquidity ratio
2	0.014	operational ratio
3	0.324	Leverage ratio
4	0.245	Profitability ratio

Table 5. paired comparisons matrix based on sub liquidity ratio

Liquidity ratio sub	Instant Ratio	Current Ratio
Instant Ratio	(1,1,1)	(2/5,1/2,2/3)
Current Ratio	(3/2 ∙ 2 ∙ 5/2)	(1,1,1)

W = (.126, .873)

Table6. paired comparisons matrix based on sub operational ratio

sub operational ratio	Period of receiving claims	Inventory flow	Assets flow
Period of receiving claims	(1,1,1)	(1 ∙ 3/2 ∙ 2)	(1/2,2/3,1)
Inventory flow	(1/2,2/3,1)	(1,1,1)	(2/5,1/2,2/3)
Assets flow	(1 ∙ 3/2 ∙ 2)	(3/2 ∙ 2 ∙ 5/2)	(1,1,1)

$w_i = \frac{w'_i}{\sum w'_i}$ W' = (.617, .173, 1) W = (.345, .096, .558)

Table 7. the weight of sub-criteria and prioritization of activities

Priority	Fuzzy weighted	Components of risk assessment	row
2	.345	Period of receiving claims	1
3	.096	Inventory flow	2
1	.558	Assets flow	3

Table8. paired comparisons matrix based on sub Leverage ratio

sub Leverage ratio	Debt to equity ratio	Debt ratio
Debt to equity ratio	(1,1,1)	(1 ∙ 3/2 ∙ 2)
Debt ratio	(1/2,2/3,1)	(1,1,1)

W = (.658 ∙ , .315)

Table9. paired comparisons matrix based on Sub Profitability ratio

Sub Profitability ratio	Profit margin	ROE	ROI	ROA
Profit margin	(1,1,1)	(3/2 ∙ 2 ∙ 5/2)	(3/2 ∙ 2 ∙ 5/2)	(1 ∙ 3/2 ∙ 2)
ROE	(2/5,1/2,2/3)	(1,1,1)	(1/2,2/3,1)	(1/2,2/3,1)
ROI	(2/5,1/2,2/3)	(1 ∙ 3/2 ∙ 2)	(1,1,1)	(1 ∙ 3/2 ∙ 2)
ROA	(1/2,2/3,1)	(1 ∙ 3/2 ∙ 2)	(1/2,2/3,1)	(1,1,1)

Table10. fuzzy decision matrix

Priority	Fuzzy weighted	index of preference
1	.441	Profit margin
4	.074	ROE
2	.274	ROI
3	.211	ROA

decision matrix phase Scale, the harmonious Scale Matrix, finding the positive and negative ideal, the ideal spacing options (indexes ranked by FTOPSIS).

Fuzzy TOPSIS (FTOPSIS) method:

The multi-attribute decision methods of Fuzzy AHP and Fuzzy TOPSIS form the theoretical basis of the present research for achieving the stated objectives. This model was initially presented by Hwang and Yoon (1981), and with undergoing some modifications subsequently, it has become one of the best and most accurate multi-attribute decision methods in use among planners. This technique was founded on stronger theoretical principles relative to other comparable methods, so as many problems of methods such as the Numerical Taxonomy were resolved in the new method. According to the conceptual framework of this technique, first, the positive ideals (the most efficient state) and the negative ideals (the most inefficient state) are calculated for each indicator and then, distance of each option from positive and negative ideals is calculated. The selected option is the option which has the least distance from the positive ideals and the greatest distance from the negative ideals. This technique is so designed that allows controlling for the type of indicators in terms of their positive or negative effect on the end goal of decision making and including weight and significance level of each indicator in the model. For application of Fuzzy TOPSIS technique for the purpose of ranking and choice of the best option from among the available options, the following steps need to be taken in succession (Knif & et al,2000).

Forming the decision matrix and weight assignment to indicators;

$$D = \begin{matrix} & C_1 & C_2 & \dots & C_n \\ \begin{matrix} A_1 \\ A_2 \\ \vdots \\ A_m \end{matrix} & \begin{bmatrix} X_{11} & X_{12} & \dots & X_{1n} \\ X_{21} & X_{22} & \dots & X_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ X_{m1} & X_{m2} & \dots & X_{mn} \end{bmatrix} \end{matrix}$$

Quantification of decision matrix and setting up the unscaled matrix;

$$\begin{aligned} \tilde{r}_{ij} &= \left\{ \left(\frac{a_{ij}}{c_j^+}, \frac{b_{ij}}{c_j^+}, \frac{c_{ij}}{c_j^+} \right), \quad j \in B \right. \\ \tilde{r}_{ij} &= \left\{ \left(\frac{a_{ij}}{c_j^-}, \frac{b_{ij}}{c_j^-}, \frac{c_{ij}}{c_j^-} \right), \quad j \in C \right. \\ c_j^+ &= \max_i c_{ij} \quad \text{if } j \in B \\ a_j^- &= \min_i a_{ij} \quad \text{if } j \in C \end{aligned}$$

Finding the positive and negative ideals in Fuzzy TOPSIS (with positive ideal being (1,1,1) and the negative ideal (0,0,0);

$$\begin{aligned} A^+ &= (\tilde{v}_1^+, \tilde{v}_2^+, \dots, \tilde{v}_k^+) \\ A^- &= (\tilde{v}_1^-, \tilde{v}_2^-, \dots, \tilde{v}_k^-) \end{aligned}$$

Finding distance of each indicator from ideal answers;

$$d(A_1, A_2) = \sqrt{\frac{1}{3}[(a_1 - a_2)^2 + (b_1 - b_2)^2 + (c_1 - c_2)^2]}$$

$$d_i^+ = \sum_{j=1}^k d(\tilde{v}_{ij}, \tilde{v}_j^+), \quad i = 1, 2, \dots, m$$

$$d_i^- = \sum_{j=1}^k d(\tilde{v}_{ij}, \tilde{v}_j^-), \quad i = 1, 2, \dots, m$$

Specifying relative proximity of each option, their ranking, and final selection;

$$CC_i = \frac{d_i^-}{d_i^+ + d_i^-}, \quad i = 1, 2, \dots, m$$

The greater the CCI of an option is, the closer it is to the ideal solution and the higher its priority becomes. Once the fuzzy and definitive pairwise comparison matrices have been formed, the fuzzy weights are calculated as follows

4-Prioritize the top companies based on financial ratios, using Fuzzy TOPSIS:

After taking the decision matrix four remarks was used for positive and negative ideal for each criterion were determined using by FTOPSIS and the distance from the positive and negative ideal system was determined. The index close to ideal for both options, the rankings were based on distinctions. Our results in tables suggested that the decision Matrix and Matrix Scale according to 4 criteria and is rated based on EXCEL software. (It should be noted that the values obtained for Financial Ratios in industry companies has been prepared based on software industry stock availability).

Table11.fuzzy decision matrices

Superior industries	Profitability ratio				Leverage ratio		operational ratio			Liquidity ratio		
	Financial brokers, investment & holding	6.400	8.100	9.100	4.700	6.600	8.200	6.200	7.700	8.900	6.200	7.700
Cement, lime, chalk & metal ore extraction	6.400	8.200	9.200	6.500	8.200	9.300	6.300	7.900	9.100	4.800	6.500	8.200
Automobile manufacturing & base metals	5.900	7.600	8.900	4.500	6.400	8.100	5.100	6.900	7.500	5.200	7.100	8.300
Food and chemical products	5.100	6.700	7.100	4.700	6.400	7.800	4.500	6.100	7.500	5.200	6.600	7.800
Pharmaceutical materials& products	5.700	7.500	8.800	5.100	7.100	8.600	5.600	7.500	9.100	5.200	6.900	8.300

Table12.Unscaled fuzzy decision matrices

Superior industries	Profitability ratio			Leverage ratio			operational ratio			Liquidity ratio		
Financial brokers, investment & holding	.696	.880	.989	.505	.710	.882	.670	.846	.987	.705	.875	1.000
Cement, lime, chalk & metal ore extraction	.696	.891	1.000	.699	.882	1.000	.692	.868	1.000	.545	.739	.932
Automobile manufacturing & base metals	.641	.826	.967	.484	.688	.871	.560	.758	.824	.591	.807	.943
Food and chemical products	.554	.728	.772	.505	.688	.839	.495	.670	.824	.591	.750	.886
Pharmaceutical materials& products	.620	.815	.957	.548	.763	.925	.615	.824	1.000	.591	.784	.943
vazn Wj	.221	.344	.576	.099	.1366	.228	.169	.273	.468	.125	.247	.360

Table13. Weighted unscaled matrices

Superior industries	Profitability ratio			Leverage ratio			operational ratio			Liquidity ratio		
Financial brokers, investment & holding	.154	.303	.570	.050	.097	.201	.113	.231	.458	.088	.216	.360
Cement, lime, chalk & metal ore extraction	.154	.307	.576	.069	.120	.228	.117	.237	.468	.068	.182	.335
Automobile manufacturing & base metals	.142	.284	.557	.048	.094	.199	.095	.207	.386	.074	.199	.340
Food and chemical products	.123	.251	.445	.050	.094	.191	.084	.183	.386	.074	.185	.319
Pharmaceutical materials& products	.138	.280	.551	.054	.104	.211	.104	.225	.468	.074	.194	.340

Table 14. Finding the negative& positive ideals

di+	1	1	1	1	1	1	1	1	1	1	1	1
di-	0	0	0	0	0	0	0	0	0	0	0	0

Table 15. Distance of options from the ideal (the model ranking based on TOPSIS method)

Priority	$CI = d^- / (d^- + d^*)$	di-+di+	di+	di-	Superior industries
2	.256	4.165	3.099	1.066	Financial brokers, investment & holding
1	.258	4.169	3.093	1.075	Cement, lime, chalk & metal ore extraction
4	.238	4.156	3.166	.990	Automobile manufacturing & base metals
5	.217	4.133	3.236	.898	Food and chemical products
3	.249	4.173	3.133	1.040	Pharmaceutical materials& products

Table 16. Correlations between the rankings of TSE and FAHP-FTOPSIS approach based on financial ratios Correlations

		rank1	rank2
rank1	Pearson Correlation	1	.600
	Sig. (2-tailed)		.285
	N	5	5
rank2	Pearson Correlation	.600	1
	Sig. (2-tailed)	.285	
	N	5	5

Discussion:

Firms ranking, while promoting competition and market efficiency, is a useful guide for investors and market operators. The results obtained from study of correlation between the ranks made by the financial ratios using FAHP-FTOPSIS combined approach and those by indicators of the stock exchange regarding top-50 listed companies in the years 20013-2014 indicate that between these two types of ranking, in the sense that contrary to our expectation, the higher ranked companies on the stock exchange, were not ranked as much higher based on the financial ratios. In general, it can be said that there is no significant association between ranking of the top-50 TSE listed companies based on financial ratios in

FAHP-FTOPSIS combined approach and their ranking based on the indicators of the stock exchange and the presented items in firms' financial statements are not regarded an adequate approximation for their estimation of their excellence.

Result:

Firms and industries ranking is of high importance in decisions regarding shares trading, investment and finance of firms. In this study, the top five industries introduced by the Tehran Stock Exchange is ranked by a combined approach based on FAHP-FTOPSIS four financial ratios (liquidity, activity, leverage and profitability) during the year 2014. Generally, it suggested that there is no significant in the ranking of the top five industries listed with a combined approach based on the financial ratios (FAHP-FTOPSIS) and indicators ranking is based on the exchange relationship. Besides, based on presented results in the financial statements of companies, there is relatively poor correlation for superiority in the stock. In order to similar research, Johnson (2003) found a significant correlation between the rankings of firms based on performance and financial criteria. Furthermore, Hasanzadeh et al (2010) found a significant positive relationship between financial ratios of companies and executives in the credit decision of the bank. Anvari Rostami and Khotan Lu (2006) showed a weak correlation between the two typically methods (rank companies based on stock indices and accounting profitability ratios) confirms a significant correlation between the rankings based on financial ratios and stock market indicators.

Suggestion: In similar with our results, the following suggestions are offered:

- ✓ Using of actual financial indicators companies and the most effect in rankings
- ✓ Setting up electronic and on-line system to provide in reasonable investment based on moment rating
- ✓ and organization of independent rating agencies in ranking affairs

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