Ranking and Managing Stock in the Stock Market Using Fundamental and Technical Analyses

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Abstract

The stock selection problem is one of the major issues in the investment industry, which is mainly solved by analyzing financial ratios. However, considering the complexity and imprecise patterns of the stock market, obvious and easy-to-understand investment rules, based on fundamental analysis, are difficult to obtain. Fundamental and technical analyses are two common methods for predicting the future behavior of the stock.Fundamental analysis focuses on the economic forces of supply and demand which cause stock prices change. On the other hand technical analysis examines historical data relating to changes in the price and trading volume by using graphs and indicators as a primary tool to predict future price movements. Therefore, in this paper, a model has been proposed for selection of the right portfolio in stock exchange. Financial industries ranking and companies ranking have been applied for selection of the right stock in this model. These rankings have been done through the PROMETHEE decision making method. Technical Analysis has been done for determining the right time to buy and sell the superior stocks. A survey has been done for determining the effective criteria over industry and company evaluation. The developed model has been applied in Tehran Stock Exchange (TSE) as a real case and a real problem has been solved. It is concluded that by using both Fundamental and Technical Analysis, an investor can get higher return on stocks instead of using just one individual analysis. In other words, while fundamental analysis distinguishes which stocks to buy, technical Analysis shows when to buy the superior stocks.Finally, some important and most commonly used indicators have been extracted. These indicators can be used by investors to consistently and correctly predict the future stocks prices.

Keywords

1. Introduction

Determining the appropriate time for the stock trading which requires trend or price forecasting is an important subject in the investment management, as a result, there will be a model of successful prediction. However, it is not easy to predict stock prices or returns. Because many market factors are involved and their complex structural relationship is not clearly defined.

The stock selection problem can be traced back to the efficient market hypothesis (EMH) [1], which assumes that investors cannot use available information to form an investing strategy for consistently outperforming the stock market. In the hope of finding a useful strategy, researchers have used various investment plans to examine the EMH [2–4].

The stock selection problem is solved using two main approaches. In the conventional approach, financial studies tend to use regression models for determining the relationship among historical financial ratios and future earnings (or stock performance).

In addition, in the nonconventional approach, researchers from other fields, such as artificial intelligence (AI) and multiple criteria decision making (MCDM) have attempted to leverage the computational strength of computer programming to solve the complex stock selection problem [5]. Tehran's stock market comprises more than 400,000,000 stocks and numerous financial attributes. The complex relationship among the financial attributes and future stock returns is unlikely to be solved using linear models, such as the regressions.

Fundamental and technical analyses are two common methods for predicting the future behavior of the stock. Fundamental analysis focuses on the economic forces of supply and demand which cause stock prices change. Related factors (such as business, industry and economic conditions) that affect stock prices are examined to determine the intrinsic value of stock [6]. On the other hand technical analysis examines historical data relating to changes in the price and trading volume by using graphs and indicators as a primary tool to predict future price movements [7]. Investors base their studies on the assumption that historical patterns of stock prices are repeated in the future and so these patterns can be used for prediction purposes. The motivation behind technical analysis is its ability to identify trend changes at an early stage and to maintain an investment as long as signs indicate the trend of changes [8].

In this study, we intend to take of the advantages of both fundamental and technical analyses to achieve high returns in the stock market. In this regard, we predicted two phases. First, most important and most commonly used fundamental indicators are identified by reading research literature and by applying non-parametric statistical methods we will finalize them. Then, by using stock experts' opinions on the degree of importance of each indicator, use of paired comparisons and PROMETHEE multi-criteria decision-making methods we will proceed to financial industries ranking and from there to ranking of active companies in top known industries. In the second phase and after the introduction of top companies, we will use three of the most important and most commonly used indicators to describe the timing of superior stock. Finally, the efficiency resulting from the application of fundamental-technical technique with the return of buy and hold strategy (ES) is compared.

2. Literature review

The possibility of predicting the future price of financial assets (stocks, ETFs, options, futures, etc.) from historical price series is one of the most important challenges both for individual investors and for companies linked to the financial environment.

There are several ways to invest in the stock market namely technical analysis, value investing and the random walk theory. Technical analysis studies the market patterns, the demand and supply of stocks shares [9].

As stated by Bagheri et al. [10], professional traders use two major types of analysis to make accurate decisions in financial markets: fundamental and technical.

Fundamental analysis uses global economic, industrial and business indicators. The technical analysis makes its decisions on the basis of historical prices, under the assumption that past behaviors have an effect on the future evolution of prices. In technical analysis it is common to use

indicators [11-13], which are created by applying more or less complex formulas to historical prices. Together with these indicators, it is also common to use chart pattern analysis [10, 14], which tries to predict the future behavior of prices from chart patterns which are constantly repeated in financial markets, regardless of the financial assets considered or the temporary window analyzed.

Those who have developed trading rules based on technical analysis use information based on indicators, chart patterns, or both of these. From a methodological point of view, these studies incorporate models from econometrics, statistics and artificial intelligence. In all cases trading rules are generated which allow investors to beat the market, confronting the efficient market hypothesis. Examples include the work of Hu et al. [11], who propose a hybrid long- and short-term evolutionary trend-following algorithm that combines trend-following investment strategies with extended classifier systems (XCS). Through this methodology they introduce a trading rule which selects stocks by different indicators. Silva et al. [5] apply a Multi-Objective Evolutionary Algorithms (MOEA) with two objectives, return and risk, to optimize portfolio management. They conclude that to obtain stocks with high valuation potential, it is necessary to choose companies with a lower or average market capitalization, low PER, high rates of revenue growth and high operating leverage.

Bagheri et al. [10] combine an Adaptive Network-based Fuzzy Inference System with a Quantum-behaved Particle Swarm Optimization to forecast a financial time series from the foreign exchange market (Forex), developing a prediction system by means of chart patterns.

De Oliveira et al. [15] use economic and financial theory, combining technical analysis, fundamental analysis and analysis of time series, to predict price behavior in the Brazilian stock market by an artificial neural network.

Kao et al. [16] propose a new stock price forecasting model which integrates wavelet transform, multivariate adaptive regression splines (MARS), and support vector regression (SVR) to improve price forecasting accuracy. Patel et al. [12] compare four prediction models to forecast the trend direction in financial markets: Artificial Neural Network (ANN), Support Vector Machine (SVM), random forest and naive- Bayes. The results suggest random forest outperforms the three other prediction models on overall performance. Yu et al. [17] also use SVM to construct a stock selection model, which can classify stocks nonlinearly. Guresen et al. [18] present an excellent compilation of studies which use neural networks in order to predict stock market indexes.

Although the results show the inefficiency of the analyzed markets, a further analysis is needed to limit the number of failed operations and to increase the return of the trading rule. As a future line of research we consider that the results might be improved by using other indicators. By including information on indicators like the moving averages, stochastic and/or MACD with techniques like decision trees, neural networks or support vector machines, we believe it will be possible to filter the operations and to increase the return adjusted to the risk of the trading rule.

In terms of both magnitude and statistical significance, the effects of technical analysis are strongly confined to investors who are high derivative rollers [19]. Hoffmann and Shefrin [20] find evidence of causality from high derivative rolling to technical analysis, with high derivative rollers being almost twice as inclined to use technical analysis than other investors. Half of all high derivative rollers use technical analysis.

Largely as a result of these failures, researchers have started to look beyond fundamentals to the role of other 'non-fundamentalist' influences on financial markets including the approach to forecasting taken by practitioners [21].

Both methods aim to predict stock movements from different perspectives. Fundamental analysis looks into why the market moves and technical analysis considers its effect. Technical analysis has a long history in predicting movements in financial time series [22]. Nevertheless, it has long been criticized by academic researchers and users. This criticism has been established based on two facts: the first fact which is the theory of labor markets argues that "prices always fully reflect available information." This theory suggests that any attempt to make a profit by taking advantage of the information available is futile [23]. The second fact is that technical analysis is based on weak fundamentals. For example the expectation that some historical patterns of stock price will repeat in the future may not necessarily occur because market conditions can change over time and there is no explanation for why should we expect these patterns to be repeated [24].

Despite these facts, in recent years technical analysishas widely been accepted as one of the most important analytical options by financial experts and brokerage firms. In fact, major investments are rarely made without the benefit of these technological tools because many researchers have proposed the idea that markets may not be fully efficient and prices may be influenced by human sentiments [25]. It appears that technical analysis be a compromising tool since it offers a relative composition of human, political and economic events. Theoretically, technical analysis tries to predict the trend of stock price using data on prices and trading volume over the last. The main problem with this approach is thatit highly relies on empirical regularities based on price and volume movements [26]. In other words, supporters of this approach are only interested in identifying main return points to assess the movement of securities. In the real world these rules are not always evident; they are often covered with noises and vary from one share to another share. Therefore, it is difficult for investors to use this method consistently and correctly to predict future prices [27].

3. PROMETHEE decision-making method

PROMETHEE method is a multi-criteria decision method that brans introduced in 1982 and then in 1985 and 1994 with the help of his colleagues has developed [28]. This method is a ranking method that its starting point is the evaluation table. In this table, the options are evaluated based on different criteria. These evaluations are quantitative or qualitative. Using PROMETHEE method needs to determine the weight (relative importance) and a decision making preference function for each criterion. In this method the positive and negative flows for each option is calculated. Positive flow of option a, or $\varphi^+(a)$ is compared to all other options, negative flow of option a, or $\varphi^-(a)$ represents all the other preferred options compared to option a.

PROMETHEE ranking is done in two ways. In the PROMETHEE 1, a better option is going to be more positive and less negative flow. In this case, if one option has more positive and negative flows than other options, these two options are not comparable to each other, so the result of this procedure is a partial ranking. In the PROMETHEE 2, a net flow obtained by the difference between the positive and negative flows is calculated for each option, and the option that has a higher net flow is better. In this method all the options are comparable with each other. So, in this

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process some comparative data between options may go away. Hence, the result of this method is a full ranking.

PROMETHEE method is used in various fields such as information technology strategies modeling and renewable energy production and programming. Comparing PROMETHEE and AHP methods due to fewer paired comparisons, using actual values of criteria when evaluating and having features for sensitivity analysis of solutions like GAIA page the PROMETHEE method has been used [29]. To implement this method, the decision lab 2000 software is used which supports PROMETHEE 1 and 2 methods [30].

4. Research method

The aim of this paper is to introduce an algorithm for stock portfolio selection through the financial industries ranking, stock ranking of top companies and also determining the best time of trade in the Tehran stock exchange. Decision-making process involves setting goals, gathering relevant information and reviewing and evaluating information relate to alternatives. Since in order to gather much of the information required by this study knowledge of exchange experts should be used, the issue of financial industries ranking and also Tehran stock exchange companies ranking will be a group decision issue. Group decision-making and using expert views in this study, like other decision-making studies has been done with the aim of improving the efficiency and quality of decision results [31].

In addition, using views of a decision-making group (experts) instead of considering only one decision maker includes advantages like combination of talents, possibility to provide more innovation etc. in unstructured problems [32].

4.1. Industries and companies ranking (fundamental analysis)

The required data in PROMETHEE method are:

- Effective criteria in evaluation: these criteria are foundation of ranking and have been extracted through the study of literature and surveying decision-making process in one of Tehran investment and stock exchange companies. Then, using a questionnaire, the necessity of using expert views is asked.
- Weight or relative importance of criteria: this weight will be provided with the help of information obtained from the questionnaire where weights of criteria are calculated using the effects of their interaction on each other.
- Type of criterion (max / min): other required information about the criteria, is its type which was considered using questionnaire and integrating experts views for each criterion.
- Preference function for each criterion: preference function in the PROMETHEE method much depends on the nature of the criterion and view of decision maker. For this purpose there are six standard preference functions that take into consideration most applications.

4.2. Design and implementation of the questionnaire for determining criteria in the industry evaluation and relevant weights

To determine evaluation criteria, they are extracted from literature and observations made in the Tehran stock exchange. To determine the final criteria and their weights, the first questionnaire was designed to experts give their views about the degree of importance of each one of them. After

performing factor analysis on the first questionnaire (evaluating industries criteria) weights of remaining criteria should be calculated according to their mutual influence on each other. To do this, a second questionnaire was used to determine the weight of the remaining indicators of distribution and finally the weights were calculated using paired comparisons method (improvement in AHP). The results of the above steps are given in Table 1 related to industry evaluation criteria.

Table1. The effective criteria for industries evaluation and ranking

Row	Effective criterion in evaluating industry	Type of criterion	Evaluation unit	Preference function	Weight
1	The average P / E in industry (x1)	Max	Number	U-shape, q=2	0.35
2	The Current value of industry (x2)	Max	Milliard Rials	U-shape, q=100	0.38
3	The volume of transactions (x3)	Max	Milliard Rials	U-shape, q=10	0.27

5. Findings

5.1.The ranking of industries

After calculating the weights of effective criteria in evaluating financial industries we will rank them.UsingRah- Avard- Novin software, the results are given in Figure 1.
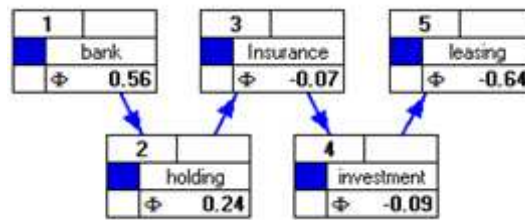

Figure1. The ranking of financial industries
(Rah- Avard- Novin software output)

5.2. Design and implementation of the questionnaire for determining criteria in evaluation of top companies and relevant weights

Like industries evaluation, to determine the criteria for banking companies that selected as top industry, two questionnaires will be distributed among stock experts. The first is designed to determine the final indicators extracted from the literature and important in banking companies. After performing factor analysis and deleting 7 indicators, we will continue criteria weighting by paired comparisons technique (improvement in AHP) and second questionnaire designing. In Table 2 the results of the factor analysis and in table 3, information on indicators are used in evaluating banks can be seen.

Table2. The final matrix after VARIMAX rotation

Factors	1	2	3	4	5
Average return on equity (ROE)	0.771	-	-	-	-
Capital adequacy ratio	-	0.923		-	-
Concessional loans to total deposits ratio	-	-	0.838	-	-
Ratio of book value to market (P/B	-	-	-	0.861	-
Earnings per share (EPS)	-	-	-	-	0.981

Table3. The effective criteria in evaluating banks

Row	Effective measure in assessing industry	Title	Measure type	Evaluation Unit	Preference function	Weight
1	Capital adequacy ratio	Y_{11}	Max	Percent	Usual	0.461482252
2	Concessional loans to total deposits ratio	Y_{12}	Max	Percent	Usual	0.538517748
3	Average return on equity (ROE)	Y_{23}	Max	Percent	Usual	1
4	Ratio of book value to market (P/B)	Y_{31}	Max	Percent	Usual	0.655502392
5	Earnings per share (EPS)	Y_{32}	Max	Percent	Usual	0.344497608

5.3. Theranking of banking companies

After calculating the weights of the criteria in evaluating banks, they are ranked using indicators information which has been extracted from Rah- Avard- Novin software [33]. The result is shown in figure 2.
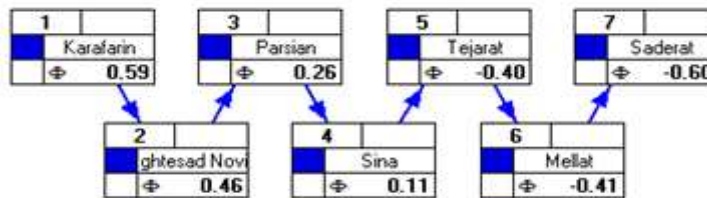

Figure2. The ranking of banking companies
(Rah- Avard- Novin software output)

5.4. Determining the best time for transaction by using technical analysis

In this section by using the three most important and widely used indicators in technical analysis (RSI‹stochastic % k, % d and MACD) the appropriate time to buy and sell stocks of the top banking companies that have been selected in the previous step is determined. For this purpose,Amibroker software [34] has been used. The green arrows are buying signals and the red arrows are selling signals. The trades take place when three indicators simultaneously issue buying and selling signals (Figure 3-6).

Figure3. The time of interactions for Karafarin bank
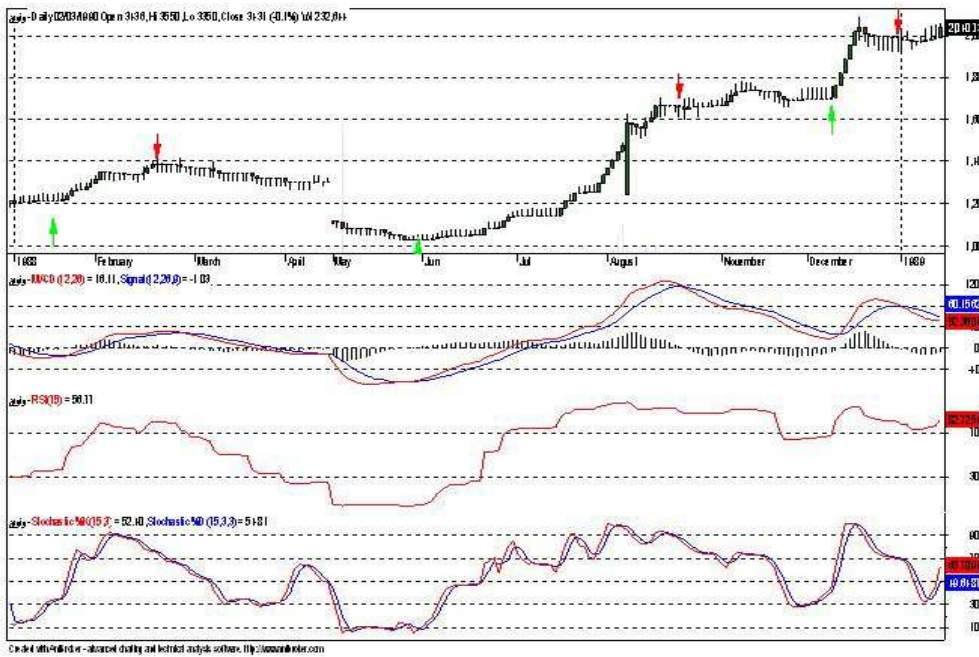(Amibroker software output)

Figure4. The time of interactions for Eghtesad-e- Novin bank
(Amibroker software output)

Figure5. The time of interactions for Parsian bank
(Amibroker software output)

Figure6. The time of interactions for Sina bank
(Amibroker software output)

5.5. Calculating the rate of return obtained from using three indicators of technical analysis for trading schedule

According to buying and selling signals issued for each bank, first we will calculate their periodic rate of return and then annual rate of return. The results are given in Table 4.

Table4. Calculating the rate of return for bank with respect to the signals issued

Stock name	Purchase date	Purchase price	Selling date	Selling price	Periodic rate of return	Return, including transaction costs	Annual rate of return	Average annual return
VAPARS	2011/08/04	1549	2011/08/31	1756	13.8%	12.3%	165.82%	133.07%
VAPARS	2011/12/28	2127	2012/03/17	2392	24.68%	23.18%	106.8%	
VAKAR	2011/03/30	2561	2011/05/04	3320	30.4%	28.9%	300.56%	196.6%
VAKAR	2011/08/02	2972	2011/11/07	3944	35.77%	34.27%	128.6%	
VANOVIN	2011/04/07	2231	2011/04/26	2475	10.99%	9.49%	181.8%	
VANOVIN	2011/08/22	1889	2012/02/11	2272	34.79%	33.29%	85.33%	169.19%
VANOVIN	2012/02/27	2342	2012/03/17	2734	16.94%	15.44%	312.23%	
VASINA	2011/08/18	1129	2011/11/15	1709	51.51%	50.01%	204.53%	168.25%
VASINA	2011/12/30	1596	2012/03/10	2055	28.12%	26.62%	138.42%	

5.6. Calculating the rate of returnresulting from purchase and maintenance strategy

In order to compare the hybrid fundamental-technical method and the fundamental method we should calculate the rate of return resulting from buy and hold strategy (ES). The calculation result can be seen in Table 5.

Table5. Calculating the rate of return resulting from purchase and maintenance strategy for banks

Stock name	Purchase date	Purchase price	Selling date	Selling price	Annual return, including transaction costs	Average annual return
VAPARS	2012/03/28	1528	2012/03/17	2392	83.5%	85.85%
VAKAR	2012/03/25	2561	2012/03/08	3320	70.55%	74%
VANOVIN	2012/03/28	2202	2012/03/17	2734	49.74%	51.14%
VASINA	2012/03/25	1072	2012/03/10	2055	111.78%	116.58%

6. Conclusions

In this paper, the ranking of industries and companies approach through PROMETHEE decision making method is used to select stocks. The three major contributions of this study are summarized as follows: (1) Identify the contexts (decision rules) and core criteria to rank and manage stock; (2) Explore the cause–effect relationships among the decision criteria (by using the PROMETHEE technique), which enables investors to observe the source factors that might improve or deteriorate the future prospects of value stocks; (3) Illustrate the proposed approach with clearly defined steps and operational procedures, which may help practitioners understand how to leverage advanced MCDM techniques to solve real world problems in finance.

By using the proposed model for a sample problem in the Tehran stock exchange, the following results were obtained:

a) While theorists rarely describe two analytical methods as complementary but apparently many practitioners consider them as complementary. This seems reasonable because fundamental analysis on the question of which stock and technical analysis on the question of when can be used together in a complementary manner. Based on a questionnaire survey in February 1995 in Hong Kong on foreign currency traders that were using fundamental and technical analysis to form their predictions about the exchange rates it was found over 85% of respondents rely on both fundamental and technical analysis to predict future rate movements in different time horizons. In shorter time horizons there is more likely to rely on technical analysis rather than fundamental analysis. But if you consider the long-term time horizon it tends to be consistently reversed.

b) Using PROMETHEE decision making method and the possibility of sensitivity analysis of problem results can improve the structure of industries and companies evaluation. Finally, it is suggested to scholars do more research on the following issues: Comparing the results of fundamental and technical analyses with other analyzing methodsfor predicting the future behavior of the stock; Improving the results by using other indicators; Applying appropriate policies to obviate the role of mediating variables; Surveying the effect of market conditions change and temporary fluctuations on the analyses; Using a combination of different MCDM techniques to get better results; and Conducting the same analyses using grey relation and fuzzy theories together with fuzzy numbers.

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