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# Stock price forecasting for companies listed on Tehran stock exchange using multivariate adaptive regression splines model and semi-parametric splines technique



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## HIGHLIGHTS

- We used 40 variables for predicting stock price in Tehran Stock Exchange.
- MARS and semi-parametric splines predict stock price in Tehran Stock Exchange.
- Various comparison studies with different models exhibit superiority of our model.
- The proposed models provide very good results.

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## ABSTRACT

One of the most important topics of interest to investors is stock price changes. Investors whose goals are long term are sensitive to stock price and its changes and react to them. In this regard, we used multivariate adaptive regression splines (MARS) model and semi-parametric splines technique for predicting stock price in this study. The MARS model as a nonparametric method is an adaptive method for regression and it fits for problems with high dimensions and several variables. semi-parametric splines technique was used in this study. Smoothing splines is a nonparametric regression method. In this study, we used 40 variables (30 accounting variables and 10 economic variables) for predicting stock price using the MARS model and using semi-parametric splines technique. After investigating the models, we select 4 accounting variables (book value per share, predicted earnings per share, P/E ratio and risk) as influencing variables on predicting stock price using the MARS model. After fitting the semi-parametric splines technique, only 4 accounting variables (dividends, net EPS, EPS Forecast and P/E Ratio) were selected as variables effective in forecasting stock prices.

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## 1. Introduction

Scholars are always looking for ways to predict the future. In this regard, techniques which have the lowest forecasting error are naturally viable and functional. So, for many years the mathematical methods such as simple average, weighted

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average, double mean, regression, etc. were the only models used and confirmed firmly but these methods had some drawbacks in many cases as well. Developing artificial intelligence methods such as neural networks bring hopes and this continues that scientists consider them as a mathematical method replacement [1], particularly when we cannot make a relationship between the data and dependent and independent variables. It is anticipated that there is a complex relationship between the stock prices and macroeconomic variables on one hand and competitor or alternative asset prices in other markets on the other hand. Since there is no complete and comprehensive theoretical understanding about the mentioned variables and their relationships, using MARS method for modeling these relationships is a useful approach. Predicting stock prices at stock exchange is one of the most challenging issues in this field and it is found interesting by the investors and market activists. Not only these people care about the stock price forecasting but also it is interesting for many researchers and scholars. These markets are even more interesting when they are complex and unstable and because many variables are influencing these kinds of markets, the researchers look out new methods for predicting these markets.

The optimal allocation of resources is one of the most basic economic issues that have concerned natural and legal persons, economic decision-makers and officials involved in the capital market. Resource allocation is possible when resources are directed toward high returns investments with rational risk. The important role of the processed data that are combined with a valid measure is quite evident here. Since the capital market plays an important role in providing financial resources, directing capitals and promoting investments, measuring the effectiveness of stimuli with high predictive power for active decision-making process is one of the most important issues in capital markets in many countries. Hence, if capital markets are stable or improving, it can be concluded that the overall economy is growing. Therefore, more attention must be paid to the market and to the fundamentals of decision-making in it.

Market analysis that is sometimes known as technical analysis method is based on three basic and broad principles. The three principles that apply in all world markets are: (1) All information about a share is reflected in its price. Technicians believe that all knowledge available about the shares, whether economic, political, or psychological knowledge, is manifested in the stock market price. Unlike fundamental analysts, some furious technicians argue that efforts to study data and financial statements of companies and their revenue and supply and demand factors are in vain. They believe that all the information appears in the "stock price". (2) The second principle states that prices move in specific trends or processes which resist abrupt changes. Supply and demand for a product allows the share to move in a state of equilibrium. When a movement begins, no change will be sustainable in it unless it is over. For example, if the share price started to rise, it will continue to increase until they reach a certain point of return. (3) The third principle relates to the repetitive nature of market activity. According to this principle, the market is constantly repeating itself. Therefore, certain patterns can be found at various intervals on the chart. Of course, this is a psychological principle that people in similar conditions show similar responses. Since the capital market is a reflection of human performance, the technicians investigate the reactions to anticipate similar responses in similar situations [2].

One of the most important reasons for companies to look out for methods to predict the stock price changes, is the factors which influence the stock price changes that are unknown. Stock prices forecasting or stock return is possible through discovering the behavior patterns of the stock prices generating process and success rate of the discovery of these behavior patterns which show forecasting efficiency. In fact, we could investigate the stock price generating process as a dynamic pattern. The mentioned process could be obtained by linear models, nonlinear models or stochastic models.

## 2. Literature review and theoretical basis

In the early twentieth century, some security market participants believed that price historical reviewing provide useful information for predicting prices at future so they believe if they could obtain price trends, they could discover change patterns and it would tell us when certain trends will occur. These people are called Chartists because they focus on charts. They believed that they could identify and predict supply and demand relationships as a result of stable trends for any stock or whole market. More importantly, technical analysts believe that investors behave in a predicted way when they face similar situations that occurred in the past. In other words, the history repeats Rajabi divarzam et al. [3].

### *Stock price forecasting*

Stock price is an index which represents the general level of stock prices of companies listed in Stock Exchange. Investigating time series patterns of a company stock price is its prices at opening and closing market or its highest or lowest values for each day and many days. Tradable financial assets are the basis of market decisions. Investors are looking at the latest news of company's stock prices and analyze for future fluctuations forecasting. Since analyzing markets through prices is easy for everyone, so it is more common to use stock price.

For predicting stock prices and finding the optimum stocks, there are two groups of experts. The first group is called the fundamental analysts; they try to predict stock prices by domestic stock price and investigate the factors influencing the stock prices. In this method, for accurate stock price determination, we identify and investigate all factors influencing stock price. Determining stock value and comparing it with its price in exchange market, we select stocks which are exchanging at a price lower than their real value to buy and stocks which are exchanging at a higher price to sell.

The second group is called technical analysts; they believe that they could predict stock performance in future by investigating its behavior at past. In this method, we investigate stock price to find good opportunities for selling and buying.

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