Comparative Evaluation of Linear and Neural Network Model Ability to Predict the Returns of Listed Companies in Tehran Stock Exchange

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Abstract: Predicting the future is always a necessity in everyday life and as a common sphere in several disciplines has been discussed. One of the areas that forecast in it has the particular importance in matters related to financial and economic fields. Present study compared investigates the linear and neural network model ability to predict the returns of listed companies on the Stock Exchange of Tehran. In the present study, with causal correlation method has been done the statistical population includes all companies listed in Tehran Stock Exchange which their information for the period of 2011-2013 is available. Order to prediction from daily stock returns of companies active in the stock and the independent variables net profit to asset, sale asset, the ratio of profit to sale, operating profit to sale, operating profit to gross profit and returns of investments have been used. For linear model from the multivariate linear regression method and for neural network model from the multilayer architecture with back-propagation algorithm has been used. Results of the research showed that both linear and artificial neural network models are able to predict stock returns. But, the accuracy of neural network in this forecast is higher and this shows the superiority of artificial neural network against multivariate linear regression model and artificial neural network capabilities in this forecast is confirmed.

Key words: Artificial neural networks, linear model, stock return, Tehran Stock Exchange

INTRODUCTION

Necessity and attention to future issues and predict them that always been raised in the financial markets, increasingly and becoming more complex with the expansion of these markets has become more important, so that now managers of investment companies in such markets, tried to use the latest scientific instruments to analyse financial markets to be able its portfolio of asset selected in a way so that maximum returns is achieved. That this issue indicates that it is possible to activity in advanced markets today without the use of scientific tools and techniques did not exist and for activity in those markets, failure and obtain negative returns is among the obtained results. Considering that the Tehran Stock Exchange as an organization in order to mobilize savings and guiding it investments towards productive and useful for society and the economy is concerned the study about issues related to this organization has especial importance. Capital market returns is an important aspect in terms of investors. So, financial analysts are always followed a suitable criterion for identify its estimation.

Much of the basic researches in the field of predict the behaviour of capital market returns have taken place only in the use of linear models showed that price fluctuations have a large number of shares traded on the New York Stock Exchange Nonlinear Model. After that was obtained a lot of evidence that was showed stock returns is variable that can be predicted by using a nonlinear model. Including the non-linear models used in this context artificial neural networks. Artificial neural networks are part of intelligent systems with processing empirical data, knowledge and law behind the data transfer to the network structure; for this reason to this system, intelligent is called. Human progress in information technology, Intelligent Expert system creative thinking have had the ability to choose the best data and to make a rational decision based on information selected became a reality and systems based on artificial intelligence was created. According to the subjects mentioned in this study tried it is to comparative evaluation of predicted returns of listed companies in Tehran Stock Exchange with the use of linear and nonlinear models (artificial neural networks) to be paid.

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Theoretical foundations and research background: For optimal investment, there are several models in the financial sector that gives to investor the power of assessment and decision-making. Technical models, fundamental and pricing capital assets including models predict and explain the behavior of returns exchange. Forecasts as well as a key element of management decision-making, with the aim of reducing risk estimates for future events. Usually predictions are not correct and have bit error that this amount is reduced with more information about the system. In such circum stances investors in order to continue the presence of investors as the main pillars of the capital markets having a predictive model proper cause optimal allocation of resources and performance in this market. Research shows that if can be achieved data generating process of a variable (linear or nonlinear) predict of that variable easier and with fewer errors will be possible. Although, linear models advanced forecasts appropriate for time periods, the medium-term but studies has shown in capital market that stock behaviour of a linear pattern does not follow and linear patterns show only part of the behaviour of the stock market. Neural network resource allocation in the portfolio selection and optimization of the portfolio weights have done, would conclude that the optimal portfolio weights can be achieved in this way and if this method is used to select the portfolio investment returns When the buy and hold strategy is used in comparison with returns Taiwan Stock index is more. Study portfolio selection problem dynamically paid great attention. In this study, researchers to offering artificial neural network of elements for the first time dealt to simulation of the behaviour of their shares Then estimated covariance matrix and eventually are formulated the dynamic portfolio model. The researchers suggest this argue that even if you are at the present time (t) you have optimal stock portfolio in the next time (t+1) does not optimize your stock portfolio and must in selection of desired portfolio for remaining optimum dynamism of returns also be considered. In the final stage, also own model compare with autocorrelation vector model and are concluded that their methodology for portfolio selection is a better way. They prove this result by using numerical example model. This research new presentation is based on the prediction investment portfolio optimization model that can be used to attract short-term investment opportunities. In this study from the artificial neural networks to predict the returns and of risk stock and also amount of prediction error of risk in the mean-variance model has been used and data examined is Brazil's stock shares as result of these studies show that by using short-term opportunities can be found abnormal returns and can be obtained yield more than significant returns but it should be divided into two parts: part that arising from the use of this method and another part that can be considered abnormal returns resulting from the market turbulences. Hong *et al.* (1996) in a research entitled linking between arbitrage pricing theory and artificial neural networks to improve portfolio management to conclude that the establishment of this link leads to synergistic In the extraction process of risk factors, risk factors unique trend forecasting, portfolio selection and finding the optimum portfolio. This shows that the artificial neural networks is not just a tool that can be used alone in investment analysis but also a means by which can be generalized the use of other tools or can be resolved defects of them. These researchers in this study in order to predict returns of factors have used the quadratic programming and eventually came to the conclusion that this hybrid approach can be outperformed than traditional methods that from models similar to ARIMA were used.

Namazi and Kimia (2007) in a study to examine the predictability of stock returns the behaviour of companies listed in Tehran Stock Exchange and also conducting predict of returns with the use of artificial neural networks are explored. In this research, the neural network with different learning functions was used. The results artificial with structure of Multi-Layer Perceptron (MLP) results show that: Time series behaviour of daily stock returns of the companies is not a random process and has memory.

Artificial neural networks the ability to predict the daily returns with error rates relatively good. Raei and Fallahpour (2004) in study of predicting financial distress of companies with the use of artificial neural networks dealt to study of 80 companies and with the use of neural network model and also multiple auditor analysis models predict the financial distress of companies. Results of this research also show the better performance of neural network model than multi-auditor analysis. Raei and Chavoshi (2003) in an article entitled predicting stock returns in the Tehran Stock Exchange: artificial neural network model and multi-factor model to examine the behaviour of stock returns have paid in the Tehran Stock Exchange. This study by reviews the history of the process of forecasting methods with bring up issues of econometric models, including regression model and then multi-factor model study the artificial neural networks. In this study, by using the multi-layer perceptron neural networks with back propagation error learning algorithm and multi-factor model predict stock returns pay and finally come to the conclusion that neural networks have better performance than multi-factor models.

Research hypotheses:

- H_1: The linear model can predict stock returns of companies listed in Tehran Stock Exchange
- H_2: Artificial neural networks can predict stock returns of companies listed in Tehran Stock Exchange
- H_3: There is a significant difference between the ability to predict linear and artificial neural networks models

MATERIALS AND METHODS

Given that this study seeks to comparative evaluation of ability of linear and neural network models to predict the returns of listed companies in Tehran Stock Exchange, the research is descriptive from correlational type. In fact, in correlation research, the relationship between the variables based on research objective is analysed. In this research sampling. In this way, that of all the companies listed in Tehran Stock Exchange that their information for the years of 2011-2013 is available by using systematic elimination method we have chosen. According to which 109 companies were selected and their information were studied.

Research model and its variables: In this research, linear model and neural networks are independent variables and the companies returns are dependent variable.

How to calculate the research variables are as follows: Our desired linear equation for this is Eq.1 that by using it, we examine the returns of listed companies in stock exchange:

$$Y_t - Y_{t-1} = C + A_1 \left[Y_{t-1} - Y_{t-2} \right] + A_2 \left[Y_{t-2} - Y_{t-3} \right] + \ldots + A_p \left[Y_{t-p} - Y_{t-p-1} \right] + e_t \qquad (1)$$

We estimate a model and specify based on the number of delays of P. For neural network also delays are network input and main returns as purpose of the network is defined (Fig. 1).

Model forecast error (Case; the second hypothesis): To evaluate a predictive model or choosing the best model among the various models for time series, we need to index that by it necessary decision, about accept or reject prediction model to be adopted. In addition, there is uncertainty in all predictions. In fact from the part series
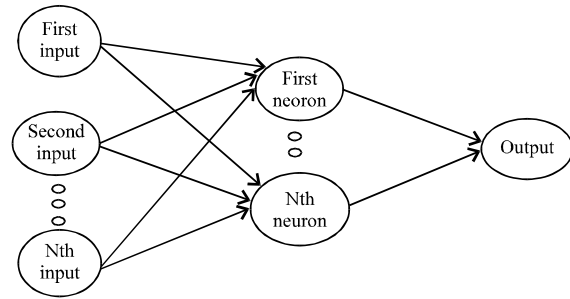

Fig. 1: Description of neutral network

appears unusual. As a result, in all methods should be kept in mind the error prediction. In general, whatever amount of the actual series (yt) to its predicted value.

RESULTS AND DISCUSSION

Researchers to offering artificial neural network of elements for the first time dealt to simulation of the behaviour of their shares Then, estimated covariance matrix and eventually are formulated the dynamic portfolio model. Results of the research showed that both linear and artificial neural network models are able to predict stock returns. But, the accuracy of neural network in this forecast is higher and this shows the superiority of artificial neural network against multivariate linear regression model and artificial neural network capabilities in this forecast is confirmed. For optimal investment, there are several models in the financial sector that gives to investor the power of assessment and decision-making. Technical models, fundamental and pricing capital assets including models predict and explain the behaviour of returns exchange. Forecasts as well as a key element of management decision-making, with the aim of reducing risk estimates for future events. Usually, predictions are not correct and have bit error that this amount is reduced with more information about the system.

CONCLUSION

According to the study conducted, first hypothesis showed that the linear model can predict stock returns of companies listed in Tehran Stock Exchange. Also, the result of second hypothesis showed that artificial neural networks can predict stock returns of companies listed in Tehran Stock Exchange. The results of third hypothesis showed a significant difference between the ability to predict linear and artificial neural networks models. According to the study, all hypothesis was approved.

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