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The Predicting Stock Price using Artificial Neural Network

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ABSTRACT

The aim of this research is to predicting of stock price in Tehran Stock Exchange Using Artificial Neural Network for annual data from 2000 to 2008. In this regard this approach is established with investment income, stock sales income, earnings per share and net assets as independent (Input) variables. Results showed that estimation and predictions of stock price with Artificial Neural Network is possible and have suitable and stronger results. Best architecture is a network with two hidden layer and twelve two neuron in hidden layers with hyperbolic tangent transfer function both in hidden and output layers with Quasi -Newton training algorithm.

KEYWORDS: Artificial Neural Network, Stock Price, Tehran Stock Exchange (TSE).

1- INTRODUCTION

People tend to invest in common stock because of its high returns over time. Stock markets are affected by many highly interrelated economic, social, political and even psychological factors, and these factors interact with each other in a very complicated manner. Therefore, it is generally very difficult to forecast the movements of stock markets (Abdoh, 2000). Inspired artificial neural networks in the brain and nerve cells (neurons) exist. Although human knowledge about the human brain is very limited, but too many details are in connection with the anatomy and physiology of the brain has neurons. The output of each neuron is axons that are disciplines that have seen too long. Artificial neural networks covered a much smaller range that biological neural networks and the ability of biological neural networks are much less. What actually is the ability to perform computational network in a particular activity is such as pressing a function approximation. Signs or electrical pulses are generated by nuclear neurons and axons that are transferred through the branches. The networks are examined in three main areas: one, Network environment and training data, two, Network organization and three, Network performance. The Tehran Stock Exchange (TSE) is Iran's largest stock exchange, which first opened in 1967. The TSE is based in Tehran. As of July 2010, 337 companies with a market capitalization of US$72 billion were listed on TSE. TSE, which is a full member of the World Federation of Exchanges and a founding member of the Federation of Euro-Asian Stock Exchanges, has been one of the world's best performing stock exchanges in the years 2002 through 2010. TSE is an emerging or "frontier" market. The most important advantage that Iran's capital market has in comparison with other regional markets is that there are 40 industries directly involved in it. Industries such as the automotive, telecommunications, agriculture, petrochemical, mining, steel iron, copper, banking and insurance, financial mediation and others trade shares at the stock market, which makes it unique in the Middle East (Financial Times, 2010). The rest of the paper proceeds in the following steps: Section 2 will introduce our theatrical framework. Section 3 gives methodology and model. Section 4 presents results. Finally, section 5 is this paper's conclusion.

2. REVIEW OF LITERATURE

It is clear from the proposal above that the success or failure of these trading models depends crucially on our ability to generate accurate volatility forecasts. There is quite a strong body of literature advocating the use of the GARCH family of models to forecast volatility. See for example Chong et al. (1999), Walsh and Tsou (1998), Akgiray (1989), Corhay and Rad (1993) and Vasilellis and Meade (1996). Corhay and Rad (1993) investigated whether autoregressive conditional heteroskedastic models could adequately describe stock price behavior in European capital markets. The reason they chose to do this was due to the fact that so much work had been applied to American markets as in Akgiray (1989) and they wanted to investigate whether the models were suitable in markets which are "generally much smaller and thinner" than the American ones. A major criticism of these models made by Kroner et al. (1995) is that they ignore the market's expectations of the future volatility and rely only on past information. Kroner et al. acknowledge that GARCH forecasts seem to provide the best forecasts of volatility (based on evidence from literature) but also that implied volatility based forecasts can still be used to explain some of the forecasting error from the GARCH models. If their assumptions are correct, then it should be possible for a volatility trading model to be successfully implemented based on a combined model.

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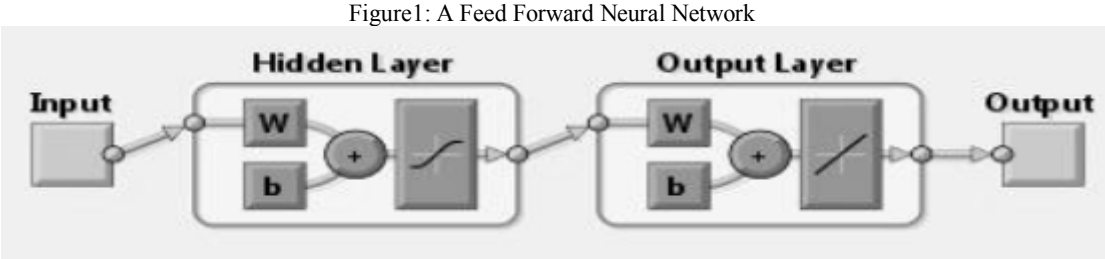
3. METHODOLOGY

An Artificial Neural Network is making of Artificial Neurons. Neuron is the smallest processing unit and is the base of neural network operation (Wu, 1995). The greatest advantage of a neural network is its ability to modeling complex nonlinear relationship without a priori assumptions of the nature of the relationship neural networks has three layers; input layer, hidden layer and output layer. Input layer just take the data and behave like an independent variable therefore amount of neuron in input layer depend to the variable. Output layer behave like a depended variable and amount of neuron in this layer depend on the dependent variables (forecasting variables). For the amount of neurons in hidden layers researcher suggest some relations like; 2n+1, 2n, n, n/2 ; that n is the number of neuron in input layer but the best rule for choice the number of neuron in this layer is based on trial and error. Data divided in two set; training and test set. Network take the training set an according them estimate the behavior of series, then examine the estimation of network according to compare output of network with actual data using test set. Often use one of the following ratios for allocation data between two set (Zhang et al., 1998). In some study researcher divide the data in three set; train, validation and test set (Yao and Tan, 2000). If the networks output shows with and actual value with y, the purpose of network training is to find the networks weight to minimize the network error. If the error of forecasting determined with Sum of Squared Errors (SSE), purpose is to minimize the Eq.1.

$$SSE = \sum (y_i - \bar{y}_i)^2 \qquad [2]$$

In Hetro-association method that used it in our study, gives the network actual values of targets with input variable and network with estimate the target value compare actual and estimated values and calculate errors, and using algorithms change the weights to minimize the errors. With iteration, this process network has trained and weights and parameters are calculated (Moshiri and Cameron, 2000). There are algorithms to training a network such as Quick Propagation (QP), Quasi -Newton (QN), Levenberg - Marquardt (L-M), Back - Propagation (BP) and Genetic Algorithm (GA). There are several type of neural network; Feed Forward, Cascade Forward, Elman and General Regression Neural Network (GRNN), but researchers unanimously about better performance of Feed Forward neural network in forecasting (Kasstra and Boyd, 1996), (Tkacz, 2001). Neural networks are powerful in forecasting non-linear variables so in the next section first tested the non-linearity of depended variable, and then to set up the network examined various network components.
In the figure.1 there is a research's network.

Figure1: A Feed Forward Neural Network

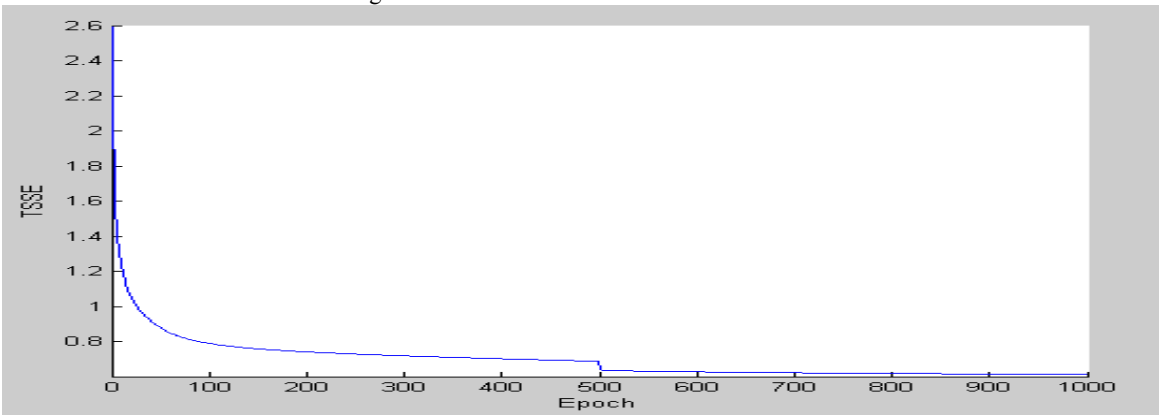


In this research, investment income, stock sales income, earnings per share and net assets are as independent (Input) variables and stock price is defined as output data.
All indices are defined below:
Earnings per Share (EPS): Earnings per share are one of the most important measures of company's strength. The significance of EPS is obvious, as the viability of any business depends on the income it can generate. A money losing business will eventually go bankrupt, so the only way for long term survival is to make money. EPS allows us to compare different companies' power to make money. The higher the EPS with all else equal, the higher each share should be worth. To calculate this ratio, divide the company's net income by the number of shares outstanding during the same period.
Prediction Earnings per Share (PEPS): PEPS are the last of Prediction Earnings per Share. On the other hand, it is unrealized Earnings per Share.
Dividend per share (DPS): DPS is the total dividends paid out over an entire year (including interim dividends but not including special dividends) divided by the number of outstanding ordinary shares issued.
Price - earnings ratio (P/E): Value investors have long considered the price earnings ratio as one of the single most important numbers available when evaluating a company's stock price. The P/E looks at the relationship between the stock price and the company's earnings and it is the most popular metric of stock analysis. The price earnings ratio is equal to the price of the stock divided by EPS of common stock.
Stock price: The Stock price is equal to the last of Stock price which is trading at the one day.

4. RESULTS

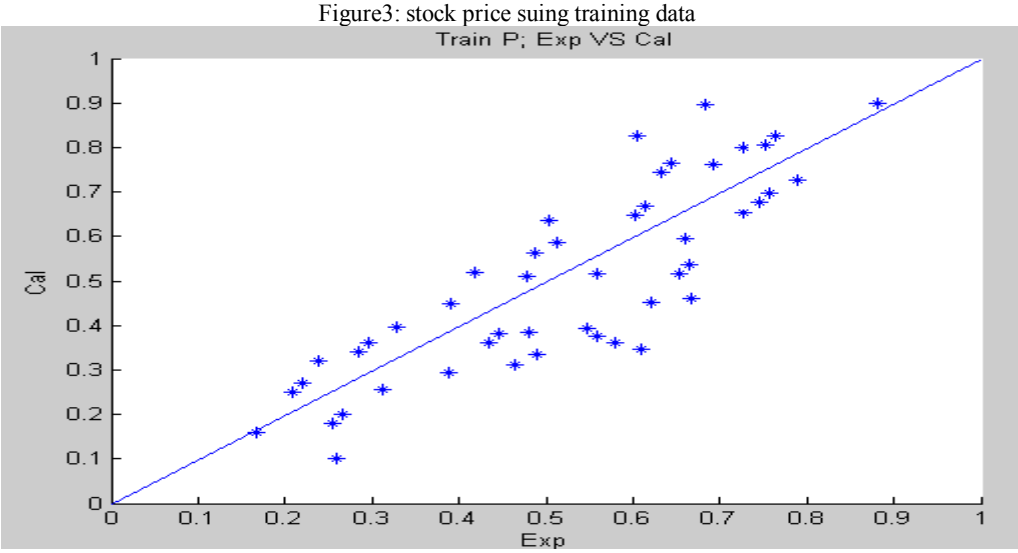
In first step, we evaluate the total errors of artificial neural network that is showed in figure2.

Figure2: total errors of artificial neural network



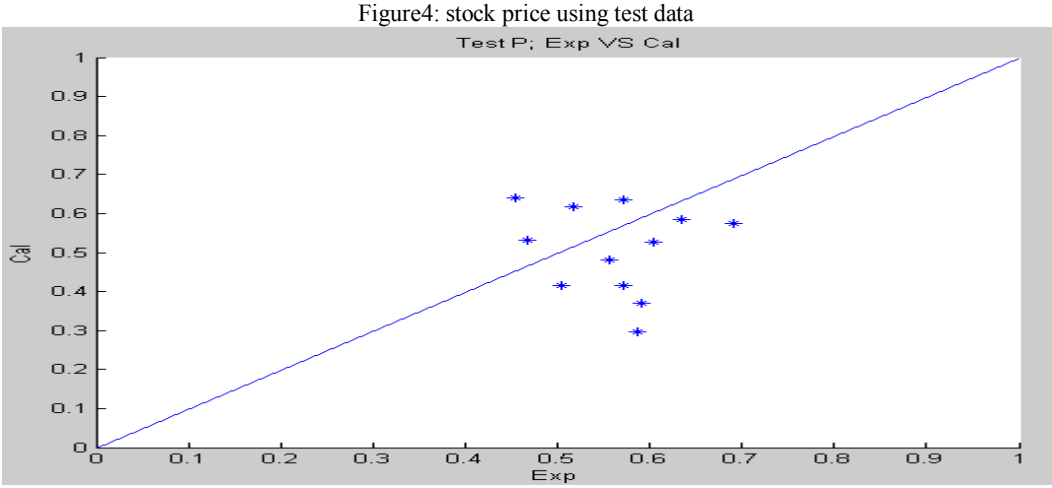
In next step we examine the stock price using training data that is presented in figure3.

Figure3: stock price suing training data



Finally in this step we examine the stock price using test data that is presented in figure4.

Figure4: stock price using test data



Due to figures 3 and 4, we resulted that prediction of stock price using artificial neural network is possible.

5. Conclusion

Artificial Neural Network is the well known approach for estimation and prediction of various economic and accounting variables. The aim of this research is to predicting of stock price in Tehran Stock Exchange Using Artificial Neural Network for annual data from 2000 to 2008. In this regard this approach is established with investment income, stock sales income, earnings per share and net assets as independent (Input) variables. Results showed that estimation and predictions of stock price with Artificial Neural Network is possible and have suitable and stronger results. Best architecture is a network with two hidden layer and twelve two neuron in hidden layers with hyperbolic tangent transfer function both in hidden and output layers with Quasi -Newton training algorithm.

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