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Chapter III

Neural Network-Based Stock Market Return Forecasting Using Data Mining for Variable Reduction

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Abstract

Researchers have known for some time that nonlinearity exists in the financial markets and that neural networks can be used to forecast market returns. Unfortunately, many of these studies fail to consider alternative forecasting techniques, or the relevance of the input variables. The following research utilizes an information-gain technique from machine learning to evaluate the predictive relationships of numerous financial and economic input variables. Neural network models for level estimation and classification are then examined for their ability to provide an effective forecast of future values. A cross-validation technique is also employed to improve the generalization ability of the models. The results show that the classification models generate higher accuracy in forecasting ability than the buy-and-hold strategy, as well as those guided by the level-estimation-based forecasts of the neural network and benchmark linear regression models.

Introduction

Important changes have taken place over the last two decades within the financial markets, including the use of powerful communication and trading platforms that have increased the number of investors entering the markets (Elton & Gruber, 1991). Traditional capital market theory has also changed, and methods of financial analysis have improved (Poddig & Rehkugler, 1996). Stock-return forecasting has attracted the attention of researchers for many years and typically involves an assumption that fundamental information publicly available in the past has some predictive relationships to future stock returns or indices. The samples of such information include economic variables, exchange rates, industry- and sector-specific information, and individual corporate financial statements. This perspective is opposed to the general tenets of the efficient market hypothesis (Fama, 1970) which states that all available information affecting the current stock value is constituted by the market before the general public can make trades based on it (Jensen, 1978). Therefore, it is impossible to forecast future returns since they already reflect all information currently known about the stocks. This is still an empirical issue since there is contradictory evidence that markets are not fully efficient, and that it is possible to predict the future returns with results that are better than random (Lo & MacKinlay, 1988).

With this in mind, Balvers, Cosimano, and McDonald (1990), Breen, Glosten, and Jagannathan (1990), Campbell (1987), Fama and French (1988, 1989), Fama and Schwert (1977), Ferson (1989), Keim and Stambaugh (1986), and Schwert (1990), among others, provide evidence that stock market returns are predictable by means of publicly available information such as time-series data on financial and economic variables. These studies identify that variables such as interest rates, monetary-growth rates, changes in industrial production, and inflation rates are statistically important for predicting a portion of the stock returns. However, most of the studies just mentioned that attempt to capture the relationship between the available information and the stock returns rely on simple linear regression assumptions, even though there is no evidence that the relationship between the stock returns and the financial and economic variables is linear. Since there exists significant residual variance of the actual stock return from the prediction of the regression equation, it is possible that nonlinear models could be used to explain this residual variance and produce more reliable predictions of the stock price movements (Mills, 1990; Priestley, 1988).

Since many of the current modeling techniques are based on linear assumptions, a method of financial analysis that considers the nonlinear analysis of integrated financial markets needs to be considered. Although it is possible to perform a nonlinear regression, most of these techniques require that the nonlinear model must be specified before the estimation of parameters can be determined. Neural networks are a nonlinear modeling technique that may overcome these problems (Hill, O'Conner, & Remus, 1996). Neural networks offer a novel technique that does not require a prespecification during the modeling process since they independently learn the relationship inherent in the variables. This is especially useful in security investment and other financial areas where much is assumed and little is known about the nature of the processes determining asset prices (Burrell & Folarin, 1997). Neural networks also offer the flexibility of numerous

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