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Intelligent technical analysis based equivolume charting for stock trading using neural networks

Thira Chavarnakul, David Enke *

Department of Engineering Management and Systems Engineering, Laboratory for Investment and Financial Engineering, Center for Intelligent Systems, University of Missouri – Rolla, Rolla, MO 65409-0370, USA

Abstract

It has been long recognized that trading volume provides valuable information for understanding stock price movement. As such, equivolume charting was developed to consider how stocks appear to move in a volume frame of reference as opposed to a time frame of reference. Two technical indicators, namely the volume adjusted moving average (VAMA) and the ease of movement (EMV) indicator, are developed from equivolume charting. This paper explores the profitability of stock trading by using a neural network model developed to assist the trading decisions of the VAMA and EMV. The generalized regression neural network (GRNN) is chosen and utilized on past S&P 500 index data. For the VAMA, the GRNN is used to predict the future stock prices, as well as the future width size of the equivolume boxes typically utilized on an equivolume chart, for calculating the future value of the VAMA. For the EMV, the GRNN is also used to predict the future value of the EMV. The idea is to further exploit the equivolume potential by using a forecasting system to predict the future equivolume measurements, allowing investors to enter or exit trades earlier. The results show that the stock trading using the neural network with the VAMA and EMV outperforms the results of stock trading generated from the VAMA and EMV without neural network assistance, the simple moving averages (MA) in isolation, and the buy-and-hold trading strategy.

Keywords: Neural networks; Technical analysis; Financial forecasting; Stock trading

1. Introduction

Technical analysis, also known as ''charting'', has been a part of financial practice for many decades (Lo, Mamaysky, & Wang, 2000). It is considered by many to be the original form of investment analysis, dating back to the 1800s (Brock, Lakonishok, & Lebaron, 1992). As opposed to fundamental analysis, which is the study of economic, industry, and company conditions in an effort to determine the intrinsic value of a company' stock (Cutler, Poterba, & Summers, 1989), technical analysis studies the historical data surrounding price and volume movements of the stock by using charts as the primary tool to forecast future price movements (Murphy, 1999). Technical analysis normally uses two techniques to evaluate the stock prices. The first technical analysis technique uses charts to study the movement of stock prices. The use of technical indicators is another technique that includes calculations or mathematic equations to investigate the trading decisions.

However, technical analysis has also been criticized and scorned by many academics and practitioners (Malkiel, 1995). This is due to its inconsistency with the theory of market efficiency. As such, many studies have been made to investigate the performance of technical analysis, but conclusions vary. Some researchers have found results consistent with market efficiency, such that technical analysis cannot predict the future stock prices (Allen & Karjalainen, 1999; Bessembinder & Chan, 1998; Jegadeesh, 2000; Ratner & Leal, 1999; Sullivan, Timmermann, & White, 1999). Others have relied on technical analysis for successful stock price prediction (Blume, Easley, & O'Hara, 1994; Brock et al., 1992; Lo et al., 2000; Neely, Weller, & Dittmar, 1997; Neftci, 1991). In recent years, however,

* Corresponding author. Tel.: +1 573 341 4565; fax: +1 573 341 6567.
E-mail address: enke@umr.edu (D. Enke).

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technical analysis has proven to be powerful for evaluating stock prices and is widely accepted among financial economists and brokerage firms. This is due to the fact that technical analysis appears to be a compromising tool since it offers a relative mixture of human, political, and economical events (Achelist, 1995).

Trading volume is a standard market measurement and is one of the principal sources of information that is important to interpreting price movement. Furthermore, academics and practitioners have long recognized that past trading volume may provide valuable information about future stock price (Lee & Swaminathan, 2000). Studies have been made to examine the role of trading volume in an area of stock market prediction and investment (Blume et al., 1994; Campbell, Grossman, & Wang, 1993; Kaastra & Boyd, 1995; Lee & Swaminathan, 2000).

Based on an awareness of the importance of trading volume for stock price movement, equivolume charting (Arms, 1996), which is an increasingly important and popular type of technical analysis chart, was developed to take the effect of volume into consideration when studying stock market action. Equivolume charting is unique in the way that the trading volume is used to replace time on the horizontal axis of the chart. As a result, for this paper the equivolume charting will be of interest since this technique redefines the time-scale for use in technical analysis by considering how stocks appear to move in a volume frame of reference as opposed to a time frame of reference. Various studies have focused on the time-scale for technical analysis and financial markets forecasting, especially in high-frequency markets, such as the foreign exchange market (FX) (Ceballos Hornero & Sorrosal i Forradellas, 2002; Dacorogna, Muller, Nagler, Olsen, & Pictet, 1993; Dacorogna, Gauvreau, Muller, Olsen, & Pictet, 1996; Levitt, 1998). However, less research has focused on the stock market. Therefore, this paper will provide an exploration of technical analysis based on equivolume charting by using an intelligence method to assist the stock trading signals. Neural network (NN) will be used as the method of computational intelligence for this study since they typically perform well for classification, recognition, and forecasting of financial data. Neural networks have also become an important method for stock market prediction because of their ability to deal with uncertain, fuzzy, or insufficient data that fluctuate rapidly in very short periods of time (Schoeneburg, 1990). Furthermore, neural networks are able to decode nonlinear time series data that adequately describe the characteristics of the stock markets (Yao, Tan, & Poh, 1999). Many researhers have utilized various types of neural networks for technical analysis and stock market prediction (Chenoweth, Obradovic, & Stephenlee, 1996; Enke & Thawornwong, 2005; Kim & Han, 2000; Kuo, Li, Cheng, & Ho, 2004; Leigh, Hightower, & Modani, 2005; Saad, Prokhorov, & Wunsch, 1998).

The experiment will be developed using the volume adjusted moving average (VAMA) and the ease of movement (EMV) indicators from the equivolume chart. The VAMA assigns a volume measure rather than a time parameter to the moving averages, while the EMV converts the information of the equivolume chart into a numerical equivalent and shows the relationship between volume and price change. The objective will be to examine whether the neural network can help to assist the VAMA and EMV trading signals to generate better profitability. The generalized regression neural network (GRNN) will be selected and developed on past S&P 500 index data. For the VAMA, the GRNN will be used to predict a future stock prices as well as the future width size of the volume boxes typically utilized on an equivolume chart so that the future value of VAMA can be considered for stock trading. For the EMV, the GRNN will also be used to predict the future value of EMV for stock trading. Trading strategies will then be developed and the results will be compared against the results generated from those without neural network assistance, the simple moving averages (MA) in isolation, and the buy-and-hold trading strategy.

The paper is organized as follows. A brief introduction of equivolume charting, VAMA, and EMV are given in Sections 2–4, respectively. Section 5 discusses the neural network architecture being used. Section 6 provides the trading strategies. The empirical results and analysis are reported in Section 7. Finally, conclusions are discussed in Section 8.

2. Equivolume charting

The concept of equivolume was invented by Arms (1996) after his research with the Arms Index (Arms, 1996). The Arms Index takes the affect of volume into consideration when studying market action (i.e. a measure of the overall market trading activity). Equivolume charting recognizes the fact that volume is a market measurement and important to the price movement. It was developed to consider how stocks appear to move in a volume frame of reference as opposed to a time frame of reference. Therefore, equivolume charting (see Fig. 1) uses volume to

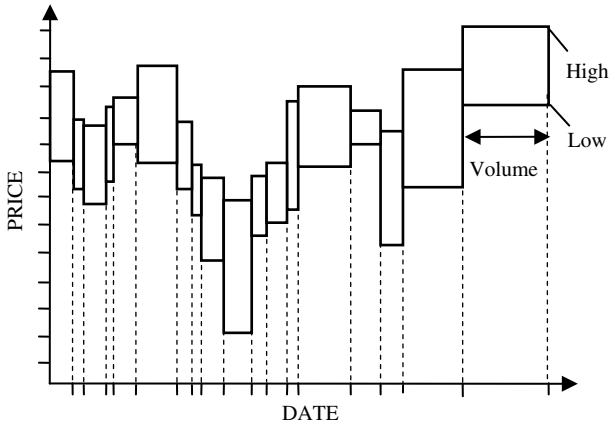

Fig. 1. Equivolume charting.