Chapter IV

Forecasting Emerging Market Indexes with Neural Networks

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ABSTRACT

Forecasting financial time series with neural networks is problematic. Multiple decisions, each of which affects the performance of the neural network forecasting model, must be made, including which data to use and the size and architecture of the neural network system. While most previous research with neural networks has focused on homogenous models, that is, only using data from the single time series to be forecast, the ever more global nature of the world’s financial markets necessitates the inclusion of more global knowledge into neural network design. This chapter demonstrates how specific markets are at least partially dependent on other global markets and that inclusion of heterogeneous market information will improve neural network forecasting performance over similar homogeneous models by as much as 12 percent (i.e., moving from a near 51% prediction accuracy for the direction of the market index change to a 63% accuracy of predicting the direction of the market index change).
INTRODUCTION

Neural network models are widely used for evaluating and solving business problems (Li, 1994; Widrow et al., 1994), with applications in accounting (Etheridge & Brooks, 1994; Falas et al., 1994; Walczak et al., 1998), finance (West, 2000; White, 1993; Zahedi, 1996; Zhang & Hu, 1998), and other business domain problems. Additionally, neural networks have demonstrated significantly superior performance over more traditional statistical forecasting models of business problems (Bansal et al., 1993; León, 1994; Piramuthu et al., 1994; Walczak et al., 1998; West, 2000). Although still outperforming random walk and statistical forecasting models, empirical research evidence has indicated that standard neural network forecasting of financial time series values typically does not fare very well, with performance at or below 60% accuracy (Lequarré, 1993, Tahai et al., 1998).

Why have neural network financial time series forecasting models been unable to achieve the 90% and above accuracy levels of neural network business classification models? Several explanations have been offered including: time series are dynamic in nature and thus are less representable by static models, financial time series are essentially a random walk following the weak form efficient market hypothesis and thus would be unpredictable, and current neural network design philosophy does not accurately capture necessary knowledge for modeling time series (Walczak & Cerpa, 1999). While the former arguments may ultimately limit the long term usage of a single neural network model, retraining of the model on more current data should overcome the limitations of a static model (Walczak, 2001).

A commonly employed neural network design heuristic is to use homogeneous input data sets, that is, only use the time series values or other values that may be calculated directly from the time series itself (e.g., lags or trends). Research by Walczak et al. (1998) has demonstrated that heterogeneous data sets that contain not only the time series but other relevant data values are critical for improving a financial time series neural network’s forecasting performance (specifically, forecasting the correct direction of change to a financial time series). Additionally, the ever more global economy causes interaction effects among the various economies around the world.

Well established capital markets, such as the New York or London or Tokyo stock exchanges may be better insulated against disruptive signals received from other global markets or they may have an efficient means for incorporating external signals into their respective time series. The growth of telecommunication infrastructure has investors and business planners looking more globally for opportunity and this includes many markets that are consid-
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