ON THE MARKET TIMING ABILITY OF NEURAL NETWORKS:
AN EMPIRICAL STUDY TESTING THE FORECASTING PERFORMANCE

TAE HORN HANN
Institute for Statistics and Mathematical Economics
University of Karlsruhe
Rechenzentrum, Zirkel 2
76128 Karlsruhe, Germany

JÖRN HOFMEISTER
University of Ulm
present address: Rosenweg 17, 71706 Markgröningen, Germany

The evaluation of the forecasting performance of a neural network is essential especially for practitioners. Measures such as mean square error (MSE in the following), mean error (ME) or mean absolute error (MAE) are widely used in applied econometrics. However, these measures are not very meaningful in forecasting, as we usually are interested in sign prediction only. On the other hand, economic performance measures (annualized return, Sharpe ratio, etc.) which are used to evaluate trading models, are sensitive to market behavior (trends, volatility) and have to be compared to benchmarks. In this paper we test for significant market timing ability in order to assess the performance of trading models based on neural nets. We use three modeling approaches and show that they have a significant influence on market timing ability.

1 Introduction

Recently several methods have been proposed to design trading models with neural networks. Moody and Wu (1997), Kang et al. (1997) or Bengio (1997) for example propose to optimise the financial criterion of interest and report superior results relative to the standard approach of minimising the MSE. However, the results of these case studies cannot be compared as they are dependent on the time series to be predicted and on the time period chosen. In this paper the influence of three neural network models on market timing ability is tested. This test was proposed by Hendriksson and Merton (1981) and tests for independence between the forecasts and the realized return based on sign prediction.

2 Forecasting the Bund-Future using Technical Indicators

2.1 The Bund-Future

The Bund-Future is a future contract on a generic German long term bond. Months of maturity are March, June, September, and December, and a contract is valid for 9 months. When a trading model of a future-contract is modeled, problems such as the roll-over-effect, cheapest-to-deliver-bond and the cost-of-carry have to be considered.¹

The Bund-Future market is considered to be a highly technical market. As the markets are centralized we have access to all information necessary for technical indicators such as high, low, open, and close prices as well as open interest. Recently there has been an increased academic interest in technical trading rules. Studies such as Levich and Thomas (1993), Sweeney (1986) or Allen and Taylor (1990) report that technical indicators are widely used, especially in short term forecasting, and that they proved to be profitable.

As there is no sound theoretical base for the choice of parameters² we optimized them with respect to their parameters on the training sample. This procedure leads to more significant indicators and avoids an arbitrary choice of parameters. We chose technical indicators from Reuters (1994). In addition to these indicators we used the Bund-Future with lag 1, 2, and 3 as well as a moving average of five trading days.

2.2 The Complexity of the Neural Network

The specification of neural nets is of major interest in time series application. To avoid overparameterized models which lead to overfitting and thus to inferior generalization results, methods such as pruning, penalty terms and recently testing are widely used. However, during the training process we observed the following:

• The number of hidden units (we used 2, 4, 6, and 8 hidden units) did not lead to the well known overfitting effect which is most visible when the error curve of the training set gets close to zero, whereas concurrently the error on the validation set increases.
• In addition, when the error of the early stopping point is compared with later stopping points, the increase is minimal.

¹ for more detailed information see Azoff (1994)
² see Menkhoff and Schlumberger (1995)