Measuring of Value at Risk (VAR) on Emerging Stock Markets by Neural Networks Method

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Abstract—This study using neural network method for estimating VAR in emerging stock markets include Chinese and Hong Kong stock markets. Empirical results showed that the neural network method has outperformed conventional methods (historical simulation (HS), variance/covariance and the Monte Carlo simulation) in estimating VAR.

Keywords: Neural Networks, Value at Risk

I. INTRODUCTION

The conventional methods used to estimate Value at Risk (VAR) include historical simulation (HS), variance/covariance (VCV), and Monte Carlo simulation (MCS) methods. Badik [3] pointed out that VAR is the value of the negative result (loss) that for a certain period and with a certain probability will not be exceeded. Consequently, estimating VAR requires the determining of the two parameters of holding period and confidence level. Linsmeier and Pearson [20] defined VAR as a measure of losses resulting from normal market movements. Jorion [15] documented the fact that VAR summarizes the worst expected loss over a target horizon and within a given confidence interval.

Recently, Neural Network simulation has been extremely popular in forecasting stock prices, but has almost never been applied to VAR estimation. Chen, Hsieh and Chang [7] propose a hybrid model which combines generalized autoregressive conditional heteroskedasticity (GARCH) and Neural Network simulation for estimating VAR in the futures market. On the other hand, stock price data usually exhibit time series correlation, and Neural Network simulation forecasting of stock prices cannot be influenced by time series correlation.

II. Conventional Methods

Historical simulation method which the advantage is easy to understand and explain since it makes no statistical assumptions about the distribution of returns (Alexander & Leigh [2]). The main difficulty in implementing historical simulation is that it requires a time series of the relevant market factors over the last N days.

Variance/Covariance method is the simplest and perhaps most widely used method of modeling changes in portfolio value is the variance/covariance method popularized by RiskMetrics (Glasserman, Heidelberger, & Shahabuddin [10]).

Monte Carlo simulation method which is assumed that the volatility of an investment portfolio returns follows a certain stochastic process, meaning the paths of stock prices can be computationally simulated hundreds, thousands, or even millions of times to establish portfolio returns distribution and estimate VAR (Stambaugh [24]). Monte Carlo simulation is a natural alternative for handling nonlinear portfolios (Jin & Zhang [14]), and is also extremely flexible since it makes no definite assumptions regarding asset returns. However, the Monte Carlo simulation procedure can be quite complex and time consuming, requiring expensive intellectual and technological skills.

III. Neural Network Simulation Method

Neural Network (NN) is an artificial intelligence (AI) method (Kai & Wenhua [17]). It is a highly non-linear, large-scale, continuous, time-based, and dynamic system. The knowledge of Neural Network is stored in the relationship among numerous nodes in the form of a weigh matrix. This method has become extremely important in making stock market predictions. Back-propagation neural networks...