Forecasting Inflation in India:
An Application of ANN Model

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ABSTRACT

This paper presents an application of Artificial Neural Network (ANN) to forecast inflation in India during the period 1994-2009. The study presents four different ANN models on the basis of inflation (WPI), economic growth (IIP), and money supply (MS). The first model is a univariate model based on past WPI only. The other three are multivariate models based on WPI and IIP, WPI and MS, WPI, and IIP and MS. In each case, the forecasting performance is measured by mean squared errors and mean absolute deviations. The paper finally concludes that multivariate models show better forecasting performance over the univariate model. In particular, the multivariate ANN model using WPI, IIP, and MS resulted in better performance than the rest of other models to forecast inflation in India.

Keywords: ANN, Forecasting, Inflation, Multivariate, Univariate

1. INTRODUCTION

Inflation is one of the recurrent topics in finance, particularly with reference to macroeconomic policies. This is because high inflation disrupts smooth functioning of market economy (Yap, 1996). The behaviour of inflation is well articulated in Philips curve analysis. Inflation has direct impact on money supply in the economy. So the existence of high inflation will certainly affect country's investment plan in particular and economic growth in general. The best that one can do is to reduce uncertainty that involved in inflation and examining its short optimum relationship with money supply and economic growth.

Numbers of techniques are readily available to examine the financial time series data (Box & Jenkins, 1970). But with the developments of non-linear time series analysis, several authors have begun to explore the forecasting properties of non-linear models in finance (Zhu et al., 2008; Marcellion, 2004; Stock & Watson; 1998; Swanson & White, 1997). Artificial Neural Network (ANN) is one of the very important one (Kiani, 2008; Zhang, 2003; McMenamin, 1997; Kaun & White, 1994). ANN is an attractive alternative tool to both forecasting researchers and practitioners. The existence of several distinguishing features of ANNs makes them valuable and attractive for a forecasting task (Zhang et al., 1998).

The objective of this study is to forecast inflation in India using artificial neural networks. The rest of the paper is organized as follows:

Figure 1. A Node in a Neural Network Structure
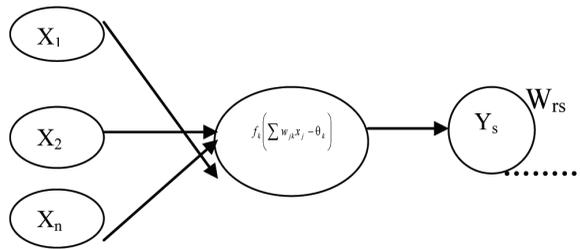
Section 2 describes the model specification and database; Section 3 presents results and its discussion; and Section 4 finally renders conclusion.

2. MODEL SPECIFICATION AND DATABASE

Artificial Neural Network (ANN) is an information process technique for modelling mathematical relationships between input variables and output variables. It is a class of generalized non-linear non parametric models inspired by studies of the brain and nerve system (Alon et al., 2001). Based on the construction of the human brain, a set of processing elements or neurons (nodes) are interconnected and organized in layers (Malliaris & Salchenberger, 1996). In the recent times, this technique is extensively used in financial markets, particularly to forecast inflation, interest rate, inflation, exchange rate, etc. The comparative advantage of ANN over more conventional econometric model is that they can model complex, possibly non-linear relationships without any priori assumptions about the underlying data generating process (White, 1990).

There are two ways ANN can be designed: feed forward and feedback networks. Feedback networks contain neurons that are connected to them, enabling neuron to influence other neurons. Kohonen self-organizing network and Hopfield network are the type of feed forward network (Wang, 2009). On the contrary, back propagation neural network take inputs from the previous layer and send outputs to the next layer. The present study uses back propagation neural technique for the forecasting exchange rate in India. In general, ANN structure is composed of three layers: input layer, hidden layer and output layer. Each layer has a certain number of processing elements called neurons. Signals are passed between neurons over connection links. Each connection link has an associated weight, which, in a typical neural net, multiplies the signal transmitted. Each neuron applies an activation function (usually nonlinear) to its net input (sum of weighted input signals) to determine its output signal. A neural network performance (Figure 1) is highly dependent on its structure. The interaction allowed between various nodes of the network is specified using the structure. The forecasting set up of ANN consists of followings steps (Zhang, 2003): data preparation, neural network set up (input variable selection, choice of structure, transfer function, etc.) and evaluation and selection.

The Structure of ANN

In this investigation, the feed-forward back-propagation ANN is employed and its procedure is outlined (Erims et al., 2007).

Step 1. Evaluate the net input to the jth node and that to the kth node in the hidden layer as follows:

$$net_j = \sum_{i=1}^{n} w_{ij} x_i - \theta_j, net_k = \sum_{j=1}^{n} W_{jk} x_j - \theta_k$$

(1)

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