

Preface

The foreign exchange market is one of the most complex dynamic markets with the characteristics of high volatility, nonlinearity and irregularity. Since the Bretton Woods System collapsed in 1970s, the fluctuations in the foreign exchange market are more volatile than ever. Furthermore, some important factors, such as economic growth, trade development, interest rates and inflation rates, have significant impacts on the exchange rate fluctuation. Meantime, these characteristics also make it extremely difficult to predict foreign exchange rates. Therefore, exchange rates forecasting has become a very important and challenge research issue for both academic and industrial communities.

In this monograph, the authors try to apply artificial neural networks (ANNs) to exchange rates forecasting. Selection of the ANN approach for exchange rates forecasting is because of ANNs' unique features and powerful pattern recognition capability. Unlike most of the traditional model-based forecasting techniques, ANNs are a class of data-driven, self-adaptive, and nonlinear methods that do not require specific assumptions on the underlying data generating process. These features are particularly appealing for practical forecasting situations where data are abundant or easily available, even though the theoretical model or the underlying relationship is unknown. Furthermore, ANNs have been successfully applied to a wide range of forecasting problems in almost all areas of business, industry and engineering. In addition, ANNs have been proved to be a universal functional approximator that can capture any type of complex relationships. Since the number of possible nonlinear relationships in foreign exchange rates data is typically large due to the high variability, ANNs have the advantage in approximating them well.

The main motivation of this monograph is to provide academic researchers and business practitioners recent developments in forecasting foreign exchange rates with ANNs. Therefore, some of the most important progress in foreign exchange rates forecasting with neural networks are first surveyed and then a few fully novel neural network models for exchange rates forecasting are presented. This monograph consists of six parts which are briefly described as follows.

Part I presents a survey on ANNs in foreign exchange rates forecasting. Particularly, this survey discusses the factors of affecting foreign exchange rates predictability with ANNs. Through a literature review and analysis, some implications and research issues are presented. According to the results and implications of this survey, the sequel parts will discuss those research issues respectively and provide the corresponding solutions.

In Part II, we provide a data preparation scheme for neural network data analysis. Some basic learning principles of ANNs are presented before an integrated data preparation scheme is proposed to remedy the literature gap.

In terms of the non-optimal choice of the learning rate and momentum factor in neural network learning algorithms in the existing literature, Part III constructs three single neural network models through deriving optimally adaptive learning rates and momentum factors. In the first single neural network model, optimal instantaneous learning rates and momentum factors are derived from the back-propagation (BP) algorithm. Using adaptive forgetting factors, an online BP learning model with optimally adaptive learning rates is developed to realize the online prediction of foreign exchange rates. In the third single neural network model, adaptive smoothing techniques are used to determine the momentum factor of neural network algorithm. Meantime, the proposed neural network model with adaptive smoothing momentum factors is applied to exchange rate index prediction.

In accordance with the analysis in the survey, the hybrid and ensemble models usually achieve better prediction performance than that of individual ANN model, Part IV and Part V present three hybrid neural network models and three ensemble neural network models, respectively.

In the first hybrid neural network model of Part IV, neural network and exponential smoothing model are hybridized into a synergetic model for foreign exchange rate prediction. Subsequently, the generalized linear autoregression (GLAR) and neural network models are fused by another neural network model in a nonlinear way. This model is applied to three typical foreign exchange rate forecasting problems and obtained good prediction performance. In the third model, a hybrid intelligent data mining approach integrating a novel ANN model — support vector machine (SVM) with genetic algorithm (GA) for exploring foreign exchange market movement tendency. In this model, a standard GA is first used to search through the possible combination of input features. The input features selected by GA are used to train SVM. The trained SVM is then used to predict exchange rate movement direction.

In the three ensemble neural network models of Part V, the first model presents a multistage ensemble framework to formulate an ensemble neural

network model. In these stages of formulating ensemble models, some crucial issues are addressed. The second ensemble model introduces a meta-learning strategy to construct an exchange rate ensemble forecasting model. In some sense, an ensemble model is actually a meta-model. In the third ensemble model, a confidence-based neural network ensemble model is used to predict the exchange rate movement direction. In the last chapter of Part V, we propose a double-phase-processing procedure to solve the following two dilemmas, i.e., (1) whether should we select an appropriate modeling approach for the prediction purpose or should combine these different individual approaches into an ensemble forecast for the different/dissimilar models? (2) whether should we select the best candidate model for forecasting or to mix the various candidate models with different parameters into a new forecast for the same/similar modeling approaches?

Depended upon the previous methodology framework, an intelligent foreign exchange rates forecasting support system is developed by using client/server model and popular web technologies in Part VI. The description of this intelligent system is composed of two chapters. First of all, system conceptual framework, modeling techniques and system implementations are illustrated in details. Then an empirical and comprehensive assessment is performed. Empirical and comprehensive assessment results reveal that the intelligent exchange rate forecasting support system is one of the best forecasting systems by evaluating the performance of system implementation and comparing with the existing similar systems.

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