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A Step-By-Step Implementation of a Hybrid USD/JPY Trading Agent

Rui Pedro Barbosa, University of Minho, Portugal

Orlando Belo, University of Minho, Portugal

ABSTRACT

In this article we describe the step-by-step implementation of an agent that can trade the USD/JPY currency pair using a 6 hours timeframe. The agent is capable of trading autonomously due to its ability to handle money management and to decide when to buy or sell the currency pair. Its implementation consists of a prediction mechanism, which it uses to forecast the direction of the price, and a risk management system, which enables it to make decisions regarding how much to invest in each trade and when to avoid trading. We present several alternatives for the price prediction mechanism, from using a standalone classification or regression model to using an ensemble with fixed or dynamic vote weights. The agent performed simulated trades over a period of 17 months, and obtained a return of around 50% using low leverage and after taking into account the trading costs. [Article copies are available for purchase from InfoSci-on-Demand.com]

Keywords: *Agent; Algorithmic Trading; Data Mining; Finance*

INTRODUCTION

The foreign exchange market, better known as Forex market, is the place where currency prices are set. The participants in this market can be divided in three main groups: banks, brokers and clients (Shamah, 2003). Central and commercial banks provide the bulk of liquidity, while brokers act as intermediaries for clients, which can range from multinationals to individual speculators. Trading in the Forex market is accomplished by buying and selling currency pairs. The price of a currency pair states the price of the base currency in terms of the other currency. For example, USD/JPY is the price of the United States Dollar expressed in Japanese Yen. A price of 107.57 for the USD/JPY pair means we need 107.57 JPY to buy 1 USD. To profit from price movements in this pair, we should buy USD/JPY lots (go long) if we expect the USD to become more valuable compared to the JPY, or sell USD/JPY lots (go short) if we expect the JPY to become more valuable compared to the USD. Buying the currency pair actually means buying the base currency and selling the other currency, while selling the currency pair means selling the base currency and buying the other one. Closing an open trade is achieved by performing the opposite operation, or in other words, buying the currency that was sold and selling the one that was bought. When a trade is closed, the resulting profit or loss can be expressed in pips. A pip is the smallest possible change in the price of a currency pair. For the USD/JPY pair, a pip corresponds to a price movement of 0.01. The actual amount of money won or lost with this price movement will depend on the amount invested. For example, if a trader buys or sells 100,000 USD/JPY, each pip will be worth ¥1,000 (100,000 times 0.01), or $9.30 (1,000 divided by 107.57).

The Forex market is quite different from any other financial market. The most remarkable differences are the nonexistence of a central marketplace and the 24 hours a day availability. Currency prices continuously rise and fall throughout the day, in reply to the constant flow of news and reports being released, and periods of high volatility are frequent. For this reason, trading currencies is always associated with a great deal of risk. The objective of our research is to implement an agent that can manage this risk and be profitable trading the USD/JPY currency pair. We will start by developing the mechanism that the agent will use to predict price movements. Different implementations will be tested, from using standalone classification or regression models to using an ensemble. The practical use of this type of models in financial time series prediction has already been extensively studied. Yao and Tan (2000) obtained empirical evidence of the usefulness of artificial neural networks in the development of profitable Forex trading strategies. Franses and Griensven (1998) reported similar results, and demonstrated that artificial neural networks can often perform better than linear models. The same conclusion was achieved by Kamruzzaman and Sarker (2003), which showed that artificial neural networks can outperform traditional time series prediction models, such as the autoregressive integrated moving average. But artificial neural networks are not the only models that have been shown to make reasonably accurate Forex predictions. Gençay (1999) compared the performance of nearest neighbor regression models with artificial neural networks using different sets of currency price data, and concluded that the nearest neighbors models performed better. Tay and Cao (2001) used different types of financial data to compare the predictive capability of both artificial neural networks and support vector machines, and concluded that the support vector machines would make better predictors. Some studies have also shown the advantages of more complex prediction strategies. Abraham (2002) used the price data of several currencies to compare the accuracy of artificial neural networks with the accuracy of hybrid predictors, and concluded that the hybrid solutions performed better. Pavlidis, Tasoulis, Plagianakos, Siriopoulos and Vrahatis (2005) obtained better results with a hybrid approach when compared with several nearest neighbors models. Yu, Lai and Wang (2005), with a hybrid solution consisting of artificial neural networks and an expert system, were able to create a trading strategy that was profitable under simulation. Singh and Fieldsend (2001) tested their hybrid system using the Santa Fe competition datasets (Weigend & Gershenfeld, 1993) and obtained interesting results for most datasets, but not the one containing the currency price data. Cao (2003) applied support vector machines experts to those same datasets, and reported acceptable results. Many other articles have been published on this subject, with most demonstrating the potential of some classification and regression models to be used in the implementation of profitable Forex trading strategies.

So far, accuracy has been the preferred way to measure the performance of the prediction models. Of the previously mentioned studies, only the ones by Yao and Tan (2000), Yu et al. (2005) and Pavlidis et al. (2005) use the profit or the rate of return to measure the models' performance. The others use primarily the accuracy predicting price direction (for classification) or the predicted prices mean squared error (for