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Does high frequency trading affect technical analysis and market efficiency? And if so, how?

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ABSTRACT

In this paper we investigate how high frequency trading affects technical analysis and market efficiency in the foreign exchange (FX) market by using a special adaptive form of the Strongly Typed Genetic Programming (STGP)-based learning algorithm. We use this approach for real one-minute high frequency data of the most traded currency pairs worldwide: EUR/USD, USD/JPY, GBP/USD, AUD/USD, USD/CHF, and USD/CAD. The STGP performance is compared with that of parametric and non-parametric models and validated by two formal empirical tests. We perform in-sample and out-of-sample comparisons between all models on the basis of forecast performance and investment return. Furthermore, our paper shows the relative strength of these models with respect to the actual trading profit generated by their forecasts. Empirical experiments suggest that the STGP forecasting technique significantly outperforms the traditional econometric models. We find evidence that the excess returns are both statistically and economically significant, even when appropriate transaction costs are taken into account. We also find evidence that HFT has a beneficial role in the price discovery process.

1. Introduction

The extensive use of technical trading rules by currency market practitioners has long been a puzzle for academics. On the one hand, as Cheung and Chinn (2001) and Gehrig and Menkhoff (2003) note

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up to 40 per cent of foreign exchange (FX) traders worldwide rely on technical analysis as their main trading tool. On the other hand the Efficient Market Hypothesis (Fama, 1970) suggests that in a market with vast trading volume and virtually non-existent private information about fundamentals, such as the foreign exchange (FX) market (turnover of 2000 billion US dollars per day; BIS, 2005), trading rules based on historical price information should not yield excess profits to traders.

Most academic studies related to technical trading in the FX market are inconsistent with real-life practice because they largely limit their trading strategies to daily data observations (Brabazon and O'Neil, 2004; Qi and Wu, 2002; Reitz and Taylor, 2006). However, nearly all FX traders who use technical analysis operate at a high frequency (Gomber et al., 2011; Ahlstedt and Villysson, 2012; Guo, 2012). In addition more than 75 per cent of FX trading has been shown to take place within a single day (BIS, 1996), and that the applicability of technical analysis increases with the frequency of trading (Taylor and Allen, 1992).

While some empirical studies of daily FX data report the existence of significant profits (Martin, 2001; Mathur et al., 2001; Saacke, 2002), some other studies demonstrate the contrary (Levich and Thomas, 1993; Lee and Mathur, 1996; Lee et al., 2001). Studies on the profitability of intra-daily technical analysis also do not convey a clear picture. Some authors report significant net profits (Gencay et al., 2002, 2003), whereas others find technical trading to be unprofitable even at these high frequencies (Cucio et al., 1997; Osler, 2000; Neely and Weller, 2003). Moreover, studies on FX technical trading profitability typically fail to account for transaction costs, trading rule optimisation over time, out-of-sample verification, and data snooping issues (Park and Irwin, 2007).

So far, our discussion has focused on the relationship between high frequency trading (henceforth HFT) and technical analysis. However, the question could be reversed and the impact of HFT on the market's quality can also be investigated. Some empirical and theoretical studies suggest that HFT improves market liquidity, reduces trading costs in the form of narrower bid-ask spreads, and makes stock prices more efficient (Jones, 2013).

On the other hand, the empirical evidence is somewhat mixed and there are theoretical arguments that HFT can have negative effects. The speed of trading could put slower moving market participants at a disadvantage, leading to adverse selection and reduced market quality. Chordia et al. (2013) argue that buy-side investors could struggle to trade large positions, and their speed disadvantage reduces their ability to supply liquidity leading to increased costs. Chaboud et al. (2010) provides evidence that computer trades are more highly correlated with each other than human trades, indicating that strategies generated by machines are not as diverse as those developed by humans. There is also a possibility of an unproductive arms race developing with HFT institutions competing to be fastest (Jones, 2013). The substantial investments in computer and communication power necessary to reduce latency in trading poses the question of whether HFT adds value overall (Chordia et al., 2013). Given the lack of conclusive evidence on its impact policymakers around the world are still debating whether to introduce limits on HFT or even to completely ban it. Academic studies to date have mainly analysed stocks particularly the 120-stock NASDAQ HFT dataset. We contribute to this debate by examining the FX market where the ability to observe all trading in our experiments allows us to investigate the impact of HFT bid and ask orders on market quality.

In this study, we implement a special adaptive form of Genetic Programming (GP), called Strongly Typed Genetic Programming (STGP). The advantage of STGP over the conventional Genetic Programming (GP) used in most previous studies is that STGP evaluates the fitness of agents through a dynamic fitness function which processes the most recent quotes of the six currency pairs in our experiment, rather than a re-execution of the same trading rules. Despite the voluminous literature on the topic, no other study has combined implementing the STGP technique, one-minute high frequency data, and a substantial number of artificial agents, which enables us to develop of a wider variety of trading rules. The presence of 10,000 artificial agents in our experiment results in increased forecasting model stability and lower sensitivity to random factors.

To summarise, the contributions of this study are as follows. Firstly, we investigate the efficiency of currency markets by analysing the profitability of technical trading rules at the frequency at which this trading actually takes place in the real world.

Secondly, we take into account all the issues identified in the literature as potentially affecting the reliability of trading results and inference based on them: transaction costs, allowing agents to learn