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Illusory profitability of technical analysis in emerging foreign exchange markets

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ABSTRACT

We conduct an extensive examination of the profitability of technical analysis in ten emerging foreign exchange markets. Studying 25,988 trading strategies for emerging foreign exchange markets, we find that the best rules can sometimes generate an annual mean excess return of more than 30%. Based on standard tests, we find hundreds to thousands of seemingly significant profitable strategies. However, almost all of these profits vanish once the data snooping bias is taken into account. Overall, we show that the profitability of technical analysis is illusory.

1. Introduction

After decades of debate, the profitability of technical trading rules (hereafter "TTR") still remains a conundrum. If the market is (weakly) efficient, rational investors should quickly arbitrage away the profits, implying that TTR is useless. If TTR cannot generate persistent profits, why do at least 90% of experienced traders place some weight on it in costly trading activity (Taylor & Allen, 1992)?

We show that the profitability of technical analysis is illusory. Studying 25,988 trading strategies for emerging foreign exchange markets, we find that the best rules can sometimes generate an annual mean excess return of 30%. Applying standard tests, we find hundreds to thousands of seemingly significant profitable strategies,[1] but almost all of these profits become insignificant once the data snooping bias is taken into account.

Economists have long acknowledged the data snooping bias in this context. In order to find the desired trading rules, investors usually need to search intensively among a potentially large universe of trading rules on a single historical data set. If one tries hard and long enough, it is very likely that seemingly profitable but in fact wholly spurious trading strategies will be found. Such a search can be done by researchers and investors as a whole. In such cases, the classical statistical inference typically conducted in the previous literature is biased.

How much can the data snooping bias explain the identified profitability? Due to its statistical difficulty, little of the existing research is able to answer this question. Our paper quantifies the extent of the data snooping bias by applying two recently developed and more powerful methods: the StepM test (Romano & Wolf, 2005) and the SSPA test (Hsu, Hsu, & Kuan, 2010). For a given universe of trading strategies, these tests are data-snooping free, since they take the entire search process into account, and hence are able to detect the genuinely profitable trading rules from the universe. We compare the numbers of profitable rules from these two tests to those from the classical tests, which do not control for data snooping bias. This comparison can

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[1] We call these strategies "seemingly significant profitable" because the standard tests ignore the effect of data snooping, and in reality, they might not be profitable if the data snooping bias was controlled for properly. In Section 5, "seemingly significant profitable" TTRs are those detected by individual rule nominal *p*-values.

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show how many profits are genuine and how many are spurious, which provides richer information about the extent of the data snooping bias than only knowing whether the best performing rule has a true predictive ability or not (as in the Reality Check of White, 2000, and the SPA test of Hansen, 2005). Thus, we are able to make the extent of the data snooping bias more transparent.

Our study provides a comprehensive test of trading rule profitability across 25,988 trading rules. The majority of these rules are popular among professional traders, but have not been studied in the literature for emerging FX markets. Hence, our paper provides a more complete picture regarding the performance of trading rules and market efficiency for these markets. The large universe of trading rules raises concerns about the power of the tests. However, we show that our major conclusions continue to hold when one is testing with smaller universes.

A study of TTR profitability for emerging FX markets is of interest in its own right. Factors such as spot exchange rate movements, interest rate differentials and transaction costs in emerging markets can all contribute to TTR profitability differently from their developed FX market counterparts. In addition, emerging markets have stricter regulations and capital controls, which makes it more difficult for speculation to arbitrage away the profits.

The remainder of this paper is structured as follows. Section 2 provides a short literature review. Section 3 presents the universe of trading rules. Section 4 discusses the empirical methodology. Section 5 briefly documents our data and empirical findings. Section 6 concludes. Finally, a detailed documentation of the trading rules considered is provided in the Appendix.

2. Literature

The FX market has substantial supportive evidence for the profitability of TTR (e.g., LeBaron, 1999; Qi & Wu, 2006; Sweeney, 1986), while several other studies show the opposite (see Lee & Mathur, 1996; Neely & Weller, 2003). Most of these studies have confined themselves to the currencies of developed economies. It is unclear whether their findings can be carried over to the emerging markets, which are themselves heterogeneous.

Existing studies on the profitability of TTR for emerging FX markets have reported mixed results (e.g., Lee, Gleason, & Mathur, 2001; Martin, 2001; Pojarliev, 2005). De Zwart, Markwat, Swinkels, and van Dijk (2009) provide evidence that combining technical analysis with fundamental analysis can improve the risk-adjusted performance of the investment strategies. However, these studies do not control formally for the effect of data snooping bias, which is a critical concern in this line of research. A notable exception is that of Qi and Wu (2006), who were the first to study the TTR profitability for developed countries' currencies with a formal data snooping check. They considered a universe of 2127 simple technical trading rules and found that data snooping biases did not change the conclusion of profitability of trading rules in the full sample, though the data snooping bias was more serious in the second half of the sample.

Data snooping has long been being considered by academic researchers (Brock, Lakonishok, & LeBaron, 1992; Jensen, 1967; Jensen & Bennington, 1970; Lo & MacKinlay, 1990), but a rigorously founded and generally applicable test remained unavailable until White (2000) introduced the Reality Check. The Reality Check can quantify the effects of data snooping directly when testing the best trading rule from the "full universe" of trading strategies. Since then, a few studies (e.g., Hsu & Kuan, 2005; Qi & Wu, 2006; Sullivan, Timmermann, & White, 1999; White, 2000) have applied the Reality Check, with mixed results.

Hansen (2005) pointed out that the power of the Reality Check can be reduced, and even driven to zero, when too many poor and irrelevant rules are included in the set of alternatives. Simply excluding poorly performing alternatives does not generally lead to valid inference either. To solve this problem, Hansen (2005) proposed a new test statistic for superior predictive ability (hereafter "SPA"), which invokes a sample-dependent distribution under the null hypothesis. This SPA test is more powerful than White's Reality Check, and less sensitive to the inclusion of poor and irrelevant alternatives.

The question of interest for both the Reality Check and the SPA test is whether the best trading rule beats the benchmark. An investor might want to know whether a particular trading rule is profitable. A researcher may want to test whether a certain trading rule which has been found profitable in the literature does indeed outperform the market. Furthermore, as was pointed out by Timmermann (2006), choosing the forecast with the best track record is often a bad idea, whereas a combination of forecasts dominates the best individual forecast in out-of-sample forecasting experiments. Thus, we may want to know all or some of the profitable trading strategies and combine them for decision making (this is what our complex trading rules do).[2] We may also want to avoid worse strategies when combining trading rules, since trimming them off often helps to improve the forecasting performance, as has been found in the forecasting literature (Timmermann, 2006). Romano and Wolf (2005) modified the Reality Check and proposed a stepwise multiple test (hereafter "StepM"), which can detect the maximum number of profitable trading rules for a given significance level. Hsu et al. (2010) subsequently proposed a more powerful stepwise SPA (hereafter "SSPA") test, combining the SPA test and the StepM test. These two stepwise tests enable us to separate the genuine profitable rules from spurious ones from among all of the seemingly profitable rules obtained from classical tests, and hence provide a more complete picture of the extent of the data snooping bias.

3. Universe of trading rules

Defining the universe of trading rules is a key step in obtaining valid inference with a superior predictive ability

[2] Some evidence of the unstable performance of a trading strategy is provided by Sullivan et al. (1999), who find that the best trading rule applied to DJIA for the period 1897–1986 does not outperform the benchmark for the period 1987–1996.