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Abstract

We use trend-following, trend continuation and trend reversal pattern recognition techniques to apply technical charting rules to trading seven major currency pairs for the period of 1999 through early 2007. Our results suggest that the persistent popularity of technical analysis among practicing traders may be the result of a "lottery" wherein most of the participants end up with zero profits. However, the rest of the participants are much more likely to end up winning rather than losing. In this way, the popularity of technical trading rules may co-exist with the validity of market efficiency hypothesis.

1. Introduction

Whether past price performance of stocks, commodities or currencies may be useful in inferring the direction or magnitude of the future market movements has been an issue of heated debate for a long time. The variety of the viewpoints on the issue, however, is basically falling down into two of the broadly defined camps. On the one hand, technical and fundamental analysts claim that one can forecast the future market movements by studying the market's performance in the past (see Levin, 1997, for an excellent analysis). On the other hand, the adepts of the efficient market hypothesis assert that no predictions can be made on the historical basis (Jensen and Bennington, 1970; Fama, 1991)[1].

The research on the efficient market hypothesis that was extensively tested in the 1960's and 1970's (see e.g. Alexander, 1964) concluded that (1) the market movements can be best described as a random walk and therefore (2) no

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[1] In fact, there is a lot of disagreement between technical and fundamental analysts themselves on the relative importance of fundamentals such as price-earnings ratios or interest rate differentials versus technical indicators such as moving averages or oscillators in predicting the future price movements. But both types of analysts are similar in the sense that they both claim future market movements can be predicted in principle.

market movement patterns identified in the past can be helpful in successfully

forecasting the future market performance. However, scores of traders around

the world have been practicing technical analysis for decades claiming that

technical analysis increases the probability of their correctly inferring the future

market movements.

As the computer technology has advanced making it easier to test technical

analysis rules using large datasets, the validity of the efficient market hypothesis

has been put into doubt. For example, the study by Sharpe et al. (1995)

concluded that technical analysis poses a serious challenge to the efficiency

market hypothesis. Studies in the behavioral finance (e.g. DeBondt and Thaler

(1985) and Jegadeesh and Titman (1993), among others), self-fulfilling

expectations and herd behavior (see Reitz, 2006 for a recent contribution) did

not only re-confirm the profitability of technical trading rules, but they also put

forward a sensible explanation as to why such rules may actually work.

Regardless of the increasing number of studies supporting the idea of

profitability of technical trading, none of these studies were able to identify a

"perfect" money-making strategy (in which case, of course, the authors of such

a study would never bother to publish it). The question then is, given the lack of

uniform consensus on the statistical value of technical trading rules for inferring

the future movements in the underlying financial instruments, *why is it that*

technical trading has been and still is so popular among practicing traders?

In this study we address this question by following the methodology offered by

Leigh et al. (2002) in order to test the performance of technical analysis rules on

the foreign exchange market. To our knowledge, technical analysis rules have

been mostly tested on the stock exchange data using single-day returns, while

such testing has not been as intensively performed in case of the foreign

exchange markets. Also the possibility of opening short positions was almost

never considered either. In this study we consider both long and short positions

open for a variety of holding horizons. Given the fact that the world's foreign

exchange markets' trading volume far exceeds that of the stock markets

comprising around 10% of the U.S. GDP on a *daily* basis, we believe our study

makes a valuable contribution to the analysis of financial markets.

Methodologically, it is mostly the easily quantifiable technical analysis rules that

have been tested in the existing literature, such as the ones based on moving averages, relative strength indices and the like (Wang and Chan, 2007). However, along with the quantifiable indicators the technical analysts also use chart patterns such as "head and shoulders", "double bottom" and "flags", to name just a few (see Luca, 2000, for an impressive collection of technical analysis indicators). The problem with testing these patterns is, they are difficult to quantify and hence not easy to test.

In this study we apply the pattern recognition matching technique in order to identify the specific patterns used by technical analysts, namely, the bull and bear flags, to enter the foreign exchange market. We first apply the bull/bear continuation pattern for the time period of January 1st 1999[2] through January 31st 2007 for testing two of the world's major currency pairs: EUR/USD and USD/JPY. We then extend our analysis to two more technical indicator gouprs and five more major currency pairs that cover North America, Europe and Asia in order to test for the robustness of our findings. For each day in the testing period we compute the fitting statistic whose value indicates how well the past

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[2] The day Euro was finally adopted by the European Union countries.

performance of the currency fits into the three technical patterns we employ. Once the value of our fitting statistic exceeds the pre-determined threshold value we enter the market. Since we are considering the possibility of opening both long and short positions, the buy-and-hold strategy is equivalent to opening mutually offsetting positions with zero return against which we compare the returns due to our technical trading strategy. Thus, in our case the benchmark profit value against which excess profits are computed is simply zero.

Our basic finding is that the problem of finding a profitable money-making strategy using technical rules is similar to the problem of finding a needle in a haystack—we know the needle is there somewhere, but we do not know how to find it. In this paper we similarly find that while most technical trading strategies are neither making nor losing money, the non-negligible amount of them does, with many more money-making strategies compared to the money-losing ones. However, our analysis is incapable of indicating *how* one can identify a profitable money-making strategy in the case of each particular currency pair so that technical trading can be considered as a lottery with a large chance of

preserving one's capital but also with a much greater chance of making money compared to losing it. We summarize our findings by formulating two stylized facts on technical analysis corroborated by our empirical study. We check for the robustness of our findings by testing the profitability of our technical rules for various holding horizons and threshold values of the fitting statistic.

This paper is organized as follows. Section 2 describes the method we used in order to evaluate the predictive power of technical analysis rules. The next Section presents and interprets our empirical results. Section 4 analyzes the robustness of our findings, while Section 5 offers concluding remarks.

2.   Choice of technical indicators and an outline of estimation methodology

Most technical analysts distinguish between three broad types of technical trading strategies (see e.g. Luca(2000)). The easiest technical strategy is simply following the trend, i.e. buying when prices edge higher and selling otherwise. However, sometimes prices stop trending and for a while they just hover around some price level after which the trend may either continue or reverse. In the first case indicators such as e.g. flags and pennants signify the continuation of a trend while in the second case traders look for reversal patterns such as double tops/bottoms or head and shoulders.

For the trend following strategy we use the trend itself as its own pattern, while for the case where prices stall "choosing" their further direction we use the bull/bear flag patterns for the continuation scenario, while we use double tops/bottoms for the trend reversal scenario. The reason for choosing these particular indicators out of several ones available is that ours are the simplest

ones in their respective groups. For example, the bull flag pattern is simpler to define and recognize compared to head and shoulders and triangle. In the same way, the double top pattern is simpler than the triple top or a diamond formation.

We thus use one indicator from each one of the three groups mentioned above in order to identify the point of entry (i.e. buying or selling the currency pair) into the market. In order to identify these charting patterns, we use the template matching technique (Duda and Hart, 1973) used for the recognition of digital images. The key to implementing this technique is the template onto which the currency pair's past exchange rates are being superimposed in order to see whether these past currency movements fit the bull flag pattern. The extent to which such a fit occurs is measured by a statistic called fitting value whose high values would indicate the chart pattern is strongly present recommending the purchase or selling of a currency pair.

The trading rules we are testing are based on the *charting templates* that are used in order to identify the extent to which a particular pattern has occurred.

This extent is measured by a fitting statistic (or value) whose higher magnitude signals a better match. Figure 1 below represents a template for the double bottom trend reversal pattern interpreted as a buying signal.

Figure 1: A Dobble Bottom Trend Reversal Pattern

	1	2	3	4	5	6	7	8	9	10
1	1	0	−1	0	1	1	0	−1	0	1
2	1	0.5	−1	0.5	1	1	0.5	−1	0.5	1
3	1	0.5	−1	0.5	1	1	0.5	−1	0.5	1
4	0.5	1	0	1	0.5	0.5	1	0	1	0.5
5	0.5	1	0	1	0.5	0.5	1	0	1	0.5
6	0	1	0.5	1	0	0	1	0.5	1	0
7	0	1	0.5	1	0	0	1	0.5	1	0
8	−1	0.5	1	0.5	−1	−1	0.5	1	0.5	−1
9	−1	0.5	1	0.5	−1	−1	0.5	1	0.5	−1
10	−1	0	1	0	−1	−1	0	1	0	−1

Grayed cells in the template represent the matched pattern (in our case, the double bottom). We divide the historical time window into ten sub-periods each one corresponding to a specific column in the template. 10% of the earliest observations in our historical window are mapped onto the first column of our template, the next 10% observations are mapped onto the second column, while the latest 10% are mapped onto the tenth column of the template. The

highest exchange rate that occurred during the historical window corresponds to the top of the template, while the lowest one corresponds to the bottom of the template so that the vertical dimension of the template grid corresponds to the exchange rate range that has occurred during the historical price window. For each trading day we thus have a different sample of exchange rates in the historical window and consequently the different values of maximum and minimum historical exchange rates corresponding to the top and the bottom of the template, but the number of days corresponding to each column of the template remains the same.

We compute the total fit value for the historical window as a sum of the individual fits for the sub-periods represented by our template's columns. The individual fit for the sub-period is computed by performing three steps:

1) Compute the percentage of observations that falls into each one of the ten sub-ranges covered by the historical window.

2) Multiply these percentages by weights in the corresponding cells.

3) Sum the resulting ten products to get the value of the fit for the particular

sub-period.

For example, if today we chose the historical trading window to be 100 days and the exchange rate were fluctuating between 1 and 2 during the past 100 days, each column in our template would correspond to a sub-period of ten days with the first row of the template corresponding to the range of [1.9;2], the second one to [1.8;1.9] and the tenth row (which is the bottom row) corresponding to the period of [1;1.1]. If hypothetically for the past 100 days the value of the exchange rate were fluctuating in the range of [1.9;2], then for each ten-day sub-period 100% of the observations would map into the upper row cell so that the value of the fit for each sub-period would be simply equal to the template weight value and the total fit for the historical window would be equal to the sum of the weights in the first row of the template.

For each trading day we calculate the value of the fitting statistic based on the past prices in the historical window and act based on how high this value is. The question of "how high is high enough" is subjective. Setting the threshold too high may result in the false rejection of the actual trend pattern, while setting it

too low will result in too many false signals. Since there is no a priori way of knowing the optimal threshold value of the fitting statistic, in practical trading we have to experiment with several thresholds. In this study we apply the trading window of forty days. Although we did not try each and every trading window, the results from applying the ones we tried did not differ much qualitatively from the ones presented in this study.

Finally, since we are considering both long and short positions, the benchmark buy/sell-and-hold strategy automatically results in zero profits which serve as a benchmark against which we compare the profits due to the trading rule. Each one of our six trading rules results in a set of market returns equal to the number of days our trading rule has been applied. To see whether these returns are statistically different from the benchmark zero value, we apply the two-tailed t-test for samples with unequal variances. The detailed technical description of our estimation methodology can be found in Appendix A. Figure 2 below presents the two remaining charting patterns: the trend and the flag.

Trend-Following

	1	2	3	4	5	6	7	8	9	10
1	−1	−1	−1	−1	0	0	0.5	1	1	1
2	−1	−1	−1	0	0	0.5	1	1	1	1
3	−1	−1	0	0	0.5	1	1	1	1	0.5
4	−1	0	0	0.5	1	1	1	1	0.5	0.5
5	0	0	0.5	1	1	1	1	0.5	0	0
6	0	0.5	1	1	1	1	0.5	0	0	0
7	0.5	1	1	1	1	0.5	0	0	−1	−1
8	0.5	1	1	1	0.5	0	0	−1	−1	−1
9	1	1	1	0.5	0	0	−1	−1	−1	−1
10	1	1	0.5	0	0	−1	−1	−1	−1	−1

Trend Continuation

	1	2	3	4	5	6	7	8	9	10
1	0,5	0	-1	-1	-1	-1	-1	-1	-1	0
2	1	0,5	0	-0,5	-1	-1	-1	-1	-0,5	0
3	1	1	0,5	0	-0,5	-0,5	-0,5	-0,5	0	0,5
4	0,5	1	1	0,5	0	-0,5	-0,5	-0,5	0	1
5	0	0,5	1	1	0,5	0	0	0	0,5	1
6	0	0	0,5	1	1	0,5	0	0	1	1
7	-0,5	0	0	0,5	1	1	0,5	0,5	1	1
8	-0,5	-1	0	0	0,5	1	1	1	1	0
9	-1	-1	-1	-0,5	0	0,5	1	1	0	-2
10	-1	-1	-1	-1	-0,5	0	0,5	0,5	-2	-2,5

3. Empirical results

We first perform our analysis for the two most actively traded currency pairs, namely EUR/USD and USD/JPY and one particular technical pattern indicating the continuation of a trend, namely, the bull/bear flag pattern. We later extend our analysis to five more currency pairs and two more technical indicators in order to check for the robustness of our initial findings. The profit values presented in Tables 1 and 2 are obtained by entering the market according to our trading rule and keeping the position open for the number of days in the holding horizon period. Since we open both long and short positions, the benchmark "buy and hold" strategy on an everyday basis results in zero profits, so it suffices to test whether our trading rule profits are statistically different from zero in order to assess the validity of our trading approach.

Indeed, our results suggest that applying our technical analysis rule statistically yields zero profits in case of more than half of the strategies based on it, which is contributing to the market efficiency (weak form) hypothesis' claim that technical analysis is not conducive to positive excess returns. However, more than one-third of the technical trading strategies result in statistically significant

positive profits, while less than ten percent are losing money. It is also true that

for the two currency pairs the optimal money-making strategy in terms of the

holding horizon is not the same. For example, while the highest returns are

obtained in both cases for the highest value of the fitting statistic, the optimal

holding horizon is eighty days for EUR/USD while it is one hundred days for

USD/JPY. Since it is not immediately clear why optimal holding horizons should

be different for the two currency pairs and since we find no apparent optimality

pattern in combinations of fitting statistic values and the holding horizons, we

conclude that while a significant share of our set of technical strategies is in fact

making money for the trader, it is hardly possible to specify one or more money-

making strategies in each specific case (i.e. to specify the optimal holding

horizon and fitting statistic threshold for a specific currency pair). We later

extend our analysis to five additional currency pairs and two more technical

indicators to corroborate the robustness of our findings.

We conduct the same kind of analysis for the non-overlapping time periods for

our two currency pairs for the average value of our fitting statistic. Table 3

contains the results for the three sub-periods spanning the overall 2256

observations for the level of fitting statistic 6, which is the lower bound of the

upper quarter of the observed positive fitting values for that currency pair. We

again observe the prevalence of statistically significant positive profits over the

negative ones (in fact, we only find one significant negative return in this case)

with a significant fraction of strategies yielding returns statistically

indistinguishable from zero. Again, our trading rule's performance varies with

the data fold and the holding horizon as well so that we are unable to identify a

universally applicable money-making technical trading strategy.

It is worthwhile mentioning that we do not parameterize our trading rule in-

sample (or data-snoop) since the threshold values of our fitting statistic were

chosen *ex ante*.

Table 1. Trading rule profits for EUR/USD based on bull/bear trend continuation patterns

	Trading Rule Holding Horizon									
	40		60		80		100		120	
Fit value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value
7	0.97%*	0.020	2.72%**	0.001	2.5%*	0.020	0.97%	0.480	-0.60%	0.780
6	1.12%**	0.0025	1.74%**	0.010	1.96%**	0.006	2.29%**	0.004	2.10%*	0.020
5	0.05%	0.830	0.46%	0.150	0.57%	0.150	0.47%	0.300	0.40%	0.400
4	-0.001%	0.670	0.20%	0.390	0.23%	0.406	0.02%	0.945	-0.20%	0.611

Table 2. Trading rule profits for USD/JPY based on bull/bear trend continuation patterns

	Trading Rule Holding Horizon									
	40		60		80		100		120	
Fit value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value
7	0.65%	0.006	0.26%	0.68	1.86%	0.002	2.68%	0.002	1.9%	0.0099
6	0.03%	0.92	0.26%	0.53	1.62%	0.009	1.62%	0.0026	1.13%	0.60
5	-0.4%	0.08	0.07%	0.79	0.79%	0.01	0.66%	0.05	0.67%	0.0998
4	-0.5%	0.0013	-0.006%	0.97	0.53%	0.02	0.33%	0.19	0.45%	0.1334

*Note: Statistical significance at the 99% level is marked with **, 95% with ***

Table 3: Excess Profits for Three Sub-Intervals, Bull/Bear Continuation Pattern, Fitting Value>6

EUR/USD	Holding Horizon									
# Obs	40		60		80		100		120	
800	1.36%	0.198	0.87%	0.522	0.79%	0.621	1.90%	0.183	2.27%	0.076
800	**1.20%***	**0.027**	**2.20%***	**0.015**	**2.15%***	**0.033**	1.64%	0.185	0.86%	0.564
656	0.64%	0.174	1.85%	0.118	1.73%	0.290	1.01%	0.606	-0.63%	0.745
USD/JPY	**Holding Horizon**									
# Obs	40		60		80		100		120	
800	**-0.20%**	**0.0117**	-0.50%	0.574	**1.84%***	**0.050**	1.35%	0.225	1.31%	0.303
800	**0.99%***	**0.004**	**1.05%***	**0.005**	**1.73%***	**0.000**	0.31%	0.399	-0.60%	0.265
656	**1.87%***	**0.011**	0.98%	0.286	1.15%	0.248	**2.22%***	**0.029**	**2.08%***	**0.047**

Finally, we ran a simple linear regression of trading returns for the five holding horizons and threshold values of the fitting statistics in order to see whether our fitting value exhibits any predictive power. However, we were unable to find any statistically significant results, which is in perfect accordance with the market efficiency hypothesis.

4. Robustness Check and Two Stylized Facts

In order to check for the robustness of our findings, we extend our analysis to five more currency pairs, namely USD/CHF, NZD/USD, AUD/USD, GBP/JPY and GBP/USD. We chose those currency pairs so as to make our analysis span major currencies from all parts of the world so that we have two more European currencies (GBP and CHF) and two currencies from Asia Pacific (NZD and AUD). In general, both the results for the overall sample and subperiods are similar to the ones found for the EUR/USD and USD/JPY. Table 6 below summarizes the results for the overall sample estimation that reinforces

preliminary findings discussed above[3].

Table 6: Summary Results of Technical Rules Profitability

	Trend following patterns			Trend continuation patterns			Trend reversal patterns		
	>0	0	<0	>0	0	<0	>0	0	<0
EURUSD	60%	40%	0%	40%	60%	0%	20%	80%	0%
USDJPY	45%	30%	25%	50%	45%	5%	35%	65%	0%
USDCHF	55%	0%	45%	75%	25%	0%	10%	90%	0%
NZDUSD	95%	5%	0%	50%	50%	0%	0%	100%	0%
AUDUSD	65%	35%	0%	20%	75%	5%	15%	85%	0%
GBPJPY	0%	50%	50%	35%	60%	5%	45%	55%	0%
GBPUSD	0%	30%	70%	15%	85%	0%	30%	70%	0%

Note: displayed are shares of money making (>0), money losing (<0) and zero-profit (0) strategies for combinations of each currency pair and type of technical indicator

We observe again that the technical trading strategies that result in statistically

significant profits are predominantly the ones that result in positive profits. At the

same time, most often the resulting profits are statistically indistinct from zero. It

is also true that we cannot find any regularity in the combination of holding

horizons and the fitting value that would result in positive and statistically

significant profits.

On the basis of our expanded results we formulate two stylized facts on

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[3] The results on five other major currencies may be provided upon readers' request.

technical analysis:

1) There is no dominating strategy neither in terms of the holding horizon nor the type of technical indicator.

Indeed, while the simple strategy of going with the trend works well in case of NZD/USD, it would be a disaster if trading GBP/USD. In the same way, exploiting continuation patterns would seem to be a good idea in case of the EUR/USD and USD/CHF, but not in case of AUD/USD. This finding corroborates the results of many previous studies on technical analysis that have failed to find a technical strategy whose performance would be robust across currency pairs and holding horizons. However, this is not the basis for claiming that technical analysis does not work since

2) The share of money-making technical strategies is not negligible and far exceeds the share of money-losing ones.

Even if in about half of the cases the application of technical rules results in no

excess profits, the share of statistically significant positive profits exceeds that

of the negative by ***around four times***, namely 36.19% and 9.76%, respectively,

in the overall sample.

As we can see, more than one in three of the overall 420 strategies (7 currency

pairs x 5 time horizons x 4 threshold values x 3 indicators) yields positive profits,

while less than one in ten loses money. Because of the stylized fact one,

however, one cannot be sure what technical indicator and time horizon to use

for each particular currency pair. While the latter question is practically very

important, it is beyond the scope of this paper.

4. Conclusion

We apply three technical charting rules to trading the world's seven major currency pairs to a variety of holding horizons and pattern fitting precision levels. We discover two stylized facts about technical analysis that simultaneously demonstrate its potential for profitability and simultaneously the difficulty of its practical application. We believe technical analysis rules are and have been popular since the share of profitable strategies exceeds one third of all strategies and is four times larger than the share of money-losing strategies. However, the practical applicability of this finding is rather questionable since more than half of the technical strategies result in zero profits and the optimal type of technical indicator and holding horizon are not robust across currency pairs.

What can we say then about the value of technical analysis? Based on our results obtained for a wide range of strategies both in terms of the technical indicators, holding horizons and the fitting statistic values, we conclude that it appears to be impossible to unambiguously indicate a universally profitable strategy that would work for any currency pair in the sense that each currency

pair seems to "prefer" a specific technical indicator and holding horizon. Thus, the bull/bear flag trend continuation patterns work best with the USD/CHF pair (75% strategies based on that pattern result in statistically significant positive profits) while it is best to use the simple "trend is my friend" strategy in case of the NZD/USD. Besides, in most cases no technical trading pattern considered here will result in profits statistically distinct from zero.

These results only confirm the market efficiency hypothesis, but yet there remains the question of the persistent popularity of technical analysis among practicing traders. Apart from the reasons already discussed in the literature (e.g. self-fulfilling prophecies, need to justify one's trading decisions, asymmetric response to important news announcements etc) one of the reasons could be simply the predominance of money-making over the money-losing outcomes *in case technical trading results in non-zero profits.* We believe this predominance is of general nature since our study has covered a wide enough variety of technical trading strategies on seven major currency pairs. It is because of this predominance that the number of practicing traders who speak in favor of or who are neutral about technical analysis largely outweighs

the number of those who would doubt the usefulness of the latter (such as e.g. the fundamentalist traders) so that the general opinion is neutral at worst and positive at best. However, since we found no evidence that a dominating technical strategy exists or that our technical trading statistics have predictive power, the question of *how* to identify a money-making technical trading strategy remains open. We thus conclude that the popularity of technical analysis among practicing traders may be largely an outcome of a "technical trading lottery" that mostly results in zero profits, but that also produces roughly four money-making strategies for each money-losing one.

Appendix A.

The Fitting Statistic Estimation Methodology

The pattern templates we employ are represented by a 10x10 grid whose horizontal axis covers the trading window (or the period the exchange rate values of which we use to match the bull flag pattern) with the vertical axis spanning the range within which the exchange rate has fluctuated within that period. The grid's cells contain weights that give most emphasis to the observations that fit the bull flag chart pattern. Below are the template grids we employ following Leigh et al. (2002).

Table A1: Upward Trend-Following Pattern

	1	2	3	4	5	6	7	8	9	10
1	−1	−1	−1	−1	0	0	0.5	1	1	1
2	−1	−1	−1	0	0	0.5	1	1	1	1
3	−1	−1	0	0	0.5	1	1	1	1	0.5
4	−1	0	0	0.5	1	1	1	1	0.5	0.5
5	0	0	0.5	1	1	1	1	0.5	0	0
6	0	0.5	1	1	1	1	0.5	0	0	0
7	0.5	1	1	1	1	0.5	0	0	−1	−1
8	0.5	1	1	1	0.5	0	0	−1	−1	−1
9	1	1	1	0.5	0	0	−1	−1	−1	−1
10	1	1	0.5	0	0	−1	−1	−1	−1	−1

Table A2: Downward Trend-Following Pattern

	1	2	3	4	5	6	7	8	9	10
1	1	1	1	0.5	0	0	−1	−1	−1	−1
2	1	1	1	1	0.5	0	0	−1	−1	−1
3	0.5	1	1	1	1	0.5	0	0	−1	−1
4	0.5	0.5	1	1	1	1	0.5	0	0	−1
5	0	0.5	0.5	1	1	1	1	0.5	0	0
6	0	0	0	0.5	1	1	1	1	0.5	0
7	−1	0	0	0	0.5	1	1	1	1	0.5
8	−1	−1	−1	0	0	0.5	1	1	1	0.5
9	−1	−1	−1	−1	0	0	0.5	1	1	1
10	−1	−1	−1	−1	−1	0	0	0.5	1	1

Table A3: Upward Trend Continuation Pattern

	1	2	3	4	5	6	7	8	9	10
1	0,5	0	-1	-1	-1	-1	-1	-1	-1	0
2	1	0,5	0	-0,5	-1	-1	-1	-1	-0,5	0
3	1	1	0,5	0	-0,5	-0,5	-0,5	-0,5	0	0,5
4	0,5	1	1	0,5	0	-0,5	-0,5	-0,5	0	1
5	0	0,5	1	1	0,5	0	0	0	0,5	1
6	0	0	0,5	1	1	0,5	0	0	1	1
7	-0,5	0	0	0,5	1	1	0,5	0,5	1	1
8	-0,5	-1	0	0	0,5	1	1	1	1	0
9	-1	-1	-1	-0,5	0	0,5	1	1	0	-2
10	-1	-1	-1	-1	-0,5	0	0,5	0,5	-2	-2,5

Table A4: Downward Trend-Continuation Pattern

	1	2	3	4	5	6	7	8	9	10
1	−1	−1	−1	−1	−0.5	0	0.5	0.5	−2	−2.5
2	−1	−1	−1	−0.5	0	0.5	1	1	0	−2
3	−0.5	−1	0	0	0.5	1	1	1	1	0
4	−0.5	0	0	0.5	1	1	0.5	0.5	1	1
5	0	0	0.5	1	1	0.5	0	0	1	1
6	0	0.5	1	1	0.5	0	0	0	0.5	1
7	0.5	1	1	0.5	0	−0.5	−0.5	−0.5	0	1
8	1	1	0.5	0	−0.5	−0.5	−0.5	−0.5	0	0.5
9	1	0.5	0	−0.5	−1	−1	−1	−1	−0.5	0
10	0.5	0	−1	−1	−1	−1	−1	−1	−1	0

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Table A5: Upward Trend Reversal Pattern

	1	2	3	4	5	6	7	8	9	10
1	1	0	−1	0	1	1	0	−1	0	1
2	1	0.5	−1	0.5	1	1	0.5	−1	0.5	1
3	1	0.5	−1	0.5	1	1	0.5	−1	0.5	1
4	0.5	1	0	1	0.5	0.5	1	0	1	0.5
5	0.5	1	0	1	0.5	0.5	1	0	1	0.5
6	0	1	0.5	1	0	0	1	0.5	1	0
7	0	1	0.5	1	0	0	1	0.5	1	0
8	−1	0.5	1	0.5	−1	−1	0.5	1	0.5	−1
9	−1	0.5	1	0.5	−1	−1	0.5	1	0.5	−1
10	−1	0	1	0	−1	−1	0	1	0	−1

Table A6: Downward Trend Reversal Pattern

	1	2	3	4	5	6	7	8	9	10
1	−1	0	1	0	−1	−1	0	1	0	−1
2	−1	0.5	1	0.5	−1	−1	0.5	1	0.5	−1
3	−1	0.5	1	0.5	−1	−1	0.5	1	0.5	−1
4	0	1	0.5	1	0	0	1	0.5	1	0
5	0	1	0.5	1	0	0	1	0.5	1	0
6	0.5	1	0	1	0.5	0.5	1	0	1	0.5
7	0.5	1	0	1	0.5	0.5	1	0	1	0.5
8	1	0.5	−1	0.5	1	1	0.5	−1	0.5	1
9	1	0.5	−1	0.5	1	1	0.5	−1	0.5	1
10	1	0	−1	0	1	1	0	−1	0	1

Note: The trading window of forty days is divided into ten sub-periods of four days that are represented by columns. The range of exchange values observed in the trading window is divided into ten sub-ranges represented by the rows. Each cell contains the weight ascribed to the percentage of exchange value observations falling into one of the ten exchange value ranges during one of the ten sub-periods of the trading window. Shaded cells represent the bull flag charting pattern.

Let w_{ij} be the weights in Table 1. Let $e_{\max}$ and $e_{\min}$ be maximum and minimum exchange rates for a specific day. Assume there are K days in the trading window where K is a multiple of ten. Each exchange rate value $e_k, k=1..K$, in the trade window is associated with row i of the image grid if

$$e_k \in \left[p_{\max} - i \cdot \frac{(p_{\max} - p_{\min})}{10}, p_{\max} - (i-1) \cdot \frac{(p_{\max} - p_{\min})}{10} \right), i=1..9 \qquad \text{and} \qquad \text{if}$$

$$e_k \in \left[p_{\max} - i \cdot \frac{(p_{\max} - p_{\min})}{10}, p_{\max} - (i-1) \cdot \frac{(p_{\max} - p_{\min})}{10} \right], i=10. \text{ In other words, each}$$

row of the image grid corresponds to one of the ten price ranges that cover the trading window price range.

e_k is associated with column j of the image grid if $k \in \left[\frac{K}{10} \cdot (j-1)+1, \frac{K}{10} \cdot j \right], j=1..10$ so that the earliest $\frac{K}{10}$ observations are associated with the first column, the next group of $\frac{K}{10}$ observations correspond to the second column and so on. In this way each observation in the trading window is associated with a specific cell in the image grid. Let N_{ij} be the number of observations e_k associated with cell (i,j) in the image grid. Then values in the image grid are calculated as $g_{ij} = \frac{N_{ij}}{(K/10)}$, which is the fraction of

observations corresponding to column j that is associated with cell (i, j). The

fitting statistic F_k is calculated as a cross-correlation between the weights of

the template grid and the corresponding values in the image grid:

$$F_k = \sum_{i=1}^{10} \sum_{j=1}^{10} \left(w_{ij} g_{ij} \right).$$

Average return for a specific trading rule is computed as

$$R(T) = \frac{\sum_{k=K+1}^{N-H} \dfrac{\left(e_{k+H} - e_k \right) \cdot B_k}{e_k}}{\sum_{k=K+1}^{N-H} B_k} \quad \text{where} \quad B_k = \begin{cases} 1, F_k > T \\ 0, else \end{cases} , \quad H \text{ is the holding period and}$$

T is the threshold value of the fitting statistic. $\sum_{k=K+1}^{K-H} B_k$ is the number of trades in

the sample.

Appendix B

Excess Profits Estimation

Continuation Patterns (Bull/Bear Flag)

Table B.1   Trading rule profits for USD/CHF

	Trading Rule Holding Horizon									
	40		60		80		100		120	
Fit value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value
7	-0.3%	0.6919	0.33%	0.55	0.37%	0.6435	-2.1%	0.1809	-2.6%	0.1815
6	1.11%	0.0005	1.3%	0.0033	1.6%	0.0007	1.66%	0.003	1.37%	0.03
5	1.1%	0.0000	1.11%	0.0003	1.41%	0.0000	1.65%	0.0000	0.43%	0.0002
4	0.58%	0.0015	0.83%	0.0002	1.17%	0.0000	1.39%	0.0000	1.17%	0.0000

Table B.2   Trading rule profits for NZD/USD

	Trading Rule Holding Horizon									
	40		60		80		100		120	
Fit value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value
7	1.04%	0.0024	0.57%	0.4064	2.86%	0.0006	3.82%	0.0000	4.42%	0.0004
6	1.24%	0.0002	1.02%	0.0344	1.40%	0.005	2.06%	0.0000	2.92%	0.0000
5	0.39%	0.1163	0.24%	0.4906	0.37%	0.3362	0.8%	0.0774	1.35%	0.0084
4	0.1%	0.3044	-0.2%	0.4870	-0.3%	0.3925	-0.3%	0.4795	0.08%	0.85

Table B.3   Trading rule profits for AUD/USD

	Trading Rule Holding Horizon									
	40		60		80		100		120	
Fit value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value
7	**2.22%**	**0.0186**	0.77%	0.4342	1.24%	0.1	1.03%	0.3624	1.09%	0.41
6	**1.21%**	**0.0023**	0.16%	0.7266	0.27%	0.56	0.51%	0.3508	0.6%	0.3295
5	**0.59%**	**0.0202**	-0.3%	0.4130	-0.31%	0.2982	-0.42%	0.8812	-0.44%	0.2738
4	**0.34%**	**0.0598**	-0.35%	0.1133	-0.36%	0.1181	-0.47%	0.06	**-0.64%**	**0.0216**

Table B.4   Trading rule profits for GBP/JPY

	Trading Rule Holding Horizon									
	40		60		80		100		120	
Fit value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value
7	**-1.7%**	**0.03**	-0.4%	0.739	0.24%	0.72	-0.3%	0.67	-0.3%	0.77
6	0.4%	0.2617	0.2%	0.64	**0.82%**	**0.0275**	0.04%	0.92	0.39%	0.43
5	0.39%	0.07	0.35%	0.16	**1.23%**	**0.0000**	**0.84%**	**0.0055**	**0.76%**	**0.03**
4	0.03%	0.82	0.06%	0.71	**0.75%**	**0.0001**	**0.57%**	**0.0053**	**0.54%**	**0.02**

Table B.5   Trading rule profits for GBP/USD

Fit value	Trading Rule Holding Horizon									
	40		60		80		100		120	
	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value
7	**0.88%**	**0.02**	0.95%	0.0711	0.64%	0.0971	0.62%	0.4169	1.42%	0.17
6	0.31%	0.38	0.34%	0.399	0.43%	0.3656	0.26%	0.6226	0.14%	0.83
5	0.16%	0.47	0.17%	0.49	0.01%	0.9686	-0.3%	0.37	-0.5%	0.22
4	**0.27%**	**0.05**	**0.31%**	**0.05**	0.1%	0.5623	-0.2%	0.44	-0.06%	0.82

Reversal Patterns (Double Top/Bottom)

Table B.6   Trading rule profits for USD/JPY

Fit value	Trading Rule Holding Horizon									
	40		60		80		100		120	
	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value
7	-0.87%	0.054	-0.03%	0.48	0.46%	0.267	**1.67%**	**0.038**	0.20%	0.42
6	0.33%	0.23	0.38%	0.227	0.27%	0.286	-0.31%	0.28	0.23%	0.328
5	**0.42%**	**0.0328**	**0.46%**	**0.0416**	0.31%	0.12	0.05%	0.427	**0.71%**	**0.012**
4	0.08%	0.22	**0.27%**	**0.04**	**0.28%**	**0.0479**	0.18%	0.174	**0.53%**	**0.004**

Table B.7   Trading rule profits for EUR/USD

	Trading Rule Holding Horizon									
	40		60		80		100		120	
Fit value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value
7	**3.33%**	**0.007**	**3.22%**	**0.002**	**2.55%**	**0.001**	**1.66%**	**0.0000**	**2.51%**	**0.006**
6	0.15%	0.39	-0.12%	0.416	-0.04%	0.469	-0.39%	0.217	-0.33%	0.291
5	0%		-0.06%	0.398	-0.25%	0.188	-0.23%	0.213	-0.18%	0.30
4	-0.15%	0.11	-0.14%	0.17	-0.21%	0.11	-0.21%	0.12	-0.16%	0.199

Table B.8   Trading rule profits for USD/CHF

	Trading Rule Holding Horizon									
	40		60		80		100		120	
Fit value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value
7	-0.88%	0.051	**0.01%**	**0.01**	**0.79%**	**0.026**	0.3%	0.211	-0.24%	0.392
6	0.31%	0.23	0.6%	0.102	0.61%	0.096	0.24%	0.31	-0.04%	0.47
5	-0.05%	0.39	0.13%	0.27	0.04%	0.44	-0.07%	0.4	-0.02%	0.48
4	-0.17%	0.07	-0.05%	0.36	-0.1%	0.26	-0.12%	0.23	-0.08%	0.34

Table B.9   Trading rule profits for NZD/USD

	Trading Rule Holding Horizon									
	40		60		80		100		120	
Fit value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value
7	0.16%	0.44	1.07%	0.21	0.69%	0.36	0.84%	0.36	-0.42%	0.43
6	0.77%	0.06	0.35%	0.27	0.83%	0.15	0.38%	0.35	0.02%	0.49
5	0.34%	0.085	0.04%	0.44	0.2%	0.295	-0.12%	0.4	-0.34%	0.25
4	0.13%	0.18	0.12%	0.26	0.25%	0.128	0.11%	0.34	0.04%	0.44

Table B.10   Trading rule profits for AUD/USD

	Trading Rule Holding Horizon									
	40		60		80		100		120	
Fit value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value
7	2.39%	0.086	**4.91%**	**0.01**	**6.05%**	**0.025**	5.59%	0.06	**5.84%**	**0.019**
6	0.01%	0.5	0.55%	0.17	0.89%	0.10	0.91%	0.11	0.25%	0.36
5	-0.1%	0.33	-0.16%	0.29	-0.32%	0.18	-0.25%	0.27	-0.2%	0.31
4	-0.01%	0.45	-0.04%	0.41	-0.08%	0.33	0		0.03%	0.44

Table B.11   Trading rule profits for GBP/JPY

	Trading Rule Holding Horizon									
	40		60		80		100		120	
Fit value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value
7	**2.09%**	**0.03**	**4.07%**	**0.002**	**3.8%**	**0.001**	**1.99%**	**0.037**	**4.59%**	**0.0007**
6	0.23%	0.31	**0.99%**	**0.04**	**0.92%**	**0.05**	0.39%	0.27	0.86%	0.11
5	0.15%	0.23	**0.5%**	**0.014**	**0.6%**	**0.009**	0.14%	0.32	0.26%	0.2
4	-0.06%	0.31	0.15%	0.12	0.22%	0.07	-0.04%	0.42	0.07%	0.35

Table B.12   Trading rule profits for GBP/USD

	Trading Rule Holding Horizon									
	40		60		80		100		120	
Fit value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value
6	**1.25%**	**0.001**	1.69%	0.0002	0.48%	0.11	0.64%	0.103	**1.15%**	**0.017**
5	**0.40%**	**0.02**	0.43%	0.016	0.12%	0.27	0.17%	0.23	0.35%	0.09
4	0.11%	0.13	0.16%	0.08	**0.23%**	**0.03**	**0.21%**	**0.07**	**0.32%**	**0.02**
3	0.3%	0.08	-0.01%	0.47	-0.15%	0.06	-0.15%	0.08	-0.05%	0.33

Trend Following Patterns

Table B.13   Trading rule profits for EUR/USD

	Trading Rule Holding Horizon									
	40		60		80		100		120	
Fit value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value
9	0.24%	0.11	-0.16%	0.27	**0.77%**	**0.007**	**0.52%**	**0.05**	**1%**	**0.002**
8	**0.39%**	**0.004**	0.19%	0.15	**0.37%**	**0.034**	0.17%	0.21	**0.43%**	**0.03**
7	**0.27%**	**0.01**	0.11%	0.24	0.06%	0.36	0.19%	0.14	**0.34%**	**0.036**
6	**0.44%**	**0.0000**	**0.31%**	**0.009**	0.15%	0.14	**0.39%**	**0.006**	**0.65%**	**0.0001**

Table B.14   Trading rule profits for USD/JPY

	Trading Rule Holding Horizon									
	40		60		80		100		120	
Fit value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value
9	**-0.1%**	**0.03**	**-0.85%**	**0.006**	**-1.74%**	**0.000**	**-1.27%**	**0.000**	-0.54%	0.1
8	**-0.23%**	**0.028**	0.06%	0.36	**-0.26%**	**0.105**	0.13%	0.289	0.74%	0.0018
7	-0.15%	0.07	**0.3%**	**0.014**	**0.35%**	**0.03**	**0.87%**	**0.0000**	**1.24%**	**0.0000**
6	0.07%	0.37	**0.45%**	**0.001**	**0.55%**	**0.0002**	**0.04%**	**0.0000**	**1.5%**	**0.0000**

Table B.15   Trading rule profits for USD/CHF

	Trading Rule Holding Horizon									
	40		60		80		100		120	
Fit value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value
7	0.24%	0.13	**-0.44%**	**0.04%**	-0.04%	0.44	-0.18%	0.26	-0.09%	0.39
6	0.12%	0.21	**-0.46%**	**0.005%**	**-0.21%**	**0.05**	-0.2%	0.17	-0.04%	0.43
5	0.08%	0.25	**-0.31%**	**0.02%**	**-0.49%**	**0.001**	**-0.44%**	**0.005**	**-0.34%**	**0.03**
4	0.07%	0.24	-0.17%	0.08	**-0.39%**	**0.003**	**-0.39%**	**0.005**	-0.22%	0.09

Table B.16   Trading rule profits for NZD/USD

	Trading Rule Holding Horizon									
	40		60		80		100		120	
Fit value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value
7	0.82%	0.005	0.56%	0.07	0.9%	0.01	0.75%	0.035	0.94%	0.023
6	1.4%	0.0000	1.51%	0.0000	1.72%	0.0000	1.4%	0.0000	1.39%	0.0000
5	1.25%	0.0000	1.47%	0.0000	1.82%	0.0000	1.69%	0.0000	1.65%	0.0000
4	0.93%	0.0000	1.26%	0.0000	1.53%	0.0000	1.55%	0.0000	1.52%	0.0000

Table B.17   Trading rule profits for AUD/USD

	Trading Rule Holding Horizon									
	40		60		80		100		120	
Fit value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value
9	0.19%	0.23	0.32%	0.15	**1.06%**	**0.0000**	**1.46%**	**0.0000**	**1.72%**	**0.0000**
8	-0.01%	0.48	**0.34%**	**0.05**	0.81%	0.0000	1.25%	0.0000	1.54%	0.0000
7	-0.12%	0.18	0.04%	0.4	**0.49%**	**0.002**	1.07%	0.0000	1.41%	0.0000
6	-0.1%	0.19	0.07%	0.3	**0.45%**	**0.001**	0.81%	0.0000	1.3%	0.0000

Table B.18   Trading rule profits for GBP/JPY

	Trading Rule Holding Horizon									
	40		60		80		100		120	
Fit value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value
7	-0.32	0.1	-0.31	0.14	-0.42	0.13	**-1.14**	**0.0000**	**-1.41**	**0.0000**
6	-0.17	0.16	0.13	0.25	-0.17	0.24	-0.24	0.17	**-0.4**	**0.05**
5	**-0.51**	**0.0000**	-0.12	0.21	**-0.62**	**0.0000**	**-0.61**	**0.0000**	**-0.36**	**0.03**
4	**-0.2**	**0.03**	0.17	0.08	**-0.41**	**0.002**	**-0.49**	**0.008**	-0.18	0.15

Table B.19 Trading rule profits for GBP/USD

Fit value	Trading Rule Holding Horizon									
	40		60		80		100		120	
	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value	Excess Profits	P-value
7	-0.61	0.004	-0.4	0.08	0.39	0.10	0.42	0.06	1.03	0.0006
6	-0.83	0.0000	-0.53	0.001	-0.15	0.24	0.09	0.32	0.19	0.2
5	-0.76	0.0000	-0.76	0.0000	-0.56	0.0000	-0.31	0.02	-0.21	0.12
4	-0.6	0.0000	-0.74	0.0000	-0.59	0.0000	-0.36	0.004	-0.33	0.02

Appendix C

Excess profits estimation for three non-overlapping subperiods

<u>**Continuation Patterns (Bull/Bear Flag)**</u>

Table C1: Excess Profits for Three Sub-Intervals, Bull/Bear Continuation Pattern, Fitting Value Is Lower Bound for the Upper 25% of the Estimated Fitting Values

USD/CHF	Holding Horizon									
# Obs	40		60		80		100		120	
800	0.49	0.3	1.88	0.09	1.83	0.09	**2.89**	**0.009**	**2.81**	**0.003**
800	**1.31**	**0.0000**	**1.58**	**0.0000**	**1.92**	**0.0000**	**1.79**	**0.01**	1.14	0.1
656	0.11	0.44	0.93	0.19	-0.26	0.42	-0.88	0.3	-0.07	0.48
Overall Sample	1.11%	0.0005	1.3%	0.0033	1.6%	0.0007	1.66%	0.003	1.37%	0.03
NZD/USD	Holding Horizon									
# Obs	40		60		80		100		120	
800	**0.92**	**0.01**	0.05	0.46	**1.7**	**0.003**	**1.67**	**0.01**	**1.58**	**0.01**
800	**2.14**	**0.003**	**3.07**	**0.001**	**1.87**	**0.04**	**4.3**	**0.0000**	**4.76**	**0.001**
656	**0.79**	**0.03**	-0.01	0.5	0.97	0.15	**2.35**	**0.01**	**4.49**	**0.0000**
Overall Sample	1.24%	0.0002	1.02%	0.0344	1.40%	0.005	2.06%	0.0000	2.92%	0.0000
AUD/USD	Holding Horizon									
# Obs	40		60		80		100		120	
800	**3**	**0.0000**	**8**	**0.0000**	**2.7**	**0.0000**	**2.39**	**0.0000**	**2.07**	**0.0000**
800	**-0.47**	**0.002**	**-1.22**	**0.0000**	**-3.12**	**0.0000**	**-3.68**	**0.0000**	**-2.67**	**0.0000**
656	**1.44**	**0.0000**	0.15	0.35	**1.02**	**0.006**	**1.56**	**0.005**	**0.89**	**0.05**
Overall Sample	1.21%	0.0023	0.16%	0.7266	0.27%	0.56	0.51%	0.3508	0.6%	0.3295

GBP/JPY	Holding Horizon									
# Obs	40		60		80		100		120	
800	-1.05	0.12	-0.46	0.47	**1.23**	**0.01**	**0.6**	**0.03**	-0.07	0.17
800	**-0.66**	**0.006**	**-1.07**	**0.002**	0.74	0.48	-0.26	0.09	0.1	0.12
656	1.1	0.36	1.46	0.35	**1.19**	**0.02**	**0.64**	**0.0000**	**1.38**	**0.02**
Overall Sample	0.4%	0.2617	0.2%	0.64	**0.82%**	**0.0275**	0.04%	0.92	0.39%	0.43
GBP/USD	Holding Horizon									
# Obs	40		60		80		100		120	
800	**0.4**	**0.006**	-0.16	0.08	**0.44**	**0.003**	**0.49**	**0.003**	-0.5	0.07
800	**-0.41**	**0.01**	**0.04**	**0.006**	**-0.5**	**0.003**	**-0.71**	**0.001**	**-2.32**	**0.0000**
656	**1.63**	**0.002**	1.8	0.08	**1.26**	**0.05**	0.8	0.35	**4.42**	**0.0000**
Overall Sample	0.31%	0.38	0.34%	0.399	0.43%	0.3656	0.26%	0.6226	0.14%	0.83

Reversal Patterns (Double Top/Bottom)

Table C2: Excess Profits for Three Sub-Intervals, Double Tops/Bottoms Continuation Pattern, Fitting Value Is Lower Bound for the Upper 25% of the Estimated Fitting Values

EUR/USD	Holding Horizon									
# Obs	40		60		80		100		120	
800	1.39	0.003	1.3	0.004	1.2	0.001	1.31	0.0000	1.3	0.0000
800	-1.97	0.008	-3.34	0.0000	-2.79	0.0000	-3.08	0.0000	-2.31	0.0000
656	0.2	0.36	0.21	0.37	-0.45	0.2	-1.27	0.08	-2.55	0.005
Overall Sample	0.15%	0.39	-0.12%	0.416	-0.04%	0.469	-0.39%	0.217	-0.33%	0.291
USD/JPY	Holding Horizon									
# Obs	40		60		80		100		120	
800	1.05	0.23	0.76	0.44	1.33	0.35	0.24	0.43	1.74	0.37
800	0.3	0.05	1.21	0.02	0.23	0.09	0.49	0.05	1.82	0.01
656	-0.43	0.05	-0.73	0.005	-1.03	0.0000	-0.73	0.0000	-1.06	0.0002
Overall Sample	0.33%	0.23	0.38%	0.227	0.27%	0.286	-0.31%	0.28	0.23%	0.328
USD/CHF	Holding Horizon									
# Obs	40		60		80		100		120	
800	-0.31	0.17	0.12	0.22	0.43	0.26	-0.13	0.11	-1.24	0.02
800	0.74	0.002	0.19	0.006	0.71	0.0004	0.22	0.0003	0.48	0.0000
656	0.09	0.23	0.29	0.35	0.45	0.16	-0.28	0.003	-0.81	0.001
Overall Sample	0.31%	0.23	0.6%	0.102	0.61%	0.096	0.24%	0.31	-0.04%	0.47

NZD/USD	Holding Horizon									
# Obs	40		60		80		100		120	
800	-1.36	0.4	-1.6	0.26	-1.41	0.08	-3.4	0.44	-3.12	0.19
800	3.51	0.26	4.29	0.45	7.16	0.26	7.86	0.35	7.04	0.44
656	1.68	0.06	1.04	0.09	0.56	0.13	-0.03	0.21	-1.05	0.4
Overall Sample	0.77%	0.06	0.35%	0.27	0.83%	0.15	0.38%	0.35	0.02%	0.49
AUD/USD	**Holding Horizon**									
# Obs	40		60		80		100		120	
800	-0.62	0.22	**-0.12**	**0.001**	**-1.07**	**0.008**	**-1.62**	**0.004**	**-2.45**	**0.003**
800	2.23	0.48	5.21	0.21	7.71	0.10	8.84	0.08	4.41	0.31
656	-1.13	0.07	**-1.6**	**0.02**	0.5	0.25	**0.64**	**0.0000**	1.26	0.06
Overall Sample	-0.01%	0.48	**0.34%**	**0.05**	**0.81%**	**0.0000**	**1.25%**	**0.0000**	**1.54%**	**0.0000**
GBP/JPY	**Holding Horizon**									
# Obs	40		60		80		100		120	
800	0.88	0.1	0.82	0.09	**1.16**	**0.05**	-1.57	0.33	1.69	0.06
800	-0.24	0.32	0.23	0.44	0.32	0.39	-0.23	0.14	-0.93	0.06
656	0.52	0.09	**0.59**	**0.05**	**-0.19**	**0.002**	0.71	0.06	0.66	0.06
Overall Sample	0.23%	0.31	**0.99%**	**0.04**	**0.92%**	**0.05**	0.39%	0.27	0.86%	0.11
GBP/USD	**Holding Horizon**									
# Obs	40		60		80		100		120	
800	-0.09	0.11	-0.3	0.11	-0.88	0.25	-1.26	0.28	**-0.23**	**0.0000**
800	2.45	0.22	3.65	0.17	**1.03**	**0.03**	**0.7**	**0.006**	**0.97**	**0.005**
656	**2.33**	**0.007**	**3.02**	**0.0006**	1.69	0.07	2.69	0.06	2.47	0.17
Overall Sample	**1.25%**	**0.001**	1.69%	0.0002	0.48%	0.11	0.64%	0.103	**1.15%**	**0.017**

Trend Following Patterns

Table C3: Excess Profits for Three Sub-Intervals, Trend-Following Pattern, Fitting Value Is Lower Bound for the Upper 25% of the Estimated Fitting Values

EUR/USD	Holding Horizon									
# Obs	40		60		80		100		120	
800	0.45	0.036	0.31	0.188	-0.25	0.27	-0.49	0.15	0.24	0.31
800	-0.16	0.32	0.35	0.15	1.95	0.0000	1.54	0.0000	1.84	0.0000
656	-1.22	0.0000	-1.33	0.0000	-1.72	0.0000	-1.14	0.21	0.43	0.03
Overall Sample	0.44%	0.0000	0.31%	0.009	0.15%	0.14	0.39%	0.006	0.65%	0.0001
USD/JPY	Holding Horizon									
# Obs	40		60		80		100		120	
800	0.6	0.02	1.79	0.0000	0.68	0.07	1	0.02	1.99	0
800	0.32	0.13	0.34	0.14	0.07	0.42	-0.79	0.0000	0.16	0.26
656	-0.22	0.18	-0.38	0.07	0.34	0.08	1.16	0.0000	0.90	0.01
Overall Sample	-0.23%	0.028	0.06%	0.36	-0.26%	0.105	0.13%	0.289	0.74%	0.0018
USD/CHF	Holding Horizon									
# Obs	40		60		80		100		120	
800	0.38	0.01	-0.01	0.48	-0.95	0.0000	-0.6	0.06	-1.59	0.0000
800	0.98	0.0000	0.48	0.03	0.93	0.0000	0.96	0.0000	1.61	0.0000
656	-1.09	0.0000	-1.25	0.0000	-0.75	0.0000	-0.16	0.26	-0.15	0.28
Overall Sample	0.12%	0.21	-0.46%	0.005%	-0.21%	0.05	-0.2%	0.17	-0.04%	0.43

NZD/USD	Holding Horizon									
# Obs	40		60		80		100		120	
800	**-0.77**	**0.001**	-0.11	0.36	-0.09	0.39	-0.24	0.25	0.08	0.41
800	**2.5**	**0.0000**	**2.63**	**0.0000**	**2.95**	**0.0000**	**2.86**	**0.0000**	**3.47**	**0.0000**
656	**0.51**	**0.009**	**0.06**	**0.04**	**0.79**	**0.007**	0.53	0.1	**-1.32**	**0.003**
Overall Sample	**1.4%**	**0.0000**	**1.51%**	**0.0000**	**1.72%**	**0.0000**	**1.4%**	**0.0000**	**1.39%**	**0.0000**

AUD/USD	Holding Horizon									
# Obs	40		60		80		100		120	
800	**-1.28**	**0.0000**	**-1.71**	**0.0000**	**-1.17**	**0.0000**	0.11	0.4	**1.58**	**0.0006**
800	**2.03**	**0.0000**	**2.76**	**0.0000**	**2.88**	**0.0000**	**3.1**	**0.0000**	**2.68**	**0.0000**
656	**-1.87**	**0.0000**	**-1.7**	**0.0000**	**-0.61**	**0.0000**	**-1.31**	**0.0000**	**-1.41**	**0.0000**
Overall Sample	-0.1%	0.19	0.07%	0.3	**0.45%**	**0.001**	**0.81%**	**0.0000**	**1.3%**	**0.0000**
GBP/JPY	Holding Horizon									
# Obs	40		60		80		100		120	
800	**-0.72**	**0.0000**	0.03	0.46	**-0.71**	**0.01**	**-0.56**	**0.05**	0.46	0.09
800	**-0.29**	**0.04**	**-0.47**	**0.002**	**-1.14**	**0.0000**	**-1.76**	**0.0000**	**-1.2**	**0.0000**
656	**1**	**0.0000**	**1.26**	**0.0000**	**1.3**	**0.0000**	**1.59**	**0.0000**	**1.36**	**0.0000**
Overall Sample	-0.17	0.16	0.13	0.25	-0.17	0.24	-0.24	0.17	**-0.4**	**0.05**
GBP/USD	Holding Horizon									
# Obs	40		60		80		100		120	
800	**-0.63**	**0.0000**	**-0.53**	**0.0000**	**-0.83**	**0.0000**	**-0.74**	**0.00000**	-0.06	0.4
800	-0.21	0.13	**-0.58**	**0.007**	-0.21	0.22	0.23	0.2	0.75	0.009
656	**-1.02**	**0.0000**	**-1.49**	**0.0000**	**-0.92**	**0.0000**	**-0.72**	**0.003**	**-1.64**	**0.0000**
Overall Sample	**-0.83**	**0.0000**	**-0.53**	**0.001**	-0.15	0.24	0.09	0.32	0.19	0.2

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