TECHNICAL ANALYSIS ON FOREIGN EXCHANGE: 1975 -2004

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ABSTRACT

The aim of this paper is to determine the potential profitability of technical analysis applied on the foreign exchange market. Eight simple rules are tested in five markets. Only long positions are tracked and reported. When neither commissions nor indexation are included in the analysis, some investment strategies outperform the index. There is little evidence that these excess returns are compensation for bearing excessive risk. However, the most of these strategies require too many transactions and produces only marginal returns. In that sense, when commissions and indexation are introduced, it is concluded that only an investor with the ability to get very low or null commissions and taxes would benefit.

INTRODUCTION

The market for foreign exchange is the most heavily traded of all financial markets. Trading is undertaken by individuals and organizations in support of management of assets and liabilities in different currencies and trade of goods and services between national economies or those who profit from buying and selling currencies at different exchange rates (Hutcheson, 2000). The Bank for International Settlements (2002) tracks the global foreign exchange and derivatives market activity through its Triennial Central Bank Survey. The last survey (April 2001) reports that, average daily turnover was US$1,200 billion in traditional foreign exchange markets. Besides, global daily turnover in foreign exchange and interest rate derivatives contracts, including what are considered to be "traditional" foreign exchange derivatives instruments, reached US$1.4 trillion. This is although the substantial decline in volume that the introduction of the euro represented, apparently due to the elimination of intra-EMS trading.

The types of information used by market participants to form predictions of exchange rate movements and to trade consistently can be separated into two broad categories: (a) fundamental information, such as inflation rates, GDP, unemployment rates, trade figures, etc.; and (b) technical information such as prices and quantities traded. The use of the former is known as fundamental analysis, and the latter technical analysis, upon which this research will focus.

Technical analysis claims that an investor can develops successful investment strategies using past information of prices and volumes (Murphy, 1986). This is an extremely controversial issue. Economists have traditionally been skeptical of the value of technical analysis, affirming the theory of efficient markets that holds that no strategy should allow investors and traders to make unusual returns except by taking excessive risk (Samuelson, 1965). According to Fama (1970) a market is efficient if “all prices reflect all relevant information”. Specifically, in the weak form efficiency, no investor can earn excess returns by developing trading rules based on historical prices or return information. In others words, the information in past prices or returns is not useful or relevant in achieving excess returns.

However, technical analysis is widely used in the financial community. Taylor and Allen (1992) report that more than 90% of surveyed foreign exchange dealers in London say that they use some form of technical analysis to inform their trading decisions and, at the shortest time horizons, 60% of respondents judged technical analysis to be at least as important as fundamentals when generating exchange rate predictions. This evidence is supported by Hutcheson (2000) who studying the Australian foreign exchange market found that: “Fundamental analysis is regarded to be better at explaining long term exchange rate movements while technical analysis is better at explaining short term movements”. Additionally, Cheung and Chinn (2000) report findings from a survey of United States foreign exchange traders. Theirs results indicate that “technical trading best characterizes about 30% of traders, with this proportion rising from five years ago… (While) economic fundamentals are perceived to be more important at longer horizons…” These conclusions are in line with the work of Menkhoff (1997) and, Cheung, Chinn and Marsh (2000).

The previous issue moves the direction quickly to the next thing: Is technical analysis profitable? And specifically in this paper: Is technical analysis in the foreign exchange market profitable?

First, being a controversial issue and although technical analysis is not new, it has traditionally been regarded with skepticism between academics. Since the publication of Fama and Blume (1966) most academics have agreed that the usefulness of these ad hoc forecasting techniques was probably close to zero. However, important research presents evidence that seems to favor technical analysis. Generally speaking, maybe the most publicized research is the study by Brock, Lakonishok, and LeBaron (1992). They analyzed moving averages and trading range breaks on the DJII from 1897 to 1985. Contrary to previous tests, they found that both types of rules work quite well. Buy signals were followed by an average 12% return at an annual rate and sell signals were followed by a 7% loss at an annual rate. They say: “The previous conclusion that technical analysis is useless was premature”. Timmermann, Sullivan, and White (1999) revisited the paper attempting to determine the effect of data-snooping on the results. They also use data collected from the period following the original study in order to provide an out of sample test. They calculated a break even transaction cost level of 0.27% percent per trade for the best performing trading rule for the full period and found "that the results appear to be robust to data-snooping... However, we also find that the superior performance of the best trading rule is not repeated in the out-of-sample experiment covering the period 1987-1996" and "there is scant evidence that technical trading rules were of any economic value during the period 1987-1996."

Second, one obvious explanation of the apparent popularity of technical analysis could be that it is simply profitable. Hence much of the empirical work has been aimed at determining whether or not it is profitable. For example: Dooley and Shafer (1976) obtained results in favor of filters. However, their results were not systematically positive. Sweeney (1986) analyzed the same type of filter strategy and found, once again, positive results with one third of them being statistically significant. Levich et Thomas (1993) studied the profitability of two simple trading rules as filter and moving average rules on the foreign exchange. Once transaction costs are taken into account (equal to 1.62% to 2.60% per annum for 65 operations), profits are however reduced but not enough for the profits to be close to zero. Neely, Weller and Dittmar (1997) using genetic programming techniques to find technical trading rules, found strong evidence of economically significant out-of-sample excess returns to those rules for each of six exchange rates, over the period 1981-1995. Betas calculated for the returns according to various benchmark portfolios provide no evidence that the returns to these rules are compensation for bearing systematic risk. Empirical support for technical trading rules in foreign exchange markets can additionally be found in Kho (1996), Gencay (1999), LeBaron (1999), among others. The key finding of these papers is that following simple technical trading rules does lead to statistically significant excess returns.

Of course, as a controversial issue this is, there is evidence in favor of market efficiency. For example: Neely and Weller (2001) examine the out-of-sample performance of intraday technical trading strategies selected using two methodologies. When realistic transaction costs and trading hours are taken into account, they find no evidence of excess returns to the trading rules derived with either methodology. Thus, their results are consistent with market efficiency. They do, however, find that the trading rules discover some remarkably stable patterns in the data.

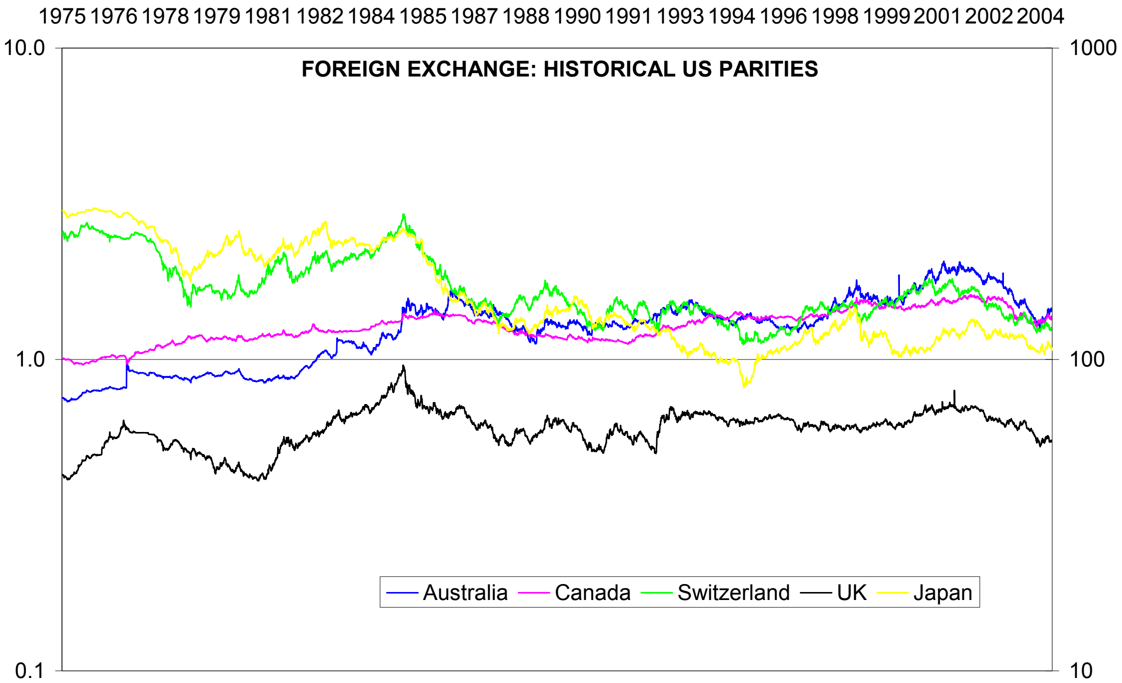
THE RESEARCH

The aim of this paper is to determine the potential profitability of investment strategies based on technical analysis, that could have been applied in the foreign exchange market between January, 2nd 1975 and the present (June, 28th 2004). Thus, there are 7456 daily observations. The focus is on the parity of the US dollar against the currency of Australia, Canada, Japan, Switzerland, and the UK. According to The Bank for International Settlements (2002), these parities represent 4%, 4%, 20%, 5%, and 11% respectively of the reported foreign exchange market turnover by currency pair. The US - European currency parity, which represents 30%, is not considered here because begun to trade in 1999. No other parity represents more share than these. Data is from the Bank of England. Disclaimer is accepted. Figure 1 shows the characteristics of the sample. Figure 2 shows the evolution of the parities.

Figure 1: Characteristics of the sample.

Statistics	Australia	Canada	Japan	Switzer.	UK
Number of observations	7456	7456	7456	7456	7456
Average daily return %	0.011	0.004	-0.012	-0.007	0.005
Annualized return %[1]	2.835	1.099	-2.877	-1.707	1.354
Standard deviation daily	0.719	0.311	0.658	0.735	0.642
Sharpe Index	0.015	0.014	-0.018	-0.009	0.008
Maximum daily return %	21.208	2.231	4.870	5.920	13.151
Minimum daily return %	-15.364	-2.438	-6.402	-5.005	-7.619

Figure 1: Parities against the US Dollar: Australia, Canada, Japan, Switzerland, and the UK.



Eight simple rules are applied in order to generate investment strategies. They are: simple moving averages (SMA), weighted moving averages (WMA), exponential moving averages (EMA), range trades (RT), filters, relative strength index (RSI), Lane %K statistic, and the Williams %R statistic. The strategies are applied on the historical data and only the long positions are tracked and reported.

For each analyzed strategy, it is reported: the number of trades that the strategy generates; the total average return per trade; the average number of days in the trade, the annualized average daily return, and the corresponding Sharpe index. In order to compare the consistency of the rules, each strategy is compared with a simple buy and hold strategy (indexation). Additionally, R2C represent the coefficient of determination in a regression between the daily return and a dummy variable (1: if a buy signal arise and 0: if not). Finally, the return in excess applicable to commissions is computed as the

[1] In order to compute annualized daily return, 252 days are introduced into the formulae. This is because; the average number of trading days in a year is 252.

differences between the average return and the return of the index, divided by the number of roundtrip[2] trades minus 1, that one equivalent to the indexation.

RESULTS

Figure 3 shows the best 30 historically simulated trading strategies, when no commissions for trading are included. Top strategy return an interesting 13% annualized considering the average return for the sample in Figure 2. And the all 30 strategies return more than 6% a year. All the Sharpe indexes are statistically significant. The most suitable parity for trading seems to be the US-UK pair. Additionally, it seems that there is no a right tool and any of all the simple rules are useful. That is, no simple rule is the best apparently. The regressions show that the dummy variable (1: if a buy signal arise and 0: if not) can explain an important portion of the times series of the daily returns. The average coefficient of determination is an important 0.11. The only problem seems to be the high number of roundtrip transactions, 563 in order to be precise. The average number of days of each transaction is just 12 days.

[2] A round trip is a move from a long position to a short position and back or vice-versa.

Figure 3: The best 30 historically simulated trading strategies. No commissions.

FX: US parity	Simple Technique	Filter %	Num Trades	Ave Num Days	Trading AvDay Return%	Trading AvYear Return%	Sharpe	R2C
UK	Filter-1	0.0	1769	2	0.10	13.00	7.22	0.46
Australia	Filter-1	0.0	1565	2	0.09	10.38	4.85	0.30
UK	%R/10	0.0	342	11	0.41	10.12	5.82	0.06
UK	EMA/1/10	0.0	625	6	0.22	9.98	5.67	0.15
UK	WMA/1/5	0.0	1075	3	0.13	9.83	5.45	0.30
UK	Filter-10	0.5	242	15	0.53	9.32	5.31	0.03
Australia	EMA/1/10	0.0	589	6	0.22	9.22	4.16	0.10
UK	SMA/1/5	0.0	905	4	0.14	9.20	5.11	0.23
UK	EMA/1/5	0.0	926	4	0.13	8.96	5.20	0.25
UK	Filter-10	0.0	449	8	0.27	8.94	5.12	0.05
UK	WMA/1/10	0.0	757	5	0.16	8.83	5.12	0.19
UK	RT/1/5	0.0	415	9	0.29	8.52	4.90	0.08
UK	Filter-5	0.0	704	5	0.17	8.46	4.85	0.09
UK	Filter-10	1.0	171	21	0.68	8.38	4.71	0.02
UK	EMA/1/50	0.0	240	16	0.50	8.36	4.54	0.03
UK	SMA/1/10	0.0	578	6	0.20	8.35	4.82	0.12
UK	RT/1/10	0.0	205	18	0.57	8.34	4.75	0.03
UK	SMA/1/50	0.0	219	17	0.52	7.99	4.40	0.03
Australia	EMA/1/5	0.0	862	4	0.12	7.62	3.51	0.16
Australia	WMA/1/10	0.0	714	5	0.15	7.55	3.47	0.12
UK	%R/5	0.0	728	5	0.14	7.51	4.42	0.16
UK	RT/1/10	1.0	42	89	2.50	7.31	3.67	0.01
Australia	Filter-10	0.0	418	9	0.24	7.25	3.68	0.03
UK	Filter-5	1.0	235	16	0.43	7.23	4.18	0.03
Switzerland	EMA/1/50	0.0	246	15	0.39	7.08	3.83	0.04
UK	Filter-5	0.5	381	10	0.26	7.04	4.05	0.05
Japan	RT/1/10	0.0	180	21	0.54	6.88	4.20	0.03
Australia	SMA/1/10	0.0	540	7	0.18	6.85	3.20	0.08
Japan	EMA/1/50	0.0	213	17	0.42	6.61	4.08	0.04
Switzerland	EMA/1/10	0.0	645	6	0.14	6.61	3.54	0.17

Figure 4 shows the best 30 historically simulated trading strategies, when commissions for trading and indexation are included into the analysis. Now, the focus of the investor should change. Before, average yearly return was the most important thing. Now, introducing commissions and indexation, the investor's focus should change to maximize the return in excess of the index return which could account for to pay commissions.

The first thing to note is the dramatic reduction in the number of transactions and the rise in days of the average transaction, 19 versus 563 before and 443 versus 12 before, respectively. Using filters for each technique not just have the advantage of identify false starts, but also have the advantage of reduce the number of trades. Top strategy now has a rate of return in excess to indexation of just 2.75% in an annualized basis. And the 30 strategies return just 2.45% a year, in average. This represents a weak 0.32%

a year, in excess of indexation, in order to pay roundtrip commissions. In this scenario, it seems that there is neither a most suitable parity nor a right tool for trading.

Figure 4: The best 30 historically simulated trading strategies. Commissions and indexation included.

FX: US parity	Simple Technique	Filter %	Num Trades	Ave Num Days	Trading AvYr Return %	Index AvYr Return %	Excess Return Comm %
Canada	WMA/1/10	1.0	1	251	3.88	1.13	2.75
Japan	EMA/1/50	1.0	8	450	1.18	-2.96	0.59
Canada	SMA/1/50	1.0	1	3,275	1.60	1.13	0.47
Japan	SMA/1/50	1.0	9	330	0.80	-2.96	0.47
Japan	WMA/1/5	1.0	12	229	1.67	-2.96	0.42
Japan	RT/1/50	0.5	26	124	5.90	-2.96	0.35
Japan	RT/1/50	1.0	17	154	2.39	-2.96	0.33
Switzerland	SMA/1/50	1.0	9	418	0.63	-1.75	0.30
Switzerland	RSI/50	0.0	7	716	-0.08	-1.75	0.28
UK	RT/1/50	1.0	16	212	4.81	1.39	0.23
Switzerland	WMA/1/10	1.0	24	155	2.98	-1.75	0.21
UK	SMA/1/5	1.0	21	147	5.45	1.39	0.20
Switzerland	EMA/1/5	1.0	14	292	0.77	-1.75	0.19
Switzerland	WMA/1/5	1.0	21	224	1.93	-1.75	0.18
UK	SMA/1/10	1.0	12	231	3.37	1.39	0.18
Canada	EMA/1/50	1.0	2	3,288	1.31	1.13	0.18
UK	EMA/1/50	1.0	6	735	2.28	1.39	0.18
Japan	SMA/1/5	1.0	26	128	1.44	-2.96	0.18
Switzerland	RT/1/50	0.0	38	100	4.46	-1.75	0.17
Japan	SMA/1/50	0.5	31	87	1.98	-2.96	0.16
Japan	EMA/1/10	1.0	12	151	-1.19	-2.96	0.16
Switzerland	RT/1/50	1.0	20	142	1.27	-1.75	0.16
Japan	RT/1/50	0.0	39	88	2.80	-2.96	0.15
Japan	WMA/1/10	1.0	12	167	-1.30	-2.96	0.15
UK	RT/1/10	1.0	42	89	7.31	1.39	0.14
Japan	EMA/1/50	0.5	39	86	2.30	-2.96	0.14
UK	RT/1/50	0.0	40	100	5.83	1.39	0.11
Australia	EMA/1/10	1.0	11	344	4.02	2.92	0.11
Switzerland	SMA/1/5	1.0	28	146	1.20	-1.75	0.11
UK	RSI/50	0.0	7	511	2.02	1.39	0.11

Figure 5 shows the best 6 historically simulated trading strategies for each pair when commissions and indexation are included into the analysis. Results for Australia show that eventually none investor could have beaten a simple strategy of “buy and hold”, using any of the eight simple rules analyzed here. Simply, there is no enough return in excess for roundtrip commissions. The average excess return was 0.06%. Results for Canada show a slightly better picture, there were two strategies that return more than 0.48% meanwhile the rest four have an average return of just 0.08%. Results for Japan, Switzerland and the UK show an average return in excess for roundtrip commissions of 0.39%, 0.22% and 0.17% respectively.

Figure 5: The best 6 historically simulated trading strategies for each country. Commissions and indexation included.

FX: US parity	Simple Technique	Filter %	Num Trades	Ave Num Days	Trading AvYr Return %	Index AvYr Return %	Excess Return Comm %
Australia	EMA/1/10	1.0	11	344	4.02	2.92	0.11
Australia	RSI/50	0.0	8	524	3.44	2.92	0.07
Australia	SMA/1/10	1.0	17	253	3.75	2.92	0.05
Australia	SMA/1/10	0.5	63	48	5.83	2.92	0.05
Australia	EMA/1/5	1.0	12	372	3.22	2.92	0.03
Australia	RT/1/5	0.5	144	25	5.87	2.92	0.02
Canada	WMA/1/10	1.0	1	251	3.88	1.13	2.75
Canada	SMA/1/50	1.0	1	3,275	1.60	1.13	0.47
Canada	EMA/1/50	1.0	2	3,288	1.31	1.13	0.18
Canada	RSI/50	0.0	5	728	1.53	1.13	0.10
Canada	RT/1/50	0.5	11	423	1.56	1.13	0.04
Canada	Filter-10	0.5	175	22	3.08	1.13	0.01
Japan	EMA/1/50	1.0	8	450	1.18	-2.96	0.59
Japan	SMA/1/50	1.0	9	330	0.80	-2.96	0.47
Japan	WMA/1/5	1.0	12	229	1.67	-2.96	0.42
Japan	RT/1/50	0.5	26	124	5.90	-2.96	0.35
Japan	RT/1/50	1.0	17	154	2.39	-2.96	0.33
Japan	SMA/1/5	1.0	26	128	1.44	-2.96	0.18
Switzerland	SMA/1/50	1.0	9	418	0.63	-1.75	0.30
Switzerland	RSI/50	0.0	7	716	-0.08	-1.75	0.28
Switzerland	WMA/1/10	1.0	24	155	2.98	-1.75	0.21
Switzerland	EMA/1/5	1.0	14	292	0.77	-1.75	0.19
Switzerland	WMA/1/5	1.0	21	224	1.93	-1.75	0.18
Switzerland	RT/1/50	0.0	38	100	4.46	-1.75	0.17
UK	RT/1/50	1.0	16	212	4.81	1.39	0.23
UK	SMA/1/5	1.0	21	147	5.45	1.39	0.20
UK	SMA/1/10	1.0	12	231	3.37	1.39	0.18
UK	EMA/1/50	1.0	6	735	2.28	1.39	0.18
UK	RT/1/10	1.0	42	89	7.31	1.39	0.14
UK	RT/1/50	0.0	40	100	5.83	1.39	0.11

CONCLUSIONS

When neither commissions nor a benchmark in the form of indexation is introduced into the analysis, there is certain support for the eight simple rules of trading suggested by technical analysis. It is possible to obtain investment strategies that outperform the return of the index. There is little evidence that these excess returns are compensation for bearing excessive risk, as the Sharpe index reports. In summary, retrospectively speaking, some of these techniques could have beaten the market.

Why these results could be possible or persistent? Among others explanations: Meese and Rogoff (1983) showed that no existing exchange rate model could forecast exchange rate changes better than a “no-change” guess at forecast horizons of up to one year. This was true even when the exchange rate models were given true values of future fundamentals like output and money. Neely (1997) suggest “Either explanation for extrapolative trading implies that bubbles may be produced by slow dissemination of private information into the market, coupled with extrapolative trading rules”.

However, the problem is that most of these strategies require too many transactions and produces just marginal returns. When commissions for trading and indexation are included into the analysis, the best 30 historical strategies produce an excess of return of just 0.31% per roundtrip trade (buy and sell). Moreover, results for the best six strategies for Australia, Japan, Switzerland and the UK show an average return in excess for roundtrip commissions of only 0.06%, 0.39%, 0.22% and 0.17% respectively. Results for Canada show a slightly better picture, there were two strategies that return more than 0.48% meanwhile the rest four have an average return of just 0.08%.

Although some consider commissions of 0.05% for roundtrip transactions realistic (Levich and Thomas (1993); Osler and Chang (1995); Neely (1997)), only an investor that could have the ability to get very low commissions, low taxes, and high volumes would benefit of these techniques. So, the trader must reach equilibrium between the numbers of trades and the return that she/he expects to get. There is, of course, an entire issue in leveraging and the cost of it. An interesting additional problem is that the investor has had the ability of to identify the proper characteristics of the technique, which seem to be different in each case because none of them is apparently better than the rest.

In summary, results seem to be strong enough in favor of market efficiency. Out of 48 strategies studied for each pair, based in eight simple rules of trading, eventually just one or two seems to report enough excess return to pay roundtrip commissions and taxes.

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