A Note on the Effectiveness of Technical Analysis in Fixed Exchange Rate Regimes

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Abstract

This paper analyzes the profitability of Moving Average trading rules for EMS exchange rates. Two results emerge: First, there appears to be no relation between the credibility of a fixed exchange rate parity and trading rule profitability and second, technical trading rule profitability seems to be regime-specific.

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Introduction

There is mounting evidence both for the use and the profitability of technical trading rules in foreign exchange markets.[1] Most studies of the effectiveness of technical trading rules concentrate on floating exchange rates. An exception is Lee and Mathur (1996), in which the authors examine the profitability of Moving Average trading rules for six European cross-rates. They find that the trading rules were unprofitable for four cross-rates and only marginally profitable for the other two cross-rates. In this paper we reconsider the evidence for the profitability of Moving Average trading rules, paying particular attention to a potential relationship between the credibility of a fixed exchange rate parity and trading rule profitability. Moreover, we examine for the cases of the British Pound and the Italian Lira whether joining/leaving the Exchange Rate Mechanism (ERM) of the European Monetary System (EMS) had an effect on the profitability of Moving Average trading rules. We find that not even during periods of low credibility of the underlying central parities did Moving Average trading rules generate profits for ERM exchange rates. Furthermore, we find strong evidence of a negative influence of participation in the ERM on trading rule profitability.

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[1]See e.g. Taylor and Allen (1992) for evidence on the use of technical analysis and Menkhoff and Schlumberger (1995) for a survey of the literature on the profitability of technical trading rules on foreign exchange markets.

Data and Methodology

The analysis uses daily exchange rate and interest rate data running from January 2, 1979, to November 28, 1997. We consider the Deutsche Mark (DM) exchange rates of the Dutch Guilder (NG), the French Franc (FF), the Italian Lira (IL) and the British Pound (GBP). Interest rates are daily overnight eurorates for each currency.[2]

When addressing the issue of the profitability of technical trading rules the first question that needs to be answered is which trading rules in particular should be looked at. This question is important since there is a risk that the choice of a trading rule is not independent of its performance during the sample period. The approach taken in this paper is to look at the most basic member of a trading rule class that is known to have been in wide use at the time our sample starts and to examine its profitability for all reasonable parameter values. We look at Moving Average (MA) trading rules, which, in their simplest form, state that one should go long in a currency if (as long as) the spot exchange rate is greater than the average of the exchange rates on the last N days.[3] Formally:

$$\phi_t = \begin{cases} +1 & s_t > \frac{1}{N} \sum_{i=0}^{N-1} s_{t-i} \\ -1 & s_t < \frac{1}{N} \sum_{i=0}^{N-1} s_{t-i} \\ \phi_{t-1} & s_t = \frac{1}{N} \sum_{i=0}^{N-1} s_{t-i} \end{cases} \tag{1}$$

s_t is the natural logarithm of the exchange rate (price notation from the point of view of the DM) and ϕ_t is the proportion of funds invested in the foreign currency at time t.[4] More 'sophisticated' versions of Moving Average trading rules use short moving averages in place of the spot exchange rate or include a filter to avoid so-called whiplash signals. We use the simplest version because it enables us to analyze its profitability exhaustively, since there is only one discrete parameter. Moreover, there is no clear evidence that greater 'sophistication' entails better performance in this context. Daily rates of return, r_t, are evaluated as follows:[5]

$$r_t = \phi_t(s_t - s_{t-1} - \frac{1}{260}(i_{t-1} - i_{t-1}^*)) - \frac{c}{2}(\phi_t - \phi_{t-1}) \tag{2}$$

i_t (i_t^*) are the DM (Non-DM) overnight eurorates; c is percentage transaction costs, which we assume to equal 0.05%.[6]

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[2] Exchange rates are ECU exchange rates at 2:15 Brussels time (prior to September 1988: 2:30 p.m.) as communicated by the Commission of the European Communities. Euromarket rates are Bid rates around 10 a.m. Swiss time. Source: BIS

[3] See e.g. Cornell and Dietrich (1978) for an assertion of the widespread use of Moving Average trading rules.

[4] N.B. ϕ_t = -1 can be interpreted as borrowing in the foreign currency (and at the foreign interest rate) and converting the proceeds into domestic currency, investing them at the domestic interest rate.

[5] N.B. Dividing the interest differential by 360 would lead to an understatement of the influence of interest differentials because of weekends. We divide by 260 (working days per year) instead so that interest effects are correctly accounted for *on average.*.

[6] This is the median value of transaction costs considered in the literature; e.g. Neely et al. (1996). Note also that the change in ϕ is divided by two in order to ensure that in the case of a change in position transaction costs are only paid once.

Profitability and Credibility

In order to analyze the relationship between the credibility of a fixed exchange rate regime and the profitability of technical trading rules we split up our sample into the following sub-samples: 1/2/1979 to 31/12/1986, 1/2/1987-8/1/1993 and 8/2/1993 - 11/28/1997. The first and second subsample are often referred to as the non-credible and credible EMS respectively (see e.g., Rose and Svensson, 1994). In August 1993, after almost a year of turbulence in the European foreign exchange markets, the official bandwidth of the exchange rate parities was increased to 15%.[7]

Figures 1 and 2 show the average annual rates of return of all Moving Average trading rules with parameter values between 2 and 500 for the NG/DM and the FF/DM exchange rates for each subperiod. The first point to note is that the trading rule returns are dominated by transaction costs and are thus on the whole negative. In particular, this is also true for the FF/DM exchange rate during the period before 1987, when its central parity was far from perfectly credible. In Figure 3 trading rule returns for the FF during this period are examined more closely. Net annual returns are split up into gross annual rates of return, average annual transaction costs and annual interest effects. Gross returns for the FF reach almost 5% in this period. The reason for this is that for long laglengths Moving Average trading rules will pick up long run trends in exchange rates and the FF depreciated considerably against the DM during the period between 1979 and 1987. These returns were, however, overcompensated by the interest differential.[8] This suggests that depreciations against the DM were taken ahead in the interest differentials and can be interpreted as casual evidence in favor of uncovered interest parity (UIP). It is interesting to note that this interpretation is consistent with Flood and Rose (1994), who find that UIP works much better for EMS exchange rates than for USD exchange rates.

Effects of ERM-Membership on MA Trading Rule Profitability

The most interesting cases for studying the influence of exchange rate regime on technical trading rule profitability are the British Pound and the Italian Lira. Whereas the Lira was a member of the ERM from the outset, the Pound only joined the ERM in October 1990. Both currencies left the ERM after massive speculative attacks in September 1992. For the GBP we split up the sample into the subsamples: 1/2/1979-10/5/1990, 10/8/1990-9/16/1992 and 9/17/1992-11/28/1997. For the Italian Lira we split up the sample into 1/2/1979-31/12/1986, 1/2/1987-9/16/1992 and 9/17/1992-11/28/1997.

Figures 4 and 5 show annual rates of return of Moving Average trading rules during the subsamples for all parameter values between 2 and 500. In contrast to the results for the NG/DM and FF/DM exchange rates, returns do not seem to be stable across subperiods. Whilst returns for the GBP tend to be greater than zero both before and after the member-

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[7] It is debatable whether one should not rather choose September 1992 as the end of the second subperiod. However, since neither the NG nor the FF were devalued between September 1992 and August 1993 the difference is likely to be small.

[8] The same holds also for the IL/DM exchange rate for this period. The details are left out for the sake of brevity.

ship in the ERM, returns during the membership are around zero. Similarly, there appears to be a surge in the profitability of the trading rules for the IL after it left the ERM.

Going beyond visual impressions, we test the hypothesis that the difference in mean returns between exchange rate regimes is zero against the hypothesis that it is positive by considering the following test statistic for each parameter value of the trading rule:

$$t = \frac{(\bar{x}_{float} - \bar{x}_{fix})}{\sqrt{\frac{s^2_{float}}{N_{float}} + \frac{s^2_{fix}}{N_{fix}}}}$$

where $\bar{x}_{(.)}$, $s^2_{(.)}$ and $N_{(.)}$ denote the mean, variance and size of the sample of trading rule returns for each regime. Figure 6 shows the values of the test statistic for both exchange rates. Whilst there is considerable variation in the values of the test statistic, most of them are at least marginally significant (one-sided test). When interpreting this result, a number of considerations should be born in mind. The first is that the GBP was only a member in the ERM for less than two years. This implies that the sample is not very large so that the test is not particularly powerful. Moreover, one might argue that another reason why the results are not stronger is that it takes some time before the full effects of joining a fixed exchange rate regime materialize. As regards the IL, one might argue similarly that after almost 14 years in the ERM and with the prospect of re-entering at a later stage and participating in the European Monetary Union, we are not dealing with the paradigmatic case of a freely floating exchange rate for the period between 1993 and 1997. In the light of these considerations we consider the results as strong evidence for the effect of exchange rate regime on technical trading rule profitability. In other words, technical trading rule returns appear to be regime-specific.

Conclusion

The analysis of the profitability of Moving Average trading rules for EMS currencies showed that the trading rules were not even profitable during periods of low credibility. An obvious limitation of the validity of this result is that only one trading rule class was considered. Whilst it is probably fair to assume that the results will remain valid for other trend-following trading rules like momentum or filter rules, the same cannot be said for technical trading rules in general. Thus, it remains to be seen whether there exist technical trading rules which can exploit time dependencies in ERM exchange rates.

More importantly, however, we provided evidence that Moving Average trading rules were much less effective when the IL and the GBP were members of the ERM than when they were not. It is a well known fact that exchange rate volatility is greater for floating exchange rates than for fixed ones. This is also true for the GBP and the IL during our sample period (the ratio of the standard deviation of exchange rate changes during membership of the ERM to during non-membership was 1.8 for the GBP and 2.9 for the IL). Flood and Rose (1993) argue that since few macroeconomic variables have exchange rate regime specific-volatility, they cannot be important determinants of exchange rate volatility. This raises the question of what else might be responsible for the relatively high volatility in floating exchange rates. Given that our results suggest that technical trading rule profitability is regime-specific, one explanation would be that technical trading creates volatility. So far we only know that

technical trading takes place on foreign exchange markets and that it is profitable. Further research will have to illuminate what mechanisms are responsible for the technical trading rule profitability for floating exchange rates and in what way the introduction of central exchange rate parities with bands renders technical trading unprofitable.

Acknowledgments

References

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Figure 1: Average Annual Returns of MA Trading Rules

NG/DM
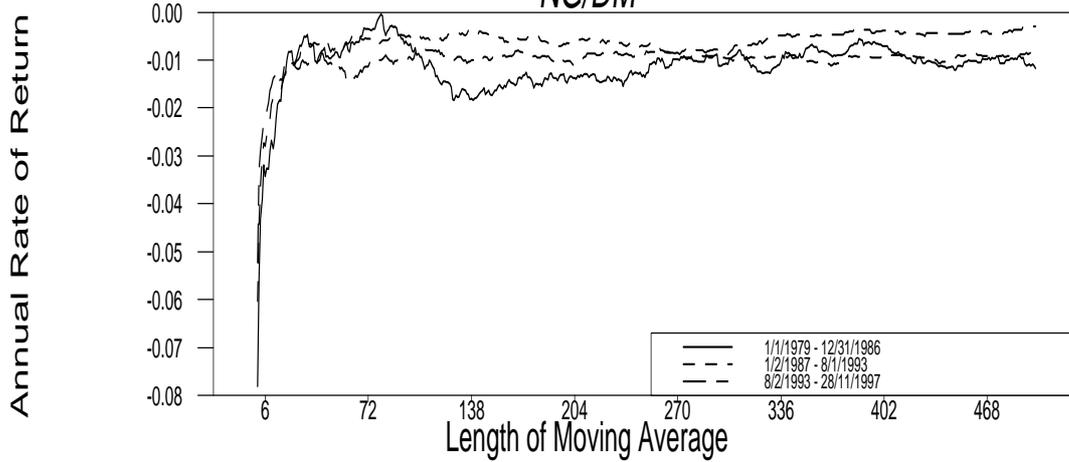
Figure 2: Average Annual Returns of MA Trading Rules

FF/DM
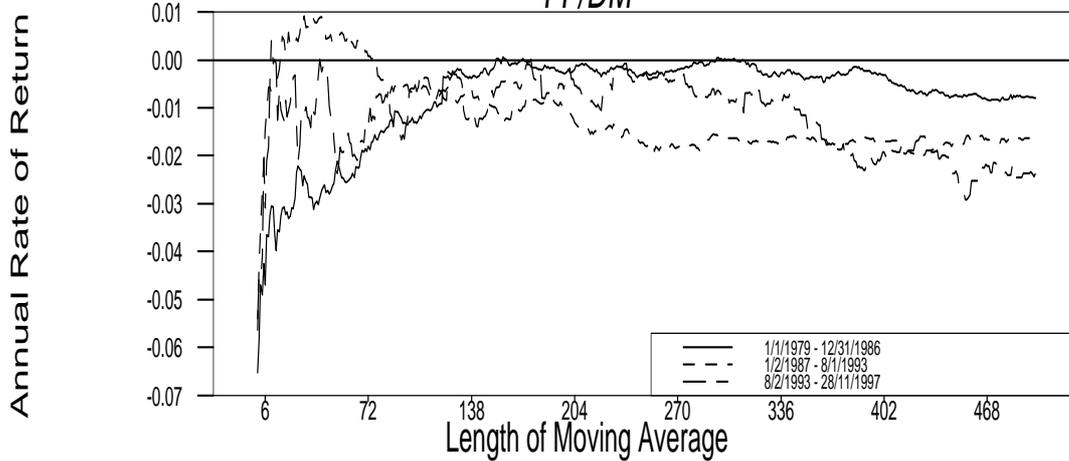
Figure 3: Analysis of Trading Rule Returns for FF/DM

1/2/1979 - 1/1/1987
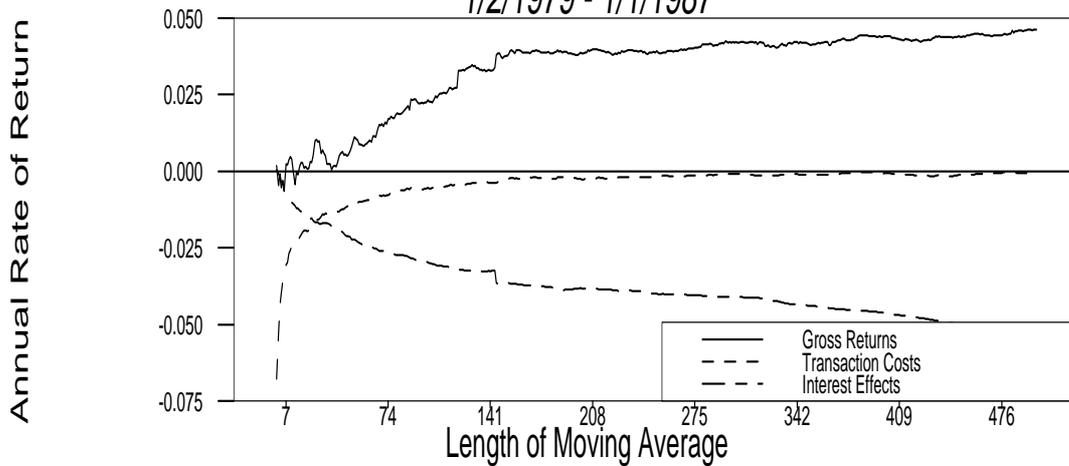
Figure 1:

Figure 4: Average Annual Returns of MA Trading Rules
IL/DM
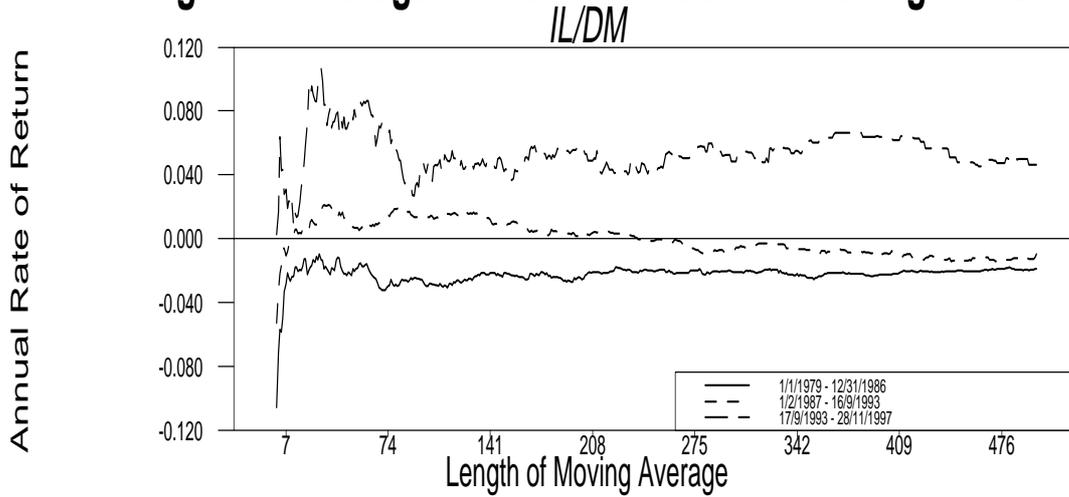
Figure 5: Average Annual Returns of MA Trading Rules
GBP/DM
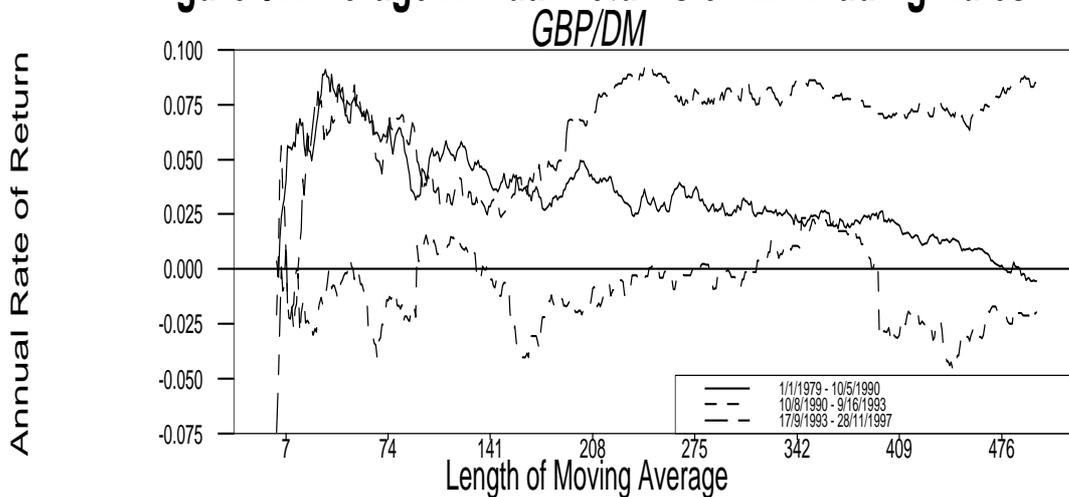
Figure 6: Tests of Difference in Means in Trading Rule Returns
Membership versus Non-Membership in the ERM

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Figure 2: