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Can Markov switching models replicate chartist profits in the foreign exchange market?

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Abstract

In this paper we show that the Markov switching model is a relevant statistical alternative to the classical martingale model for exchange rates. By extending the standard Markov switching model we decisively reject the martingale model. Moreover, the model generates autocorrelations and linear structures in line with what is observed in reality. Subsequently, we test whether this model can explain chartist profits. We find that the extended Markov switching model is able to explain the profitability of a simple MA-30 rule. Finally, we decompose the profitability of the MA-30 rule into a linear and nonlinear part. We find that, although the implied linear structure of the Markov model explains a substantial part of the profitability, part of the profits of the MA-30 rule can be attributed to the specific nonlinearities implicit in the Markov model.

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1. Introduction

The success of technical trading rules in, for instance, the foreign exchange market constitutes a major puzzle in international finance.[1] Not only does it create an anom-

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[1] For instance, Dooley and Shafer (1983), Sweeney (1986), Schulmeister (1987), LeBaron (1998), Gencay (1999) and Neely et al. (1997) convincingly show that, for most US–dollar exchange rates, standard moving average rules (MA-rules) yield excess profits, even after taking into account interest rate differentials and transaction costs.

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aly with respect to the efficient market hypothesis (satisfactory explanations based on risk premia do not (yet) exist)[2], it also raises questions about a more appropriate statistical and/or economic model for exchange rate returns than the standard martingale model. In this respect, technical trading rules are not very informative since most of these trading rules are not derived from a mathematically well-defined statistical or economic model. Instead, these rules are often ad hoc, with unknown statistical properties and, even worse, cannot be put into simple Markov-time algorithms (Neftci, 1991).[3] As a result, the statistical and/or economic sources (causes) of the profitability of technical trading rules are not clearly identified and isolated.

The contribution of this paper is to present an explicit nonlinear statistical alternative to the martingale model that allows us to analyze the source of the profitability of technical trading rules in greater detail. The class of statistical models considered in this paper is that of the Markov switching models. A priori this class of models emerges as a natural candidate since it is akin to technical trading rules in two respects. First, these models allow for stochastic trends ('long swings') in the asset price. Second, the Markov model implies that, as the filtering procedure of Hamilton (1989) shows, the sequence of past exchange rates contains useful information for the identification of the current trend of the exchange rate. Both features are in the core of the beliefs of technical traders. Moreover, the Markov switching models, as shown in this paper, belong to the class of price-trend models, introduced by Taylor (1980). Many of the statistical properties, including the linear representation, are known and can be tested in a straightforward manner.

An early test of the Markov switching model as a potential null model for explaining chartist profits can be found in LeBaron (1998). However, the standard Markov switching model fails to detect significant switches in the trend of the exchange rates. We argue in Section 2 that this failure of the Markov switching model could be due to the assumption of a single latent variable driving the dynamics (both in mean and variance) of exchange rate returns. We extend the Markov switching model so that regime identification for the mean and the variance dynamics is performed independently. Anticipating the results, we do find statistically significant trends of opposite signs in weekly exchange rates. The martingale model can thus be replaced by this nonlinear statistical alternative. This extended Markov switching model, moreover, passes several additional specification tests. First, it reproduces many of the observed linear characteristics of exchange rate returns: low autocorrelations, an ARMA(1,1) representation that is almost observationally equivalent to white noise and weak out-of-sample predictability. Second, for most of the exchange rates considered, the model replicates the profitability of moving average rules.

An important issue is whether these technical trading rules can be superior to standard linear time series analysis. Typically, technical trading rules will only be superior to standard linear models if (i) the exchange rate returns contain important

[2] See for instance Taylor (1992).

[3] Rules that are not Markov-time processes cannot generate trading indications based on current and historical information alone. They require additional and subjective judgements as for instance in the standard head and shoulder patterns.