Journal of International Money and Finance 32 (2013) 42–76

Contents lists available at SciVerse ScienceDirect

Journal of International Money and Finance

journal homepage: www.elsevier.com/locate/jimf

Learning to forecast the exchange rate: Two competing approaches

Paul De Grauwe [a], Agnieszka Markiewicz [b,*]

[a] Center for Economic Studies, Department of Economics, Naamsestraat 69, 3000 Leuven, Belgium
[b] Erasmus University Rotterdam, Erasmus School of Economics, PO Box 1738, 3000 DR Rotterdam, The Netherlands

JEL Codes:
F31
F37

Keywords:
Exchange rates
Adaptive learning
Bounded rationality

A B S T R A C T

This paper compares two competing approaches to model foreign exchange market participants' behavior: statistical learning and fitness learning. These learning mechanisms are applied to a set of predictors: chartist and fundamentalist rules. We examine which of the learning approaches is best in terms of replicating the exchange rate dynamics within the framework of a standard asset pricing model. We find that both learning methods reveal the fundamental value of the exchange rate in the equilibrium but only fitness learning creates the disconnection phenomenon and only statistical learning replicates volatility clustering. None of the mechanisms is able to produce a unit root process but both of them generate non-normally distributed returns.

1. Introduction

Exchange rate economics has been dominated by the rational expectations efficient market theory (REEM). This theory, however, has not been empirically validated. First, survey evidence indicates that traders' expectations strongly deviate from rational expectations (Frankel and Froot, 1987, 1990; Ito, 1990; Taylor and Allen, 1992 and Sarno and Taylor, 2002). Second, technical trading rules appear to make risk-adjusted excess returns, violating the efficient markets hypothesis (Sweeney, 1986; Pilbeam, 1995; Neely et al., 1997; LeBaron, 1999). As this empirical evidence against REEM theory has

* Corresponding author.
E-mail addresses: paul.degrauwe@econ.kuleuven.ac.be (P. De Grauwe), markiewicz@ese.eur.nl (A. Markiewicz).

0261-5606/$ – see front matter
doi:10.1016/j.jimonfin.2012.03.001

accumulated, researchers have increasingly looked for alternative modeling approaches. One of these approaches challenges the assumptions about the way the agents form their expectations.

First, in line with strong survey evidence, a number of studies have modeled the agents in the foreign exchange markets as chartists and fundamentalists. Frankel and Froot (1987, 1990) were the first to emphasize the impact of the trading strategies on the dynamics of the exchange rate. They argued that swings in the US dollar are due to the shifts in weights that markets give to different trading techniques. Subsequently, many studies demonstrated that the introduction of heterogenous investors into the exchange rate models can generate features observed in the data (See Goodhart, 1988; Frenkel, 1997; De Grauwe and Grimaldi, 2006a and 2006b).

Second, numerous studies, instead of assuming full rationality introduced adapting mechanisms into agents' behavior. Arifovic (1996) develops a two countries' overlapping generations (OLG) model where agents update their decisions using a selection mechanism based on a genetic algorithm. She finds that, in this model, the stationary rational expectations equilibria are unstable and result in persistent fluctuations of the exchange rate. Elaborating on the paper by Arifovic (1996), Lux and Schornstein (2005) find that the OLG model under genetic learning can generate fat tails and volatility clustering in the exchange rate series. Mark (2009) finds evidence that adaptive learning about Taylor rule fundamentals sheds some light on the real US dollar-DM exchange rate dynamics. Chakraborty and Evans (2008) propose a resolution of the Forward Premium Puzzle assuming that agents use perpetual learning. Kim (2009) and Lewis and Markiewicz (2009) demonstrate that learning about the monetary model can generate excess volatility of the exchange rate.

All these studies demonstrate that a departure from the Rational Expectations (RE) assumption can help in replicating the data features. It is not clear, however, what type of departure from RE is the best in explaining the dynamics of the foreign exchange market. Thus, the modeling choice of expectations formation in the foreign exchange markets remains an open question.

In this paper, we analyze this question. As in the related literature, we depart from RE and assume that heterogeneity prevails in the foreign exchange market. Deviating from RE creates the risk of introducing ad hoc assumptions, the number of which can be multiplied ad infinitum. We avoid this risk by imposing selection mechanisms that ensure that only the best performing forecasting rules survive. Thus, as in the spirit of RE-models, we impose a modeling discipline on agents, in that they continuously test and revise their expectation formation. Next, we compare the abilities of two different selection (learning) mechanisms in replicating features of the exchange rate series.

We assume that agents can use two different forecasting rules and combine them to form their expectations about the future exchange rate. The first one will be called a fundamentalist forecasting rule, the second one a chartist rule (technical analysis). We specify two alternative selection procedures (learning mechanisms). The first one is the dynamic predictor selection in the spirit of Brock and Hommes (1997, 1998) that will be called fitness learning. This mechanism assumes that agents evaluate forecasts by computing their past profitability. Accordingly, they increase (reduce) the weight of one rule if it is more (less) profitable than the alternative rule. In the second mechanism, agents learn to improve their forecasting rules using statistical methods as in the literature of adaptive learning in macroeconomics (see Evans and Honkapohja, 2001 for an overview). We investigate the behavior of the exchange rate within the framework of a standard asset pricing model. We examine which of the learning approaches is best in terms of replicating the exchange rate dynamics. We find that both learning methods reveal the fundamental value of the exchange rate in the equilibrium but only fitness learning creates the disconnection phenomenon and only statistical learning replicates volatility clustering. None of the mechanisms is able to produce a unit root process but both of them generate non-normally distributed returns.

The remainder of the paper is organized as follows. In Section 2, we develop the baseline model of the exchange rate and we specify the way agents form their expectations about the future exchange rate. Section 3 introduces the learning mechanisms of the agents. In Section 4, we study the equilibrium properties of the models. Section 5 presents a numerical analysis of the dynamics of the exchange rate and confronts the statistical properties of the exchange rate under the two learning rules with those of the data. In Section 6 we carry out the sensitivity and robustness analysis and Section 7 provides some concluding remarks.