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The unbeatable random walk in exchange rate forecasting: Reality or myth?

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ABSTRACT

It is demonstrated that the conventional monetary model of exchange rates can (irrespective of the specification, estimation method or the forecasting horizon) outperform the random walk in out-of-sample forecasting if forecasting power is measured by direction accuracy and profitability. Claims of outperforming the random walk in terms of the root mean square error are false because they are typically based on the introduction of dynamics, hence a random walk component, commonly without testing for the statistical significance of the difference between root mean square errors. And even if proper hypothesis testing reveals that a dynamic model outperforms the random walk, this amounts to beating the random walk by a random walk with the help of some explanatory variables. The failure of conventional macroeconomic models to outperform the random walk in terms of the root mean square error should be expected rather than considered to be a puzzle.

1. Introduction

Since the publication of the highly-cited paper of Meese and Rogoff (1983), it has become something like an undisputable fact of life that conventional exchange rate determination models cannot outperform the naïve random walk model in out-of-sample forecasting. This view is still widely accepted to the extent that it is typically argued that the Meese–Rogoff results, which are "yet to be overturned", constitute a puzzle. For example, Abhyankar et al. (2005) describe as a "major puzzle in international finance" the inability of models based on monetary fundamentals to outperform the random walk. Evans and Lyons (2005) suggest that the Meese–Rogoff finding "has proven robust over the decades". In another study they describe the finding as "the most researched puzzle in macroeconomics" (Evans and Lyons, 2004). Furthermore, Frankel and Rose (1995) argue that the negative results have had a "pessimistic effect" on the field of exchange rate modeling in particular and international finance in general. Likewise, Bacchetta and van Wincoop (2006) point out that the poor explanatory power of existing exchange rate models is most likely the major weakness of international macroeconomics. Empirical studies of exchange rate models typically corroborate the Meese and Rogoff results.

Several reasons have been put forward for the failure of exchange rate models to outperform the random walk. In their original paper, Meese and Rogoff (1983) attributed the failure to simultaneous equations bias, sampling errors, stochastic movements in the true underlying parameters, misspecification and nonlinearities (hence all of their explanations are

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related to the underlying econometrics). While Voss and Willard (2009) do not consider the forecasting accuracy of exchange rate models, they emphasize the point that monetary policy innovations have asymmetric effects on the exchange rate, which means that imposing the assumption of symmetry may be yet another reason for the failure to outperform the random walk.[1] Meese (1990) adds other explanations such as improper modeling of expectations and over-reliance on the representative agent paradigm. By referring to this paradigm, Meese seems to be questioning the theoretical pillars of conventional exchange rate models.

Contrary to what Meese and Rogoff found, some economists claim that it is possible to outperform the random walk (using the root mean square error and similar metrics as criteria) in the medium or long run (for example, Mark, 1995; Chinn and Meese, 1995; MacDonald, 1999; Mark and Sul, 2001). However, Berben and van Dijk (1998) and Berkowitz and Giorgianni (2001) criticize these studies, particularly the assumption of a stable cointegrating relation. Furthermore, Cheung et al. (2005) find that a wide range of models are not successful in forecasting exchange rates. Based on the root mean square error and similar metrics, the Meese and Rogoff results cannot be overturned and are still largely perceived to represent a puzzle. In fact we will find out that claims of the ability to outperform the random walk in terms of the root mean square error are based on flawed procedures. Emphasis must be placed on the phrase "root mean square error and similar metrics".

Two questions arise out of this state of affairs: (i) is failure to outperform the random walk a puzzle that constitutes failure of international monetary economics?; and (ii) is the random walk unbeatable in exchange rate forecasting? This paper addresses both of these questions. In particular, we endeavor to demonstrate that the "unbeatable random walk" is a myth by exploring the attempts that have been made to resolve the puzzle and by conducting some alternative empirical tests. Specifically, we re-examine the puzzle by (i) using measures of direction accuracy and profitability, in addition to the root mean square error, to judge forecasting power; (ii) introducing dynamics; and (iii) using time-varying parameters. To explore the possibility that models are more capable of outperforming the random walk over long forecasting horizons, we generate forecasts over horizons ranging between one month and six months.

We use only one of the models considered by Meese and Rogoff, the flexible-price monetary model, and justify this approach on three grounds.[2] First, in an exercise like this, one has to be selective with respect to model choice as to keep the results manageable. Cheung et al. (2005) argue that "any evaluation of these models must necessarily be selective" because "the universe of empirical models that have been examined over the floating period is enormous". Even within the class of nonlinear models, the choice is "infinite" (Taylor et al., 2001). Second, Moosa and Burns (2013a) have done similar work on the three macroeconomic models estimated by Meese and Rogoff (1983), using data covering the late 1970s and early 1980s. Their results turned out to be consistent across the three models. Likewise, Fullerton et al. (2001) use the monetary model and obtain results that they describe as "fairly weak for both specifications irrespective of the interest rate variable selected". The same conclusion is reached by Cheung et al. (2005) for a "wide variety of models". Last, but not least, demonstrating that at least one of the three models used by Meese and Rogoff outperforms the random walk is adequate for overturning their results and busting the myth. This is because they show that all of the three models fail to outperform the random walk.

As a preview, our results show that the random walk cannot be outperformed in terms of the root mean square error, which depends on the magnitude of the error only, irrespective of the forecasting horizon. In no case does hypothesis testing reveal that the static monetary model has a significantly (or even numerically) lower RMSE than that of the random walk. Introducing dynamics may alter this finding, but this procedure is flawed because it boils down to beating the random walk with another random walk (with the help of some explanatory variables). We argue that failure to outperform the random walk in terms of the RMSE is by no means a puzzle and that we should expect nothing but that. It is only in this sense that the results of Meese and Rogoff cannot be overturned. However, when forecasting power is measured in terms of direction accuracy and profitability, it is rather easy to outperform the random walk.

2. The benchmark results

2.1. Specification and testing

The basic flexible-price monetary model is specified as

$$s_t = \alpha_0 + \alpha_1(m_{a,t} - m_{b,t}) + \alpha_2(y_{a,t} - y_{b,t}) + \alpha_3(i_{a,t} - i_{b,t}) + \varepsilon_t \quad (1)$$

where s is the log of the exchange rate, m is the log of the money supply, y is the log of industrial production, i is the interest rate, and a and b refer to the countries having a and b as their currencies, respectively (the exchange rate is measured as the price of one unit of b—that is, a/b). The model is estimated over part of the sample period, $t = 1, 2, \ldots, m$, then a k-period-ahead forecast is generated for the point in time $m + k$. The forecast log exchange rate is

[1] With respect to the monetary model, asymmetry may mean one of two things: (i) the exchange rate responds differently to positive and negative changes in the explanatory variables or, when an error correction model is used, to positive and negative deviations from the long-run equilibrium condition; or (ii) relaxation of the assumption typically used in the construction of the monetary model about the cross-country equality of the income elasticities and interest semi-elasticities of the demand for money. Voss and Willard (2009) are concerned with symmetry in the first sense.

[2] These are the Frenkel–Bilson, Dornbusch–Frankel and Hooper–Morton models. None of these models in a basic static form turned out to be better than the other two as compared with the random walk.