



Contents lists available at ScienceDirect

## International Journal of Forecasting

journal homepage: [www.elsevier.com/locate/ijforecast](http://www.elsevier.com/locate/ijforecast)

## Can currency-based risk factors help forecast exchange rates?

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## ARTICLE INFO

## Keywords:

Exchange rates  
 Out-of-sample predictability  
 Economic value  
 Time series  
 Econometric models

## ABSTRACT

This paper examines the time series predictability of bilateral exchange rates from linear factor models that utilize the unconditional and conditional expectations of three currency-based risk factors. Exploiting a comprehensive set of statistical criteria, we find that all versions of the linear factor models largely fail to outperform the benchmark random walk with drift model for the out-of-sample forecasting of monthly exchange rate returns. This holds true for both individual currencies and currency portfolios formed on forward discounts. We also show that the information embedded in the currency-based risk factors does not generate systematic economic value for investors.

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## 1. Introduction

A voluminous body of literature, dating back to the work of Meese and Rogoff (1983a,b), suggests that exchange rates are very difficult to predict using traditional economic fundamental-based models, especially at short horizons.<sup>1</sup> It has become accepted widely in international

finance that individual exchange rates follow random walks closely (Della Corte & Tiakas, 2012; Engel & West, 2005; Verdelhan, 2013).

In an attempt to shed new light on this stylized fact, the recent literature has explored the predictive abilities of factor models. Engel, Mark, and West (2015) construct common factors from a panel of 17 currencies using the principal component decomposition. The idiosyncratic deviations from the factors are found to contain information that is useful for forecasting purposes. Greenaway-McGrevy, Mark, Sul, and Wu (2014) further analyze the information contained in three key currency pairs, namely the euro, the Japanese yen, and the Swiss franc against the US dollar (USD), and implement multilateral models of exchange rate variation. The authors show that the new multilateral models are able to outperform the conventional bilateral models significantly, using the purchasing power parity (PPP) as a benchmark. On a related topic, Berg and Mark (2014) explore the third-country effect, in order to

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<sup>1</sup> Chinn and Meese (1995) and Mark (1995) provide evidence that exchange rates are predictable at long horizons. More recently, Evans and Lyons (2002, 2005) resort to a microstructure approach and show that private order flow information helps to forecast exchange rates at short horizons. Furthermore, Molodtsova and Papell (2009) argue that exchange rates are predictable at short horizons using Taylor rule fundamentals. Note that Taylor (1993) posits a policy rule that closely approximates the Federal Reserve policy on adjusting the short-run nominal interest rate. The rule sets the policy rate based on the current inflation rate, the inflation gap, the output gap, and the equilibrium real interest rate. A non-exhaustive list of studies that have investigated the predictability of exchange rates from different perspectives includes

those of Cheung, Chinn, and Garcia Pascual (2005), Diebold and Nason (1990), Engel and Hamilton (1990), and Rossi (2013).

deal with the potential omitted variables problem in exchange rate forecasting.

The factor model approach has also been adopted with some success for the study of currency excess returns in a conventional asset pricing setting. Specifically, [Lustig, Roussanov, and Verdelhan \(2011\)](#) follow a portfolio approach that is consistent with the arbitrage pricing theory (APT henceforth) of [Ross \(1976\)](#), and construct two currency-based risk factors, namely the dollar risk (DOL) and the carry risk (HML). The former is the monthly average excess return between the domestic (US) and all other foreign currencies, while the latter is the monthly excess return differential between a basket of high interest rate currencies and a basket of low interest rate currencies. The in-sample results suggest that the DOL and HML factors account for most of the time series variation in excess returns of currency portfolios, sorted by forward discounts. The two factors also explain the time series movements in exchange rate returns at the portfolio-level. However, only the HML factor accounts for the cross-sectional heterogeneity in currency excess returns. Building on these findings, and consistent with the prediction of the intertemporal capital asset pricing model (ICAPM), [Menkhoff, Sarno, Schmeling, and Schrimpf \(2012\)](#) show empirically that innovations in the global foreign exchange (FX) volatility, VOL, also explain the time series and cross-sectional variation in carry trade portfolio excess returns.

While these studies report success for in-sample time series and cross-sectional modeling, policy makers and practitioners, including FX fund managers, are keenly interested in the accurate forecasting of future exchange rates, as a model's in-sample predictive performance tends to be correlated only poorly with its ability to generate satisfactory out-of-sample forecasts ([Inoue & Kilian, 2004, 2006](#)). There is ample evidence that unconditional and conditional versions of multifactor asset pricing models are often used to compute expectations of returns in practice, especially in the context of equity markets (see [Simin, 2008](#), and references therein). Hence, a natural question arises: do currency-based risk factors contain information that adds to the out-of-sample predictability of exchange rates? Motivated by this question, this paper investigates whether linear factor models with unconditional and conditional expectations of currency-based risk factors provide accurate forecasts of future bilateral exchange rate returns in the time series domain.<sup>2</sup> In particular, the primary goal of this paper is to examine whether

the asset pricing models proposed in the recent FX rate literature are able to provide accurate expectations of future exchange rate returns. We examine this issue for individual currencies and currency portfolios, sorted by forward discounts.

A second question that we are interested in is the economic value of the forecasts. Statistical significance does not always directly imply economic value from an investor's perspective ([Della Corte, Sarno, & Tsiakas, 2009; Thornton & Valente, 2012](#)). Hence, we extend the empirical analysis to a determination of the economic value of a dynamic mean–variance efficient asset allocation strategy that exploits the predictability in exchange rate returns. To do this, we quantify the portfolio payoffs to an investor who switches currency forecasts from the benchmark model to those from the competing linear factor models, assuming a reasonable level of risk aversion.

We contribute to the existing literature in several important ways. First, we focus on a very different set of potential predictors to the existing literature on exchange rate forecasting with macroeconomic fundamentals, a set which has been found to be significant in explaining the time variation of exchange rate returns and excess returns in-sample. Second, in contrast to the asset pricing literature, which is concerned mostly with explaining what generates the returns to risky assets, and especially with reference to the existence and dynamics of risk premia, we focus on the assessment of factor models based on forecast errors, rather than pricing errors. This differentiation allows us to achieve the main goal of the paper, which is to assess whether the asset pricing models proposed in the recent literature are able to provide accurate expectations of future exchange rate returns, while at the same time circumventing some well-known issues in the asset pricing literature (for example, among others, useless-factor biases, errors-in-variable problems, data-snooping biases, the use of weak instruments, etc.).<sup>3</sup> Third, we focus on both dimensions of the assessment of out-of-sample predictability: statistical and economic. In fact, while the existing literature on exchange rate predictability focuses mostly on the statistical evidence of it, very few studies have investigated the economic value of predictability that accrues to investors who exploit such a predictability in their asset allocation strategies. One common finding that is reported in this recent literature is that it is important to provide evidence of both, in order to determine whether any statistical evidence of predictability is also associated with a genuine economic value ([McCracken & Valente, 2014](#)).

The findings of our empirical investigation are as follows. First, we find that the random walk with drift benchmark remains the best-performing model in the out-of-sample horserace. Although the risk factors have been shown to be able to explain the in-sample time series variation of exchange rate returns and excess returns, they largely fail to outperform the baseline random walk with

<sup>2</sup> In our study, we focus on the predictability of nominal exchange rates instead of the predictability of currency excess returns (or deviations from the uncovered interest rate parity), as in the asset pricing literature, for two main reasons. First, we aim to contribute to the literature on exchange rate forecasting in the spirit of [Meese and Rogoff \(1983a\)](#). Second, and most importantly, the definition of currency excess returns shows that the predictability of exchange rates is tantamount to the predictability of currency returns, as interest rate differentials are predetermined variables at the time when the forecasts are made. A similar choice is often made in the context of equity markets, where it is normally the predictability of equity returns, not excess returns, that is investigated (see, among others, [Van Binsbergen & Koijen, 2010](#), and references therein).

<sup>3</sup> The methodology adopted in this paper also allows us to abstract from the debate on the efficiency differences between the estimates of the risk premia obtained using the traditional beta or the stochastic discount frameworks ([Cochrane, 2001; Farnsworth, Ferson, Jackson, & Todd, 2002; Jagannathan & Wang, 1996; Kan & Zhou, 1999](#)).

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