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An examination of the forward prediction error of U.S. dollar exchange rates and how they are related to bid-ask spreads, purchasing power parity disequilibria, and forward premium asymmetry

Marc W. Simpson[a,1], Axel Grossmann[b,*]

[a] The John B. and Lillian E. Neff Endowed Chair in Finance, The University of Toledo, 2801 W. Bancroft Street, Toledo, OH 43606, United States
[b] Department of Finance and Economics, College of Business Administration, Georgia Southern University, Statesboro, GA 30460, United States

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ABSTRACT

Using a panel data approach, we find statistically significant evidence that bid-ask spreads and deviations from purchasing power parity (PPP) are related to the forward prediction error of ten major U.S. dollar exchange rates over the post Plaza Accord period. Previous literature suggests that bid-ask spreads proxy for liquidity risk and deviations from PPP are a source of time-varying risk premiums. Additionally, the paper provides evidence that the forward discount bias is asymmetric with respect to the sign of the forward premium as well as to an undervalued and overvalued U.S. dollar.

1. Introduction

Baillie (2011) states: "The forward anomaly remains a paradox in international finance that is important and worthwhile to understand more fully." Along these lines, Pippenger (2011)

* Corresponding author. Tel.: +1 912 478 5512.
E-mail addresses: Marc.Simpson@UToledo.edu (M.W. Simpson), agrossmann@georgiasouthern.edu (A. Grossmann).
[1] Tel.: +1 419 530 4319.

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emphasizes that the forward rate puzzle is one of the most important puzzles in international finance.

According to financial theory, the forward exchange rate should be an efficient predictor of future spot exchange rates (Cumby & Obstfeld, 1984; Fama, 1984). Specifically, the covered interest rate parity hypothesis postulates that the forward premium is approximately equal to the difference between foreign and domestic interest rates:

$$f_t^k - s_t \approx i_t^{k*} - i_t^k, \tag{1}$$

where f_t^k is log of the k-period ahead forward rate available at time t, s_t, i_t^{k*}, and i_t^k are, respectively, the log of the spot foreign exchange rate, the foreign rate of interest over k-periods, and the domestic rate of interest over k-periods.

While, at the same time the uncovered interest rate parity condition postulates that the expected change in the exchange rate is also approximately equal to the difference of foreign and domestic interest rates:

$$E_t[s_{t+k}] - s_t \approx i_t^{k*} - i_t^k, \tag{2}$$

where $E_t[s_{t+k}]$ is the expectation at time t of what the log of the spot exchange rate will be at time $t+k$.

Combining these two hypotheses with the expectational efficiency hypothesis:

$$s_{t+k} = E_t[s_{t+k}] + \varepsilon_{t+k}, \tag{3}$$

leads to the hypothesis that the forward rate should be equal to the expected future spot rate, which on average will be equal to the actual spot rate.

$$f_t^k = E_t[s_{t+k}] + \varepsilon_{t+k} \tag{4}$$

This in turn implies that the forward prediction error ($f_t^k - s_{t+k}$) is equal to an independently distributed disturbance term ε_{t+k}, with a mean zero.

The literature, however, provides overwhelming evidence that the forward rate is a poor predictor of future exchange rate movements (e.g., Bansal, 1997; Bekaert & Hodrick, 1993; Bilson, 1981; Cumby & Obstfeld, 1984; Fama, 1984; Frankel & Poonawala, 2010; Froot & Thaler, 1990; Wu & Zhang, 1997). Morey and Simpson (2001a) show that the forward discount is not even a good predictor of the *direction* of change in the exchange rate. Nucci (2003) finds that a vector error correction model (VECM) based on forward premiums is unable to outperform the random walk in forecasting the spot exchange rates of the dollar-sterling and dollar-mark rates over 4- to 52-week forecast horizons.

One explanation presented in the literature for the poor performance of the forward rate in predicting spot rates is that the forward rate may not be equal to the expected future spot rate (i.e., Eq. (4) may not hold). Rather, the two could be separated by a time-varying risk premium (Domowitz & Hakkio, 1985; Fama, 1984; Frankel, 1982; Hansen & Hodrick, 1983; Hodrick & Srivastava, 1984; Korajczyk, 1985; Tai, 2003).[2]

Tests, in the literature, for the existence of a risk premium (e.g., Cornell, 1989) have estimated the following regression[3]:

$$f_t - s_{t+k} = \alpha + \sum_i^n \beta_i Rp_{i,t} + u_t \tag{5}$$

[2] Other theories attempting to explain the forward rate anomaly are those that postulate that the documented bias is: (i) an expectational error (Froot and Frankel, 1989); (ii) a combination of a risk premium and the failure of rational expectation (Cavaglia et al., 1994); (iii) a result of learning on the part of market participants and/or a "peso problem" (Bilson, 1981; Kaminsky, 1993; Lewis, 1989; Rogoff, 1979); (iv) a risk premium arising from deviations from absolute PPP (Levine, 1991); and (v) a fads-and-fashions hypothesis (Sercu and Vinaimont, 2006).

[3] The basis of this argument goes back to the general asset pricing model by Lucas (1978) according to which the risk premium can be expressed as the difference between the return on the benchmark portfolio from time t to time $t+k$, and the risk-free rate from time t to time $t+k$, both of which are dominated in the domestic currency.