

Forecasting exchange rates of major currencies with long maturity forward rates

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Extended abstract

In our pervious paper¹ we reported a strikingly new empirical observation: long maturity forward rates between bilateral currency pairs of the US, Germany, UK, and Switzerland are stationary, using monthly data from the past three decades. In order to increase the robustness of our results, we employed eight unit root tests and a stationarity test: all of these tests confirmed our main conclusion. Based on this result we suggested a new explanation for the UIP-puzzle maintaining rational expectations and risk neutrality.

We should highlight that the same tests that indicate non-stationarity of spot exchange rates and short maturity forward rates indicate stationarity of long maturity forward rates. Different order of integratedness of spot and long maturity forward rates could be possible only if long maturity interest rate differentials were also nonstationary, and if the spot rate and the long maturity interest rate differential were cointegrated. We found evidence for both implications. Moreover, we could not reject the parameter restriction implied by the definition of the forward rate when we tested restrictions on the cointegration space.

Cointegration, on the other hand, has the implication that at least one of two variables in the cointegration vector, that is, the spot exchange rate or the long maturity interest rate differential, could be forecasted using the previous period long maturity forward rate. The study of this question is the scope of the present paper. We found that the long maturity interest rate differential is weakly exogenous, while the spot exchange rate is not, implying that our model should be able to forecast the spot exchange rate. Our results confirm this hypothesis.

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¹ Zsolt Darvas, Gábor Rappai and Zoltán Schepp (2006). "Uncovering Yield Parity: A New Insight into the UIP Puzzle through the Stationarity of Long Maturity Forward Rates". De Nederlandsche Bank Working Paper No. 98. Available at: http://www.dnb.nl/dnb/home/file/Working%20Paper%20No.%2098-2006_tcm13-73823.pdf

In a related paper, using forward rates up to one year Clarida and Taylor (1997)² have already shown that the random walk model of exchange rate forecasting can be outperformed. However, the evaluation sample of Clarida and Taylor (1997) was 1990-1993 and when we extended the evaluation sample to 1990-2006, their model does not outperform the random walk anymore. In contrast, our model, using long maturity (e.g. 10 years of maturity) forward rates, does outperform the random walk in out of sample forecasting of the exchange rates of major currencies using the evaluation sample of 1990-2006.

The following table shows some of the key results. The first column shows results of our model, while the second column shows the same statistics for the forward rate. The first block shows mean absolute error (MAE) of out of sample forecasts as a percentage of the forecast error of the random walk, at the following forecast horizons: 1, 4 13, 26, 52 and 104 weeks. In general, the longer the horizon, the better the forecasting accuracy compared to the random walk. For example, in the case of the German mark/US dollar exchange rate³, the forecast error of our model compared to the random walk at 2-year forecasting horizon is 78.7%, while the error of the forward rate is 114.0%. The same general conclusion applies for the root mean squared error (RMSE) statistics, which are shown in the second block.

The third block shows the percent of correct sign predictions compared to the spot rate. Again, the performance of our model improves with the forecasting horizon, while the performance of forward rates worsens. For example, in the case of the German mark/US dollar exchange rate, our model correctly predicted the sign of future exchange rate movements at the 2-year forecasting horizon in 66.5% of the sample period, while the forward rate showed the correct direction of future exchange rate movements only in 25.7% of the sample.

Finally, the fourth block of the table shows the percent of correct sign prediction compared to the forward rate, which is perhaps an even more important statistics than the previous one, since an investor is interested in whether the future spot rate will be above of below the current forward rate. Again, the performance of our model improves with the forecast horizon. For example, in the case of the German mark/US dollar exchange rate, our model correctly predicted the sign of future exchange rate movements compared to the current forward rate at 2-year forecasting horizon in 78.6% of the sample period.

To sum up, our model indicates a substantial improvement in forecast accuracy of US dollar exchange rate at longer forecasting horizons using a very long time span (1990-2006) for evaluating the out of sample forecasts, while a previous model of the literature does not outperform the random walk in this longer sample.

² Clarida, Richard and Mark P. Taylor (1997). „The term structure of forward exchange rate premiums and the forecastability of spot exchange rates: Correcting the errors”. The Review of Economics and Statistics, LXXIX, 353-361.

³ Since 1999, German Mark exchange rates were calculated from euro rates using the fixed conversion rate, and German interest rates were substituted with euro interest rates.

Table 1. US dollar: Out of sample forecasting statistics

Mean Absolute Error (MAE), Random Walk = 100												
	Model assuming stationary long forward rate						Forward Rate					
	1W	4W	13W	26W	52W	104W	1W	4W	13W	26W	52W	104W
DEM	100.1	100.8	99.6	97.9	89.8	78.7	100.4	100.8	102.6	105.1	107.4	114.0
GBP	100.0	99.2	99.3	96.4	90.3	81.4	100.6	101.1	102.1	105.7	102.3	106.7
JPY	100.1	100.3	99.1	97.3	88.6	75.3	100.7	101.6	105.7	107.9	110.3	115.0
AUD	99.6	99.4	99.5	98.2	89.1	85.7	100.7	101.3	103.0	105.2	109.2	108.3
NZD	100.7	102.3	105.1	104.5	103.1	94.6	100.9	101.8	103.4	105.3	107.4	103.2
CAD	100.4	100.4	102.9	107.5	104.2	98.5	100.7	101.5	103.9	105.7	106.4	102.3
CHF	100.2	100.9	101.5	106.6	103.9	96.8	100.3	101.2	103.1	105.0	108.6	116.1
NOK	100.5	102.1	105.4	111.3	101.7	82.6	100.4	100.5	102.3	105.0	104.8	111.4
SEK	99.9	100.5	99.2	97.2	90.8	85.1	100.6	101.3	103.2	106.4	105.5	103.0

Root Mean Squarred Error (RMSE), Random Walk = 100												
	Model assuming stationary long forward rate						Forward Rate					
	1W	4W	13W	26W	52W	104W	1W	4W	13W	26W	52W	104W
DEM	100.1	99.9	99.7	98.3	90.5	76.8	100.1	100.6	102.0	104.4	108.7	112.0
GBP	99.9	99.5	98.3	96.0	92.4	83.1	100.1	100.3	101.0	102.1	101.6	102.8
JPY	100.0	100.2	100.7	99.2	96.7	81.0	100.2	100.9	102.7	105.2	112.1	115.6
AUD	100.0	100.4	100.4	99.0	91.0	80.9	100.2	100.9	103.4	106.6	108.6	107.9
NZD	100.2	101.1	103.2	104.0	100.1	92.0	100.3	101.2	103.5	106.2	107.5	107.4
CAD	100.2	100.8	102.9	105.1	102.4	96.9	100.2	100.8	102.7	103.9	105.4	104.1
CHF	100.2	101.1	104.0	108.0	105.9	97.2	100.1	100.7	101.8	103.9	108.2	112.2
NOK	100.3	101.1	103.6	106.9	102.3	89.8	100.0	100.1	101.4	103.7	106.5	112.7
SEK	100.3	101.2	101.4	98.4	93.2	85.1	100.1	100.0	99.5	100.2	100.6	100.5

Correct sign prediction compared to the spot rate (%)												
	Model assuming stationary long forward rate						Forward Rate					
	1W	4W	13W	26W	52W	104W	1W	4W	13W	26W	52W	104W
DEM	53.2	51.5	55.8	60.8	62.1	66.5	44.7	44.4	37.5	33.9	30.5	25.7
GBP	52.3	54.3	57.6	60.9	68.1	79.4	46.4	47.8	50.0	43.3	44.2	36.6
JPY	53.2	56.5	61.6	64.0	73.0	78.5	46.4	45.5	42.7	45.6	48.5	52.4
AUD	51.8	52.3	53.4	57.3	61.2	60.8	45.6	43.9	42.3	41.0	36.7	35.3
NZD	49.4	50.1	51.3	53.9	52.5	60.4	45.2	46.4	45.5	42.4	39.5	46.5
CAD	51.0	53.0	55.2	54.5	57.0	59.5	46.5	45.5	46.7	47.4	39.3	38.2
CHF	52.3	52.6	52.9	54.6	59.4	66.7	49.3	48.4	48.2	50.9	51.7	45.1
NOK	48.8	48.5	49.3	47.7	54.3	59.7	46.3	46.1	42.1	38.0	34.9	27.7
SEK	51.9	55.6	57.6	57.3	63.9	71.2	43.7	42.1	33.6	26.7	26.5	35.5

Correct sign prediction compared to the forward rate (%)												
	Model assuming stationary long forward rate											
	1W	4W	13W	26W	52W	104W						
DEM	54.4	54.8	58.7	64.5	65.2	78.6						
GBP	54.9	58.3	62.4	64.4	64.9	75.8						
JPY	55.8	57.5	66.9	69.5	70.9	74.9						
AUD	54.4	55.1	55.8	60.2	67.9	64.9						
NZD	51.4	51.4	52.5	55.6	52.8	52.4						
CAD	54.5	56.1	60.8	59.6	58.6	63.8						
CHF	52.4	54.9	59.3	62.5	68.0	86.0						
NOK	50.9	50.3	51.6	53.9	55.5	58.4						
SEK	53.7	57.9	62.2	65.5	72.1	75.4						

Notes: The sample period includes weekly data in 1979-2006. Out of sample evaluation of forecasts was performed in the 17-year long sample period of 1990-2006.