The Effects of Investor Sentiment on EUR/USD Exchange Rate

An Explanation of the UIP Puzzle

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Abstract

This paper demonstrates that investor sentiment plays a significant role in explaining the deviation from the Uncovered Interest rate Parity (UIP). To measure the investor sentiment, I apply new Sentix survey data including both economy sentiment index and exchange rate sentiment measured by the proportions of optimistic and pessimistic investors separately. The empirical study revisits the Fama Regression with investor sentiment. To examine the effects of sentiment dynamically, a VECM framework is used to test the effects of sentiment shocks on the deviation from UIP. The results suggest that the shocks of optimistic and pessimistic exchange rate sentiments last over longer horizons in contrast to transitory effects of the interest rate differential.

Introduction

According to Uncovered Interest rate Parity (UIP), domestic currency with higher interest rate tends to depreciate in the future against foreign currency with a lower interest rate. It implies that the expected change in exchange rate should equal the interest rate differential between the foreign and domestic countries. A regression of realized exchange rate changes on interest rate differentials should have a unity coefficient. However, UIP has been rejected by Fama (1984) and subsequent empirical studies with a consistently negative coefficient. The conjecture here is that sentiments drive the deviation between interest rate differential and the expected change of exchange rates, especially during the turmoil periods where sentiment may have played a more important role in determining the investor expectations.In this framework with the inclusion of investor sentiment, the shocks of both optimistic and pessimistic sentiment play a role in explaining the UIP puzzle. Another contribution of this study to the previous literature is that it covers the most recent turmoil periods from 2008 to 2015 which have been rarely covered by the previous empirical studies of exchange rates.

Sentiment and Its Measurements

To measure sentiment, I apply new survey data to measure the two types of sentiment, the economy sentiment index and the exchange rate sentiment.

Table B1—Sample Economy Sentiment Survey Questions

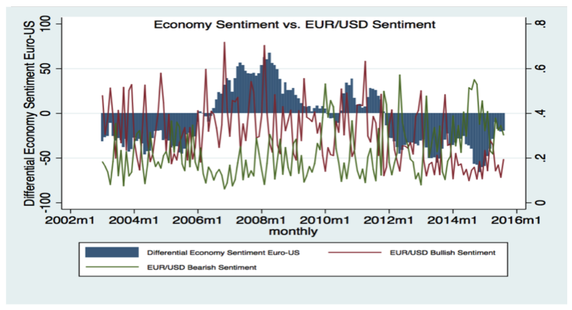
Economy Sentiment	Much Better	Better	Same	Worse	Much Worse
1 month ahead	○	○	○	○	○
6 month ahead	○	○	○	○	○

Note: There is five possible answer categories for the economic 6-month expectations: 1 = economy much better; 2 = better, 3 = same, 4 = worse, 5 = much worse. We take the arithmetic average of all answers, subtract it from 3 and multiply it by 50. You get a range from -100 (all say much worse) to +100 (all say much better).The five categories for the current situation are: 1 = very good, 2 = good, 3 = normal, 4 = bad, 5 = very bad. Construction: see above. Range: -100 to + 100.
Source: Sentix Global Investor Survey.

Table B2—Sample Economy Sentiment Survey Questions

EUR-USD	EUR-bullish	Neutral	USD-bullish	No opinion
1 month ahead	○	○	○	○
6 month ahead	○	○	○	○

Note: As all of data on financial markets the FX sentiment data is a net bulls indicator, i.e. they subtract from the percentage of investors who are bullish for a market the percentage of investors who are bearish while ignoring those who are neutral. I calculate the bullish and bearish sentiment through the net bulls indicator and the percentage of the investors with neutral beliefs. About 1,000 investors take part in our survey each week 750 individual (or retail) investors and 250 institutional investors (time series are here available for all investors [headline], individual investors, and institutional investors).
Source: Sentix Global Investor Survey.



A "Half-full and Half-empty" Model

The model design is inspired by a decision making model built by [1]. Assume that rational risk neutral investors assign equal weight to
$E[max\{\Delta s_{t+1} - (i_t - i_t^*), 0\}]$ and $E[min\{\Delta s_{t+1} - (i_t - i_t^*), 0]\}$. However, optimists and pessimists may assign different weights on the possible outcomes. For example, given mixed signals from the fundamentals suppose that an optimist who sees the glass half-full, overweights expectations positive excess return $\Delta s_{t+1} - (i_t - i_t^*) > 0$ relative to the negative excess return $\Delta s_{t+1} - (i_t - i_t^*) < 0$, while pessimists do the opposite. To introduce these optimistic and pessimistic sentiment, I use a fraction λ of the investors are optimists who have bullish sentiment on Euro and a fraction ω of the investor are pessimists who have bearish sentiment on Euro. If all investors are neutral then $\lambda = \omega = 0$ and the expected change of exchange rate is unbiased and UIP holds.

Then the deviation from UIP now is

$$D_t^{UIP} = \lambda E_t[max\{\Delta s_{t+1} - (i_t - i_t^*), 0\}] + \omega E_t[min\{\Delta s_{t+1} - (i_t - i_t^*), 0\}] \quad (1)$$

It implies the magnitude of the deviation from UIP can be explained by λ and ω. The "half-full, half-empty" model is capable of matching the stylized facts of the data summarized by Fama regression. More importantly, it shows that how sentiment affect the deviation from UIP.

$$cov(D_t^{UIP}, E_t(\Delta s_{t+1})) = (\lambda - w)(\sigma_u^2(1-\mu)^2/\rho N(d_+) - \sigma_x^2(1 - k(1-\mu))N(d_-)) \quad (2)$$

- Prediction 1: If $\lambda = \omega$, $D_t^{UIP} = E_t[\Delta s_{t+1} - (i_t - i_t^*)] = 0$ UIP holds.If the proportion of investors with bullish beliefs on the euro is equal to the proportion of investors with bearish beliefs on the euro, then UIP will hold. This implies that the absolute value of the coefficient of the bulls is the same as the absolute value of the coefficient of the bears and that there are no additional factors affecting expectations. However, the bullish and bearish are not same from the results of the empirical study. The size of the bulls coefficient is slightly larger than the size of the bear coefficient.
- Prediction 2: If λ,the proportion of investors with bullish beliefs on the euro increases, the deviation from UIP will move upward. In other words, the coefficient of the bulls will have a positive sign.
- Prediction 3:If ω,the proportion of investors with bearish beliefs on the euro increase, the deviation from UIP will move downward. In other words, the coefficient of the bears will have a negative sign.

Revisiting Fama Regression with Sentiment

Fama (1984) [3]provides a benchmark model for the UIP Puzzle.

$$s_{t+1} - s_t = \beta_0 - \beta_1(i_t - i_t^*) + \varepsilon_{t+1} \quad (3)$$

To examine the three predictions, I replace the interest rate differential with the economy sentiment differential and introduce the bullish and bearish exchange rate sentiments to the new regression.

$$D_t^{UIP} = \beta_0 - \beta_1(econsen_t - econsen_t^*) + \beta_2 Bull_t + \beta_3 Bear_t + \varepsilon_t \quad (4)$$

where $econsen_t$ denotes the US economy sentiment and $econsen_t^*$ denotes the EU economy sentiment, $Bull_t$ denotes the optimistic exchange rate sentiment and $Bear_t$ denotes the pessimistic exchange rate sentiment.

Table 3 reports that if there is a 10% increase of investors with bullish beliefs on the euro relative to the dollar, it will lead to a 0.94% increase of excess return of the EUR/USD exchange rate. Correspondingly, if there is a 10% increase of investors with bearish beliefs on the euro relative to the dollar, it will lead to a -0.75% decrease of the excess return of EUR/USD exchange rate. According to the summary of statistics, 0.94% and -0.75% demonstrate significant movement in the excess return of the foreign exchange rate, given the standard deviation of the excess return is only 0.3%. Compared to the small impact of the sentiment on fundamentals, direct sentiment on the EUR/USD exchange rate can explain the deviation from UIP better, because it is measured by the survey data containing various sources of forward-looking information used by investors to form their expectations.

Table 3—Regression table

	(Whole Sample) dpeur	(Global Financial Crisis) dpeur	(Euro Crisis) dpeur
$D_t^{EconSen}$	0.164***	-0.110	0.371
	(2.50)	(-0.19)	(1.80)
$Bull_t$	0.942***	-0.175	1.108
	(3.61)	(-0.10)	(1.53)
$Bear_t$	-0.753***	-3.935	-0.868
	(-2.62)	(-1.31)	(-1.48)
Constant	-0.123	0.782	-0.235
	(-0.88)	(0.72)	(-0.68)
Observations	151	20	20
R^2	0.378	0.3406	0.6041

t statistics in parentheses
Note: This table reports the results of estimating $D_t^{UIP} = \beta_0 - \beta_1(econsen_t - econsen_t^*) + \beta_2 Bull + \beta_3 Bear$Column 1 reports results using whole smaple and column 2 reports those using sub-sample of global financial crisis. Column 3 reports results using sub-sample of Euro debt crisis.
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Although both economy sentiment and exchange rate sentiment are significant, only the exchange rate sentiment has intuitive economic significance. By incorporating sentiments on exchange rate, the explanatory power of the new regression improves by 35%, compared to the regression on interest rate differential with near zero R^2.The exchange rate sentiment could be a better predictor since it has increasingly higher explanatory power and an intuitive economic significance.

VECM Results

I apply Vector Error Correction Model (VECM) due to the cointegration between the excess return of the exchange rate and interest rate differential.Some studies with previous non-crisis sample do not find cointegration, while the results from this study with most recent sample periods suggest that the excess return or the change of exchange rate follows the interest rate differential and the sentiments more tightly. The major goal of this section is to observe how the deviation from UIP moves over different horizons through the impulse response functions. Especially, how the deviation from UIP responded to both optimistic and pessimistic exchange rate sentiments.

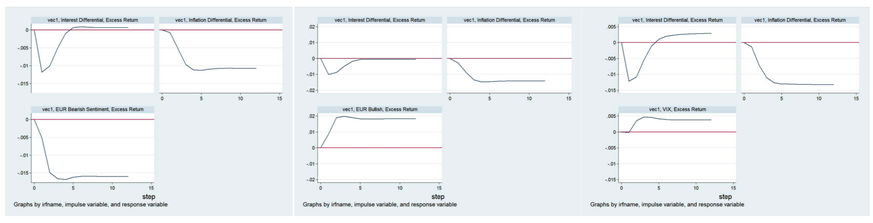


Figure 1: Impulse Response Function Graphs

Figure 1 shows the estimated effect of one standard deviation movement in optimistic sentiment for each horizon k=1, 16 months.The dynamic results confirm the predictions 2 and 3. Both optimistic and pessimistic sentiments have permanent effects on the deviation from UIP. However, the interest rate differential has only transitory effect.

Conclusion

The ability for this sentiment model to help explain the failure of UIP suggests that it may also shed some light on explaining the failure of other well-known exchange rate models, specifically by introducing the survey-based sentiment proxies. These results suggest two directions for further research. Empirically, the results support the usefulness of survey-based data on expectations and sentiment. Theoretically, this study motivates the incorporation of sentiment into exchange rate models. In practice, the sentiment approach proposed in this paper can be also applied by investors who intend to improve the forecast ability of excess return of exchange rate.

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