

Discussion:

“Crash Risk in Currency Markets”

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Background

Uncovered Interest Parity (UIP):

$$E_t s_{t+k} - s_t = i_t - i_t^*$$

Covered Interest Parity (CIP):

$$f_t - s_t = i_t - i_t^*$$

- ▶ s_{t+1} : log nominal exchange rate at time $t + 1$
- ▶ f_t : log forward exchange rate at time t
- ▶ i_t : domestic nominal interest rates at time t
- ▶ i_t^* : foreign nominal interest rates at time t

Fama Regressions

Testing based on predictive regressions (Fama, *JME*, 1984)

$$s_{t+1} - s_t = \alpha + \beta(f_t - s_t) + \varepsilon_{t+1}$$

$$s_{t+1} - f_t = \alpha + \gamma(f_t - s_t) + \varepsilon_{t+1}$$

- ▶ equivalent regressions since $\gamma = \beta - 1$
- ▶ $s_{t+1} - s_t$: **exchange rate return**
- ▶ $f_t - s_t$: **forward premium**
- ▶ $s_{t+1} - f_t$: **excess return to currency speculation**

Fama Regressions (cont'd)

Testing based on predictive regressions (Fama, *JME*, 1984)

$$s_{t+1} - s_t = \alpha + \beta(f_t - s_t) + \varepsilon_{t+1}$$

$$s_{t+1} - f_t = \alpha + \gamma(f_t - s_t) + \varepsilon_{t+1}$$

Under the null that UIP holds

- ▶ $\alpha = 0$
- ▶ $\beta = 1$ (no bias) or $\gamma = 0$ (no predictability)
- ▶ $\{\varepsilon_{t+1}\}$ are serially uncorrelated

Forward Premium Puzzle

The **forward premium puzzle** is a stylized fact

- ▶ β is close to **minus one**
- ▶ forward exchange rate is a biased predictor of the future spot rate
- ▶ high-interest currencies tend to appreciate rather than depreciate
- ▶ Fama (*JME*, 1984), Froot & Thaler (*JEP*, 1990), Engel (*JEF*, 1996), Bansal (*RFS*, 1997), Bansal & Dahlquist (*JIE*, 2000)

Forward Premium Puzzle (cont'd)

A basis for the **carry trade** strategy

- ▶ selling forward currency at premium and buying forward currency at discount yields a positive excess return (Bilson, *JB*, 1981; Backus, Gregory & Telmer, *JF*, 1993; Bekaert & Hodrick, *JF*, 1992)
- ▶ dynamic allocation strategies exploiting deviations from the UIP generate large economic gains to a risk-averse investors (Della Corte, Sarno & Tsiakas, *RFS*, 2009)

Forward Premium Puzzle (cont'd)

Bacchetta & van Wincoop (*AER*, 2009)

- ▶ agents make infrequent FX portfolio decisions

Lustig & Verdelhan (*AER*, 2007)

- ▶ focus on the cross-sectional variation between the returns of high and low interest rate currencies
- ▶ aggregate consumption growth risk matters

Burnside, Eichenbaum, Kleshchelski & Rebelo (2007)

- ▶ carry trade returns are uncorrelated to standard risk factors
- ▶ forward premium depends on market frictions

Forward Premium Puzzle (cont'd)

Excess returns to currency speculation

- ▶ sell low interest-rate currencies (*funding currencies*) and buy high interest-rate currencies (*investment currencies*)
- ▶ a risky strategy with large negative skewness
- ▶ excess returns exists to compensate investors for bearing risk

Brunnermeier, Nagel & Pedersen (NBER, 2009)

- ▶ carry traders are subject to crash risk
- ▶ negative skewness due to sudden unwinding of carry trades, which occur risk appetite and funding liquidity decrease
- ▶ high levels of the TED and the VIX predict higher future returns to the carry trade

This Paper

Carry trade investors might hedge this currency risk using foreign currency options

- ▶ a long position in the foreign currency + long put option
- ▶ a short position in the foreign currency + long call option

Difference between unhedged and hedged carry trade returns

- ▶ does not necessarily capture the compensation for bearing the risk of a large currency depreciation
- ▶ protection against large shocks
- ▶ protection against Gaussian shocks

This Paper (cont'd)

A simple model

$$ER = \pi^D + \pi^G$$

- ▶ π^D : Disaster risk premia
- ▶ π^G : Gaussian risk premia

This Paper (cont'd)

Findings based on zero investment strategies

- ▶ unhedged carry trade strategies: 6.5% excess return
- ▶ hedged 10 Δ carry trade strategies: 4.8% excess return
- ▶ hedged 25 Δ carry trade strategies: 3.8% excess return
- ▶ hedged *ATM* carry trade strategies: 1.70% excess return

Disaster risk premia can explain 20% of the carry trade returns

Comment I

BIS Triennial Survey (April, 2007)

- ▶ average daily turnover in FX markets: \$3.2 trillion
- ▶ average daily turnover in OTC options: \$212 billion
 - ▶ puts & calls
 - ▶ different strikes
 - ▶ different maturities

The **protection against FX risk** might be difficult in practice

- ▶ the potential trading of out-of-the-money options might move the prices up
- ▶ the prices used for the empirical analysis might not reflect the actual implementation of hedged carry trade strategies

Comment II

OTC currency option **quotes**

- ▶ the quotes are not made on option prices but on **implied volatilities**
- ▶ the invoice price based on the Garman–Kohlhagen formula

What is the empirical evidence on **implied volatility**?

$$RV_{t,t+1} = \alpha + \beta IV_t + \varepsilon_{t+1}$$

- ▶ an **upward-biased predictor** of future realized volatility (Jorion, *JF*, 1995; Poon & Granger, *JEL*, 2003)

Comment II (cont'd)

Premium for bearing volatility risk

- ▶ difference between realized and implied volatility (Carr & Wu, *RFS* 2009; Bollerslev, Tauchen & Zhou, *RFS* 2009)
- ▶ classic asset pricing model can explain a small part of the negative risk premiums
- ▶ in the presence of a volatility risk premium, the option price should be higher

How does this bias affect your empirical analysis?

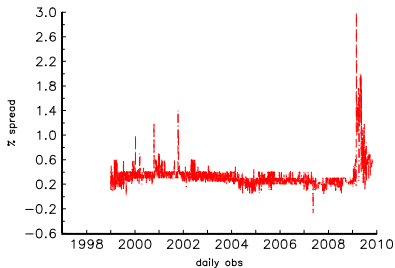
How does volatility risk premium relate to the crash risk premium?

Transaction Costs

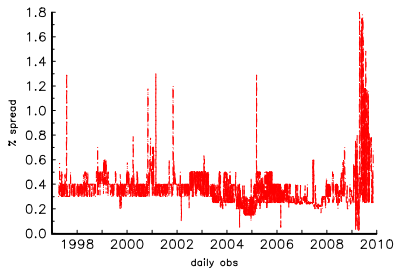
- ▶ daily ATM bid/ask IVOL quotes available from Reuters
 - ▶ EUR from 4 Jan 1999 to 17 Jun 2009: 47 *bps*
 - ▶ CHF from 7 Apr 1997 to 17 Jun 2009: 37 *bps*
 - ▶ AUD from 7 Apr 1997 to 17 Jun 2009: 47 *bps*
 - ▶ BRL from 16 Aug 2001 to 17 Jun 2009: 218 *bps*

Comment III (cont'd)

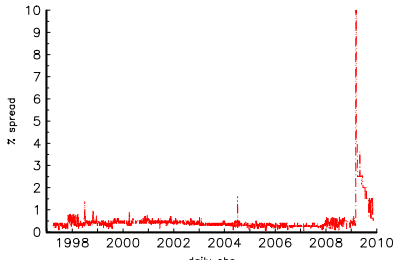
EUR



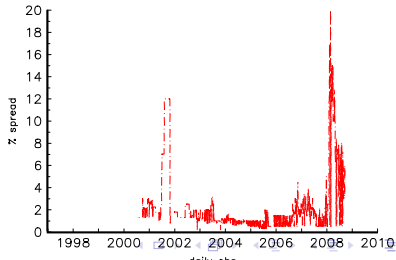
CHF



AUD



BRL



Comment III (cont'd)

Effective versus actual spread

- ▶ the ratio of effective to quoted spread is less than 0.5 (Mayhew, *JF*, 2002; De Fontnouvelle *et al.* *JF*, 2003)
- ▶ the ratio of effective to quoted spread fluctuates between 0.8 and 1. (Battalio, Hatch, and Jennings, *JF*, 2004)
- ▶ Goyal and Saretto (*JFE*, 2009) use 50%, 75%, and 100% of the quoted spread

Comment IV

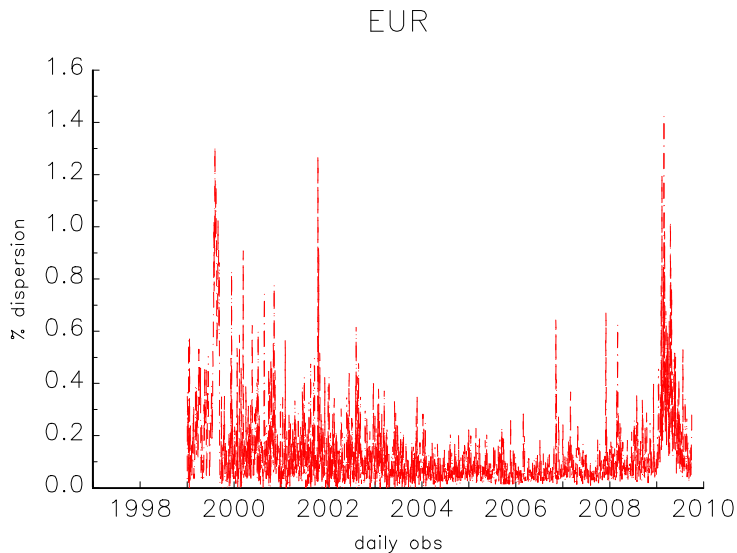
Average quotes

- ▶ the empirical analysis uses average quotes

These numbers comes from a **pool of dealers**

- ▶ this creates some measurement error
- ▶ a simulation study to account for this effect
 - ▶ TFS-ICAP FX
 - ▶ HSBC
 - ▶ Societe Generale
 - ▶ GFI Group
 - ▶ TullettPrebon
 - ▶ Bank of Tokyo Mits UFJ
 - ▶ Bank of America

Comment IV (cont'd)



Comment V

Bootstrap

- ▶ standard errors are obtained by bootstrapping the excess returns under the assumption that they are *i.i.d*
- ▶ I would suggest a block-bootstrap
- ▶ Does the statistical significance change?