The quanto theory of exchange rates

by Lukas Kremens and Ian Martin

Discussed by Urban Jermann

Contribution

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  - Quanto higher R2 than interest rates in sample
  - Out-of-sample KM equation beats UIP, RW and PPP

Theory

- No arbitrage

$$1 = E_t\left(M_{t+1}R^{\$}_{f,t}\right) \text{ and } 1 = E_t\left(M_{t+1}R^{i}_{f,t}\frac{e_{i,t+1}}{e_{i,t}}\right)$$

$$E_t\frac{e_{i,t+1}}{e_{i,t}} = \underbrace{\frac{R^{\$}_{f,t}}{R^{i}_{f,t}}}_{\text{UIP fcst}} - \underbrace{R^{\$}_{f,t}cov_t\left(M_{t+1}, \frac{e_{i,t+1}}{e_{i,t}}\right)}_{\text{residual-R1}}$$

KM equation

- Consider $1 = \frac{1}{R^{\$}_{f,t}} E^{*}_{t}\left(R_{t+1}\right)$ and $cov\left(x,y\right) = Exy - ExEy$

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- If R_{t+1} S&P500 and log-investor $M_{t+1} = 1/R_{t+1}$

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- Combined (and assuming known initial dividends)

$$\frac{Q_{i,t} - F_t}{R_{f,t}^i P_t} = \frac{1}{R_{f,t}^{\$}} cov_t^* \left(R_{t+1}, \frac{e_{i,t+1}}{e_{i,t}} \right)$$

KM equation different versions

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  - "Quanto" is short for "quantity adjusting option"

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Nikkei CME Futures USD Quanto - cov(NIK, JPY/$)

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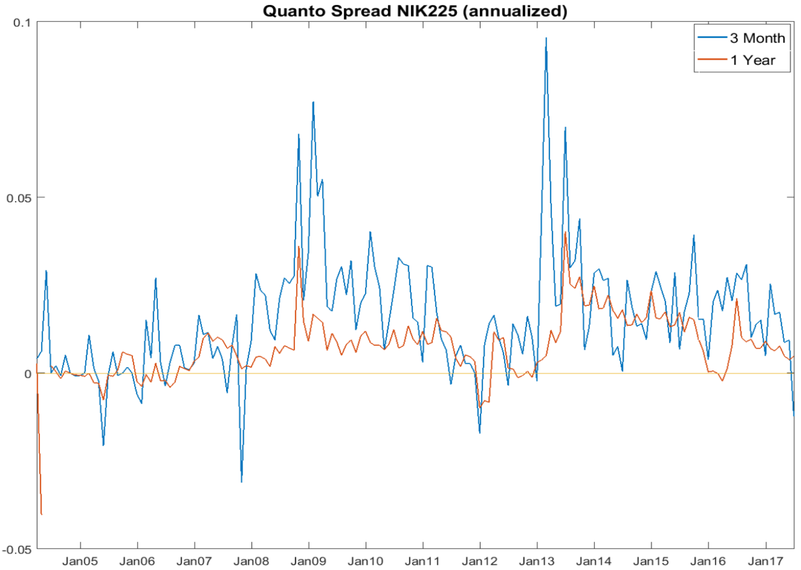

Out-of-sample forecasts JPY/USD, 2004-2017

-
$$
\begin{aligned}
KM \quad &: \quad E^Q\left(\frac{e_{t+1}}{e_t}\right) - 1 = \frac{Q_{t,t+1} - f_{t,t+1}}{f_{t,t+1}} + \frac{F_{t,t+1}}{S_t} - 1 \\
UIP \quad &: \quad E^U\left(\frac{e_{t+1}}{e_t}\right) - 1 = \frac{F_{t,t+1}}{S_t} - 1 \\
\text{Constant} \quad &: \quad E^C\left(\frac{e_{t+1}}{e_t}\right) - 1 = 0
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2004-2017	Squared err		Absolute err	
%	UIP	Constant	UIP	Constant
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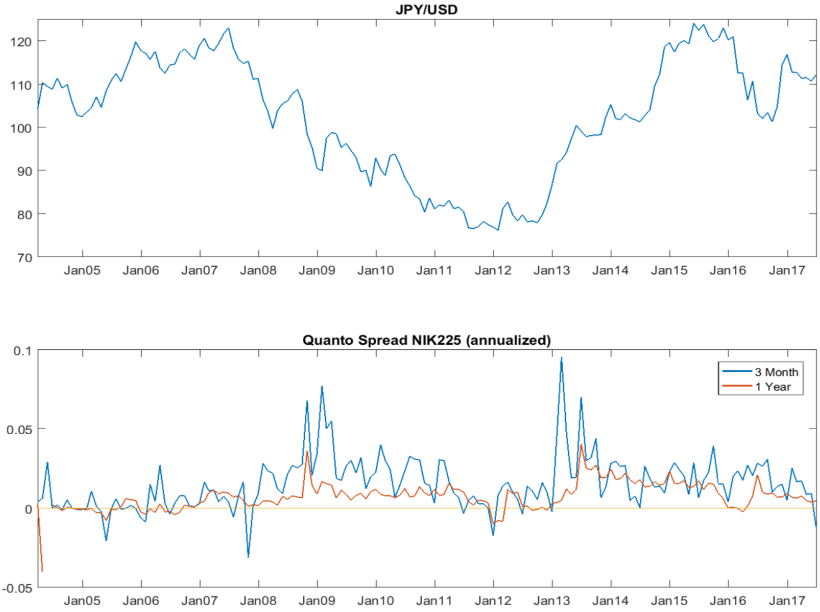
12/09-05/15				
3M	4.8	3.9	1.8	1.3
1Y	4.4	2	2.2	1.3


JPY/USD
120
110
100
90
80
70
Jan05
Jan06
Jan07
Jan08
Jan09
Jan10
Jan11
Jan12
Jan13
Jan14
Jan15
Jan16
Jan17
Quanto Spread NIK225 (annualized)
0.1
0.05
0
-0.05
3 Month
1 Year

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- To do: more data and more information about prices