Liquidity and Exchange Rates:

An Empirical Investigation

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- The literature on exchange-rate determination seems to have had little success in explaining nominal exchange rate movements:

"..there seems to be very little evidence that the supposed determinants of exchange rates—monetary policy and the determinants of real income and inflation—can explain exchange rate movements."

(Engel, Handbook of International Economics, vol. 4, 2015)

- The literature on exchange-rate determination has been in a funk ever since Meese and Rogoff (1983)

- We offer a new channel, the "liquidity yield" or "convenience yield", which appears to be very successful in helping to explain exchange-rate movements.

This ***liquidity*** or ***convenience yield*** refers to the non-monetary return that government short-term bonds provide because of their safety, the ease with which they can be sold, and their value as collateral.

- Our study uses measures of the liquidity yield on government bonds, as constructed by Du, et al. (2018a).
  - These measures take the difference between a riskless market rate and the government bond rate.
  - Moreover, the Du, et al. measure "corrects" for frictions in foreign exchange forward markets and for sovereign default risk.
- The liquidity yield can be associated with the deviation from uncovered interest parity that is now introduced as a standard feature in open-economy New Keynesian models.

The intuition for why the government bond convenience yield influences the exchange rate is straightforward.

- The liquidity that these bonds provide is attractive to investors, and influences their investment decisions as if the bonds were paying an unobserved convenience dividend.

- An increase in the liquidity yield, as measured by the difference between the private bond return and government bond return, will ceteris paribus lead to a currency appreciation much in the same way that an increase in the interest rate would affect the currency value.

Our model of convenience yield is reduced form, as in Krishnamurthy and Vissing-Jorgensen (2012), Nagel (2016), Engel (2016). It is meant to capture the intangible return on “liquid” or “safe” assets:

- Nickolas (2018) defines liquid assets as: “cash on hand or an asset that can be readily converted to cash. An asset that can readily be converted into cash is similar to cash itself because the asset can be sold with little impact on its value.”
- Gorton (2017) defines safe assets as: “A safe asset is an asset that is (almost always) valued at face value without expensive and prolonged analysis. By design, there is no benefit to producing (private) information about its value, and this is common knowledge.”

We examine the behavior of each of the so-called G10 currencies (the ten most heavily traded currencies):

- U.S. dollar
- Euro
- U.K. pound
- Japanese yen
- Canadian dollar
- Swiss franc
- Norwegian krone
- Swedish krona
- Australian dollar
- New Zealand dollar

This is <u>not</u> simply a study of the U.S. dollar, and, as we shall see, the results are not driven by the U.S. dollar.

Simple New Keynesian Model

Our baseline empirical specification is a single-equation for the exchange rate:

$$s_t - s_{t-1} = \beta_1 q_{t-1} + \beta_2 (\eta_t - \eta_{t-1}) + \beta_3 \left(i_t - i_t^* - \left(i_{t-1} - i_{t-1}^* \right) \right)$$
$$+ \beta_4 \eta_{t-1} + \beta_5 \left(i_{t-1} - i_{t-1}^* \right) + z_{j,t}$$

$\beta_1 < 0,\ \beta_2 < 0,\ \beta_3 < 0$

η_t is the home minus foreign liquidity yield

q_t is the log of the real exchange rate

The relative liquidity yield arises because agents have bonds for each country in the utility function as well as their own money.

$$i_t^{*m} + E_t s_{t+1} - s_t - i_t^m = r_t, \qquad r_t \text{ is an exogenous risk premium}$$

$$\eta_t = \left(i_t^m - i_t\right) - \left(i_t^{m*} - i_t^*\right)$$

$$\eta_t = \alpha\left(i_t - i_t^*\right) + v_t, \qquad \alpha > 0.$$

Engel (2016) proposes this model to explain excess reaction of exchange rates to interest rate changes.

Other building blocks:

Home less foreign Phillips curve (based on LCP):

$$\pi_t - \pi_t^* = \theta q_{t-1} + E_{t-1}s_t - s_{t-1}$$

Home less foreign Taylor rule

$$i_t - i_t^* = \sigma\left(\pi_t - \pi_t^*\right) + u_t - u_t^*$$

Exogenous shocks (to liquidity, money rules and risk premium) are first-order autoregressive processes.

Data

Liquidity premium: $\eta_t \equiv \left(i_t^m - i_t\right) - \left(i_t^{m*} - i_t^*\right) = f_{t,t+1} - s_t + i_t^* - i_t$

- End-of-month monthly data from January 1999 to December 2017. (Mostly on 1-year tenor converted to monthly yield.)
- Exchange rates and Forward rates from Thomson Reuters Datastream.
- The government yield data is obtained from Bloomberg, Datastream and central banks.
- Further data (for breakdown of the liquidity yield into components, for consumer prices, and for data used in instrumental variable regressions) is described in the paper and in detail in the supplemental appendix.

Table 1:
Correlation of η_t and $i_t - i_t^*$

Home Currency	Correlation of η_t and $i_t - i_t^*$
AUD	0.4110
CAD	0.4653
EUR	0.4374
JPY	0.1191
NZD	0.2208
NOK	0.4663
SEK	0.4261
CHF	0.1715
GBP	0.3934
USD	0.4937

2A. Estimation of: $\Delta s_{j,t} = \alpha_j + \beta_1 q_{j,t-1} + \beta_2 \Delta\eta_{j,t} + \beta_3 \Delta i^R_{j,t} + \beta_4 \eta_{j,t-1} + \beta_5 i^R_{j,t-1} + u_{j,t}$

Currency	$q_{i,t-1}$	$\Delta\eta_{j,t}$	$\Delta i^R_{j,t}$
AUD	-0.0305***	-5.3390***	-5.9205***
	(0.0072)	(0.7108)	(0.5445)
CAD	-0.0275***	-4.8147***	-5.3974***
	(0.0063)	(0.6024)	(0.4907)
EUR	-0.0202***	-4.8496***	-4.9312***
	(0.0060)	(0.5027)	(0.4114)
JPY	-0.0395***	-4.6732***	-6.3303***
	(0.0102)	(0.9231)	(0.7330)
NZD	-0.0286***	-6.6486***	-5.7917***
	(0.0083)	(0.6844)	(0.6054)
NOK	-0.0192***	-4.1850***	-4.8424***
	(0.0069)	(0.6038)	(0.4909)
SEK	-0.0217***	-4.6015***	-4.5942***
	(0.0063)	(0.5656)	(0.4679)
CHF	-0.0123*	-2.4595***	-2.7491***
	(0.0064)	(0.6929)	(0.5530)
GBP	-0.0230***	-3.6179***	-5.1773***
	(0.0067)	(0.6493)	(0.5185)
USD	-0.0114*	-6.4713***	-4.6688***
	(0.0069)	(0.7019)	(0.5697)

- Parameters are all estimated with the correct sign.
- Statistically significant at 1% level for all but two cases of the error correction term, using GLS standard errors
- “Within” R-squares average around 0.16
- Omitting the liquidity yield term cuts the R-squared roughly in half
- Less data on monthly tenor, but the baseline regression is essentially unchanged

2C. Estimation of: $\Delta s_{j,t} = \alpha_j + \beta_1 q_{j,t-1} + \beta_2 \Delta \eta_{j,t} + \beta_3 \Delta i^R_{j,t} + \beta_4 \eta_{j,t-1} + \beta_5 i^R_{j,t-1} + u_{j,t}$

Currency	$\Delta \eta_{j,t}$	Within R^2	$\Delta \eta_{j,t}$	Within R^2
	1999M1-2007M12		2008M1-2017M12	
AUD	-3.4161***	0.0990	-6.4067***	0.2990
	(1.3035)		(0.8303)	
CAD	-2.6968**	0.0916	-5.9904***	0.2878
	(1.1011)		(0.6854)	
EUR	-2.5990***	0.0446	-5.7893***	0.2549
	(0.8329)		(0.6234)	
JPY	-1.3979	0.0411	-6.1979***	0.3270
	(1.3078)		(1.1636)	
NZD	-4.4150***	0.0977	-7.7741***	0.3265
	(1.1288)		(0.8368)	
NOK	-3.5898***	0.0906	-5.1350***	0.2572
	(0.9989)		(0.7508)	
SEK	-2.7805***	0.0744	-5.9492***	0.2348
	(0.9110)		(0.7041)	
CHF	-0.9278	0.0281	-3.1122***	0.0920
	(0.9937)		(0.9611)	
GBP	-4.0058***	0.0996	-3.9298***	0.1961
	(0.8895)		(0.8882)	
USD	-4.0426***	0.0805	-7.3408***	0.3191
	(1.1276)		(0.8293)	

Decomposing the Measure of the Convenience Yield

Following the methods of Du et al. (2018a), we adjust the η_t for two frictions:

1. There may be default risk on government bonds. We adjust using credit default swaps on government bonds.

$$l_{j,t}^{R} = CDS_t - CDS_{j,t}^{*}$$

2. Failure of covered interest parity:

$$\tau_t \equiv f_{t,t+1} - s_t + IRS_t^{*} - IRS_t$$

CDS_t is the credit default swap premium
IRS_t is the interest rate on a LIBOR swap

The meaning of the correction for the credit default swap premium is fairly clear. The deviation from CIP is less obvious.

Suppose we find:

$$IRS_t < f_{t,t+1} - s_t + IRS_t^*$$

- Borrowing in home currency (or selling home currency deposits) is first step in profitable arbitrage
- Possibly there is counterparty risk
- Literature found in the wake of the crisis that banks were unwilling to take the first step for liquidity reasons
- Du et al. (2018b) argue that in recent years, regulatory constraints keep banks from taking advantage of the crisis.

We can conclude (ceteris paribus) that if

$l^R_{j,t} = CDS_t - CDS^*_{j,t} > 0 \quad \Rightarrow$ home depreciation

$\tau_t \equiv f_{t,t+1} - s_t + IRS^*_t - IRS_t > 0 \Rightarrow$ home appreciation

$\lambda_{j,t} = \left(IRS_t - i_t\right) - \left(IRS^*_t - i^*_t\right) + l^R_{j,t} > 0 \Rightarrow$ home appreciation

We have decomposed η_t as:

$$\eta_{j,t} = \tau_{j,t} - l^R_{j,t} + \lambda_{j,t}$$

Much of the CDS data is available only starting in 2008.

Table 3A: Estimation of

$$\Delta s_{j,t} = \alpha_j + \beta_1 q_{j,t-1} + \beta_2 \Delta\lambda_{j,t} + \beta_3 \Delta\tau_{j,t} + \beta_4 \Delta l^R_{j,t} + \beta_5 \Delta i^R_{j,t} + \beta_6 \lambda_{j,t-1} + \beta_7 \tau_{j,t-1} + \beta_8 l^R_{j,t-1} + \beta_9 i^R_{j,t-1} + u_{j,t}$$

Currency	$\Delta\lambda_{i,t}$	$\Delta\tau_{i,t}$	$\Delta\lambda_{i,t}$	$\Delta\tau_{i,t}$	$\Delta l_{i,t}$
	Full sample, no default risk		Post 2008, with default risk		
AUD	-6.3787***	-2.6578**	-7.4617***	-3.1457**	14.7568***
	(0.7812)	(1.2346)	(1.0288)	(1.5220)	(2.3365)
CAD	-4.9935***	-5.2896***	-8.8411***	-6.5675***	7.9128***
	(0.6860)	(1.1315)	(1.4732)	(1.8146)	(2.5599)
EUR	-4.9026***	-5.0570***	-6.6893***	-4.2515***	8.8972***
	(0.5501)	(0.8690)	(0.7541)	(0.9554)	(1.6703)
JPY	-4.6559***	-4.8887***	-7.7273***	-4.1051**	10.7033***
	(0.9652)	(1.5870)	(1.2821)	(1.8507)	(3.1228)
NZD	-7.0842***	-5.8046***	-8.7088***	-5.7615***	12.8062***
	(0.7435)	(1.2976)	(0.9713)	(1.4493)	(2.4061)
NOK	-4.0191***	-5.2591***	-5.4088***	-5.9528***	4.4098**
	(0.6412)	(1.0521)	(0.7841)	(1.2098)	(1.9514)
SEK	-4.4944***	-5.3331***	-5.8851***	-4.4986***	7.9955***
	(0.6227)	(0.9898)	(0.8423)	(1.1514)	(1.9317)
CHF	-3.2245***	-1.1683	-3.3282**	-1.2908	5.7111**
	(0.7445)	(1.1991)	(1.3030)	(1.7977)	(2.4801)
GBP	-4.4864***	-1.5008	-6.7052***	-0.5774	6.2626***
	(0.7222)	(1.1274)	(1.0491)	(1.4327)	(2.3370)
USD	-6.4019***	-6.6686***	-9.0553***	-3.1576**	12.8399***
	(0.7961)	(1.1977)	(1.0578)	(1.2571)	(2.1562)

Also, using various combinations to measure liquidity premium:

$$\Delta s_{j,t} = \alpha_j + \beta_1 q_{j,t-1} + \beta_2 \Delta X_{j,t} + \beta_3 \Delta i^R_{j,t} + \beta_4 X_{j,t-1} + \beta_5 i^R_{j,t-1} + u_{j,t}$$

	$\Delta\lambda_{j,t}$	$\Delta\tau_{j,t}$	$\Delta l^R_{j,t}$	$\Delta(\eta + l^R)_{j,t}$	$\Delta(\eta - \tau)_{j,t}$	$\Delta(\tau - l^R)_{j,t}$
AUD	-4.9409***	-1.3686	10.0618***	-4.6872***	-6.1165***	-4.5814***
	(1.0048)	(1.2931)	(2.2422)	(0.9077)	(0.7759)	(1.3030)
CAD	-4.2036***	-4.4387***	1.0784	-5.4798***	-4.1746***	-1.9662
	(1.2908)	(1.1314)	(2.3145)	(1.2088)	(0.7070)	(1.4628)
EUR	-3.7800***	-3.2481***	2.3930	-4.3451***	-3.7916***	-2.7033***
	(0.7210)	(0.8791)	(1.5863)	(0.6025)	(0.5614)	(0.8304)
JPY	-6.0074***	-5.8137***	4.8197	-5.1391***	-4.7219***	-6.3245***
	(1.2964)	(1.6414)	(3.1232)	(1.0822)	(0.9851)	(1.6541)
NZD	-6.5108***	-3.9589***	5.4492**	-6.3109***	-6.5900***	-5.1851***
	(0.9994)	(1.4490)	(2.7686)	(0.8332)	(0.7558)	(1.4764)
NOK	-4.4154***	-3.1094***	-1.0486	-5.0066***	-3.0522***	-3.4876***
	(0.7597)	(1.0681)	(1.9650)	(0.6532)	(0.6432)	(1.0904)
SEK	-4.4745***	-4.5536***	4.1663**	-4.6544***	-4.1911***	-4.1806***
	(0.7986)	(0.9987)	(1.8565)	(0.6641)	(0.6247)	(1.0064)
CHF	-2.1524*	-1.5412	2.4804	-1.7903*	-3.3225***	-2.2369
	(1.1963)	(1.2065)	(2.2440)	(0.9853)	(0.7500)	(1.4320)
GBP	-5.4983***	-0.6737	1.3490	-3.8347***	-4.3516***	-0.6428
	(0.9790)	(1.1507)	(2.2500)	(0.8436)	(0.7130)	(1.2233)
USD	-5.5667***	-6.0582***	5.5026**	-4.8380***	-6.1387***	-4.8923***
	(1.0809)	(1.2425)	(2.1456)	(0.8433)	(0.8173)	(1.1735)

Next, we consider IV regressions, where we instrument for the liquidity return. The first stage explanatory variables include:

- Each country's government debt/GDP ratio

- Measures of global uncertainty:
  - log of VIX
  - log of the gold price
  - G10 cross-country average square inflation rates
  - G10 cross-country average unemployment rates
  - G10 cross-country average square of change in bilateral exchange rates
  - G10 cross-country average absolute change of bilateral exchange rates.

4A: IV Estimation of $\Delta s_{j,t} = \alpha_j + \beta_1 q_{j,t-1} + \beta_2 \Delta\eta^{IV}_{j,t} + \beta_3 \Delta i^R_{j,t} + \beta_4 \eta^{IV}_{j,t-1} + \beta_5 i^R_{j,t-1} + u_{j,t}$

Home Currency	$q_{j,t-1}$	$\Delta\eta^{IV}_{j,t}$	$\Delta i^R_{j,t}$
AUD	-0.0182*	-17.0266***	-8.8974***
	(0.0093)	(3.7170)	(1.1396)
CAD	-0.0290***	-7.6484**	-6.2382***
	(0.0073)	(3.6364)	(0.9409)
EUR	-0.0246***	1.3828	-3.7141***
	(0.0075)	(4.1700)	(1.0582)
JPY	-0.0442***	-10.1391***	-7.7683***
	(0.0117)	(2.6397)	(0.8911)
NZD	-0.0293***	-5.2977*	-5.3265***
	(0.0088)	(2.7792)	(1.6711)
NOK	-0.0298***	-3.2807**	-5.2510***
	(0.0084)	(1.4327)	(0.6657)
SEK	-0.0190***	-8.2410***	-5.8034***
	(0.0068)	(2.3286)	(0.8931)
CHF	-0.0226***	0.3327	-2.2326**
	(0.0072)	(2.2550)	(0.8720)
GBP	-0.0320***	-1.7996	-5.8151***
	(0.0084)	(3.2033)	(1.3182)
USD	-0.0135*	-9.2556***	-4.7571***
	(0.0072)	(2.3212)	(0.8106)

4B: IV Estimation of $\Delta s_{j,t} = \alpha_j + \beta_1 q_{j,t-1} + \beta_2 \Delta\lambda_{j,t}^{IV} + \beta_3 \Delta i_{j,t}^{R} + \beta_4 \Delta\tau_{j,t} + \beta_5 \lambda_{j,t-1}^{IV} + \beta_6 i_{j,t-1}^{R} + \beta_7 \tau_{j,t-1} + u_{j,t}$

Home Currency	$q_{j,t-1}$	$\Delta\lambda_{j,t}^{IV}$	$\Delta i_{j,t}^{R}$
AUD	-0.0102	-24.9952***	-9.8666***
	(0.0099)	(4.6661)	(1.1951)
CAD	-0.0344***	-1.5869	-5.5205***
	(0.0079)	(5.6475)	(1.3158)
EUR	-0.0166**	-13.3353***	-7.4410***
	(0.0072)	(4.9401)	(1.4360)
JPY	-0.0477***	-13.1494***	-8.4330***
	(0.0112)	(3.8930)	(1.1123)
NZD	-0.0303***	-3.7798	-4.5362***
	(0.0085)	(2.8907)	(1.6557)
NOK	-0.0292***	-3.3983**	-5.3524***
	(0.0082)	(1.4216)	(0.6504)
SEK	-0.0191***	-7.3888***	-5.5197***
	(0.0068)	(2.6811)	(0.9683)
CHF	-0.0182***	-2.4555	-3.1620**
	(0.0070)	(3.7449)	(1.3291)
GBP	-0.0278***	-12.9091***	-9.7463***
	(0.0086)	(4.5728)	(1.7805)
USD	-0.0136*	-13.7203***	-5.7647***
	(0.0075)	(3.1740)	(0.9762)

4C: IV Estimation result of

$$\Delta s_{j,t} = \alpha_j + \beta_1 q_{j,t-1} + \beta_2 \Delta\lambda_{j,t}^{IV} + \beta_3 \Delta\tau_{j,t} + \beta_4 \Delta l_{j,t}^{R} + \beta_5 \Delta i_{j,t}^{R} + \beta_6 \lambda_{j,t-1}^{IV} + \beta_7 \tau_{j,t-1} + \beta_8 l_{j,t-1}^{R} + \beta_9 i_{j,t-1}^{R} + u_{j,t}$$

Home Currency	$q_{j,t-1}$	$\Delta\lambda_{j,t}^{IV}$	$\Delta i_{j,t}^{R}$
AUD	-0.0488***	-15.2489***	-8.9396***
	(0.0173)	(4.1251)	(1.2483)
CAD	-0.0310*	-14.8630*	-10.6889***
	(0.0176)	(8.9235)	(2.9750)
EUR	-0.0525***	-12.4744***	-9.7855***
	(0.0122)	(4.2998)	(1.7863)
JPY	-0.0712***	-10.5425***	-12.0824***
	(0.0178)	(3.7775)	(1.5085)
NZD	-0.0514***	-6.0990**	-6.6480***
	(0.0161)	(2.4091)	(1.5336)
NOK	-0.0469***	-4.5511***	-7.0127***
	(0.0117)	(1.3594)	(0.9764)
SEK	-0.0466***	-7.6232***	-6.8632***
	(0.0124)	(2.9487)	(1.3040)
CHF	-0.0282**	13.2454***	6.7238***
	(0.0133)	(4.6938)	(2.2787)
GBP	-0.0407**	-12.5210***	-12.0288***
	(0.0165)	(4.1786)	(2.2067)
USD	-0.0617***	-18.4555***	-12.9355***
	(0.0163)	(3.3857)	(1.4948)

Is everything driven by only a few currencies, or a single currency?

Here we measure the liquidity yield in each country (and ignore sovereign default risk):

$$\gamma_t = IRS_t - i_t \text{ and } \gamma^*_{j,t} = IRS^*_t - i^*_t.$$

and include the deviation from covered interest parity,

$$\tau_t \equiv f_{t,t+1} - s_t + IRS^*_t - IRS_t$$

We have decomposed η_t as: $\eta_{j,t} = \tau_{j,t} + \gamma_t - \gamma^*_{j,t}$

These regressions use the full 1999-2017 sample:

Table 5A: Estimation of

$$\Delta s_{j,t} = \alpha_j + \beta_1 q_{j,t-1} + \beta_2 \Delta\tau_{j,t} + \beta_3 \Delta\gamma_t + \beta_4 \Delta\gamma^*_{j,t} + \beta_5 \Delta i^R_{j,t} + \beta_6 \tau_{t-1} + \beta_7 \gamma_{t-1} + \beta_8 \gamma^*_{j,t-1} + \beta_9 i^R_{j,t-1} + u_{j,t}$$

Home Currency	$\Delta\gamma^*_{j,t}$	$\Delta\gamma_{j,t}$	$\Delta\tau_{j,t}$	Within R^2
AUD	5.7203***	-7.0727***	-2.4064**	0.2169
	(0.6818)	(1.2819)	(1.2156)	
CAD	4.8626***	-6.2014***	-5.3199***	0.2059
	(0.6546)	(1.9898)	(1.1316)	
EUR	4.8673***	-5.0422***	-5.1449***	0.1467
	(0.5426)	(1.0950)	(0.9088)	
JPY	4.7554***	-2.3382	-4.6968***	0.1740
	(0.9541)	(5.1744)	(1.5852)	
NZD	6.0904***	-7.3252***	-5.4168***	0.2151
	(0.8808)	(0.8193)	(1.2925)	
NOK	5.8821***	-3.3693***	-5.1586***	0.1675
	(0.7043)	(0.7629)	(1.0478)	
SEK	5.0511***	-3.4432***	-5.4056***	0.1364
	(0.6099)	(1.2680)	(0.9898)	
CHF	3.3013***	-2.7337	-1.2117	0.0574
	(0.7181)	(1.8896)	(1.1939)	
GBP	5.2858***	-3.6831***	-1.1544	0.1400
	(0.6819)	(1.0769)	(1.1162)	
USD	6.4272***	-5.8857***	-6.4658***	0.1882
	(0.7754)	(1.3745)	(1.2058)	

We see that the home liquidity term is uniformly of the correct sign and highly significant in every case except the CHF (which is highly affected by one month!)

Next is a summary of running regressions on bilateral exchange rate pairs, using the baseline specification:

Table 5B: Summary of Bilateral Exchange rate regressions
45 pairs, full sample

	Adjusted R^2	q_t	$\Delta\eta_{j,t}$	$\Delta i^R_{j,t}$
max	0.356	-0.003	1.714	0.250
min	0.006	-0.119	-10.948	-9.662
median	0.172	-0.031	-4.160	-5.051
mean	0.165	-0.039	-4.438	-4.956
Significant				
10 percent		31	37	43
5 percent		27	31	42
1 percent		14	28	42

Table 5C: Summary of Bilateral Exchange rate regressions
45 pairs, post-2008

	Adjusted R^2	q_t	$\Delta\eta_{j,t}$	$\Delta i^R_{j,t}$
max	0.487	0.003	2.905	0.767
min	0.012	-0.198	-11.860	-14.336
median	0.275	-0.067	-5.250	-6.718
mean	0.272	-0.068	-5.575	-7.534
Significant				
10 percent		32	37	41
5 percent		24	37	40
1 percent		13	28	39

Next, we consider the Meese-Rogoff exercise for out-of-sample fit (not forecast):

- We estimate the model through the end of 2007
- Use the model to fit the change in the exchange rate for 2008:1
- Update estimation using rolling regressions
- Calculate M.SE. of model fit
- Compare to M.S.E. of random walk model
- Assess significance using Clark-West statistic

Table 6: Rolling window prediction error of regression model:

$$\Delta\hat{s}_{j,t} = \hat{\alpha}_j + \hat{\beta}_1 q_{j,t-1} + \hat{\beta}_2 \Delta\eta_{j,t} + \hat{\beta}_3 \Delta i^R_{j,t} + \hat{\beta}_4 \eta_{j,t-1} + \hat{\beta}_5 i^R_{j,t-1}$$

and random walk model: $\Delta\hat{s}^{RW}_{j,t} = 0$

Home Currency	RMSE of the model	RMSE of random walk	CW statistics	CW p-value
AUD	0.02949	0.03335	10.2996	0.0000***
CAD	0.02697	0.03058	10.4216	0.0000***
EUR	0.02603	0.02859	8.9386	0.0000***
JPY	0.03960	0.04294	10.6632	0.0000***
NOK	0.02835	0.03123	7.9682	0.0000***
NZD	0.03179	0.03638	10.6607	0.0000***
SEK	0.02773	0.02987	7.7205	0.0000***
CHF	0.03333	0.03287	1.8842	0.0298**
GBP	0.03149	0.03326	7.5885	0.0000***
USD	0.03120	0.03486	11.7113	0.0000***

Conclusions

Our empirical findings are good news for macroeconomic models of exchange rates.

Liquidity yields are a significant determinant of exchange rate movements for all of the largest countries, and, with these included, traditional determinants of exchange rate movements are also important.

Our simple regressions have fairly high R-squared values.

In short, exchange rates are not so disconnected after all.

Thanks!