Lecture 14

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.

- 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:

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

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

η_t is the home minus foreign liquidity yield

q_t is the log of the real exchange rate

Let's review what this equation means.

First, it predicts that if $q_{t-1} \equiv s_{t-1} + p^{*}_{t-1} - p_t > 0$, then $s_t - s_{t-1} < 0$ (which is why we say $\beta_1 < 0$). This just means that the exchange rate adjusts so that there is movement towards PPP.

Second, it predicts that if $i_t - i^{*}_t - \left(i_{t-1} - i^{*}_{t-1}\right) > 0$, then $s_t - s_{t-1} < 0$ (which is why we say $\beta_3 < 0$). This is saying that if the home interest rate, relative to the foreign interest rate is rising, the home currency appreciates (the exchange rate falls.)

The key thing is that if $\eta_t - \eta_{t-1} > 0$, then $s_t - s_{t-1} < 0$ (which is why we say $\beta_2 < 0$).

Liquidity premium: $\eta_t \equiv \left(i_t^m - i_t\right) - \left(i_t^{m*} - i_t^*\right)$

For example, i_t is the interest rate on the home country government bond, and i_t^m is a market rate of interest.

When $i_t^m - i_t$ increases, the liquidity yield on the government bond increases (so that the government bond pays a lower rate of interest than the market rate.) This tends to make the home currency appreciate.

The lagged values of the interest rate differential, and the liquidity yield differential are included in the regression to capture dynamic adjustment in the relationship.

This equation is estimated using a panel estimator. This means that for each currency (for example, the Australian dollar), the equation is estimated against all nine of the other currencies.

The slope coefficients on all of the variables in the regression is forced to be the same for the Australian dollar against all of the other nine currencies. Only the intercept coefficient (which is the α in the equation above) is allowed to be different.

The panel regression is estimated for each of the 10 currencies.

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)	

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.