Scrambling for Dollars: International Liquidity, Banks, and Exchange Rates

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- Recent literature has focused on the regularity that the dollar appreciates in times of global volatility and uncertainty
- This makes the dollar a good hedge, and so dollar assets earn a low expected return

But why does the dollar appreciate when there is global volatility?

- We contribute one possible reason why demand for dollars increases.
- We build a model and present evidence that it is a demand for liquidity that drives the dollar.
  - A "scramble for dollars" rather than, or in addition to, a "flight to safety".
- We locate this demand for liquidity in the financial intermediation sector. Increase in liquid assets/short-term funding a key indicator.

- Globally, short-term non-deposit funding to banks is heavily skewed toward dollars.
- When uncertainty increases, banks respond by increasing demand for dollar liquid assets. In the U.S. this includes reserves, and in all countries includes short term Treasury obligations.
- This increase in demand for liquid dollar assets leads to an appreciation of the dollar.

(For convenience, we call the financial intermediation sector “banks”. We call short-term liquid assets “reserves”, but these include assets such as U.S. government bills held by financial intermediaries outside the U.S.)

Empirical Motivation

- We consider the behavior of the G10 currency/U.S. dollar exchange rate, 2001:1-2020:7.
- We start with a conventional regression in which monetary policy (interest rates, inflation rates) drive exchange rate changes
- Add change in liquid asset/short-term funding (in dollars) ratio
    - Data only available in U.S. Assume same forces drive this ratio in non-U.S. banks
    - Liquid assets = reserves + U.S. Treasury assets held by banks
    - Short-term funding = demand deposits + financial commercial paper

$$\Delta e_t = \alpha + \beta_1 \Delta\left(LiqRat_t\right) + \beta_2\left(\pi_t - \pi_t^*\right) + \beta_3 LiqRat_{t-1} + \varepsilon_t$$

“Home” is non-US, “Foreign” is U.S., *e* is G10 currency/U.S. dollar

$\beta_1 > 0, \ \beta_2 < 0$

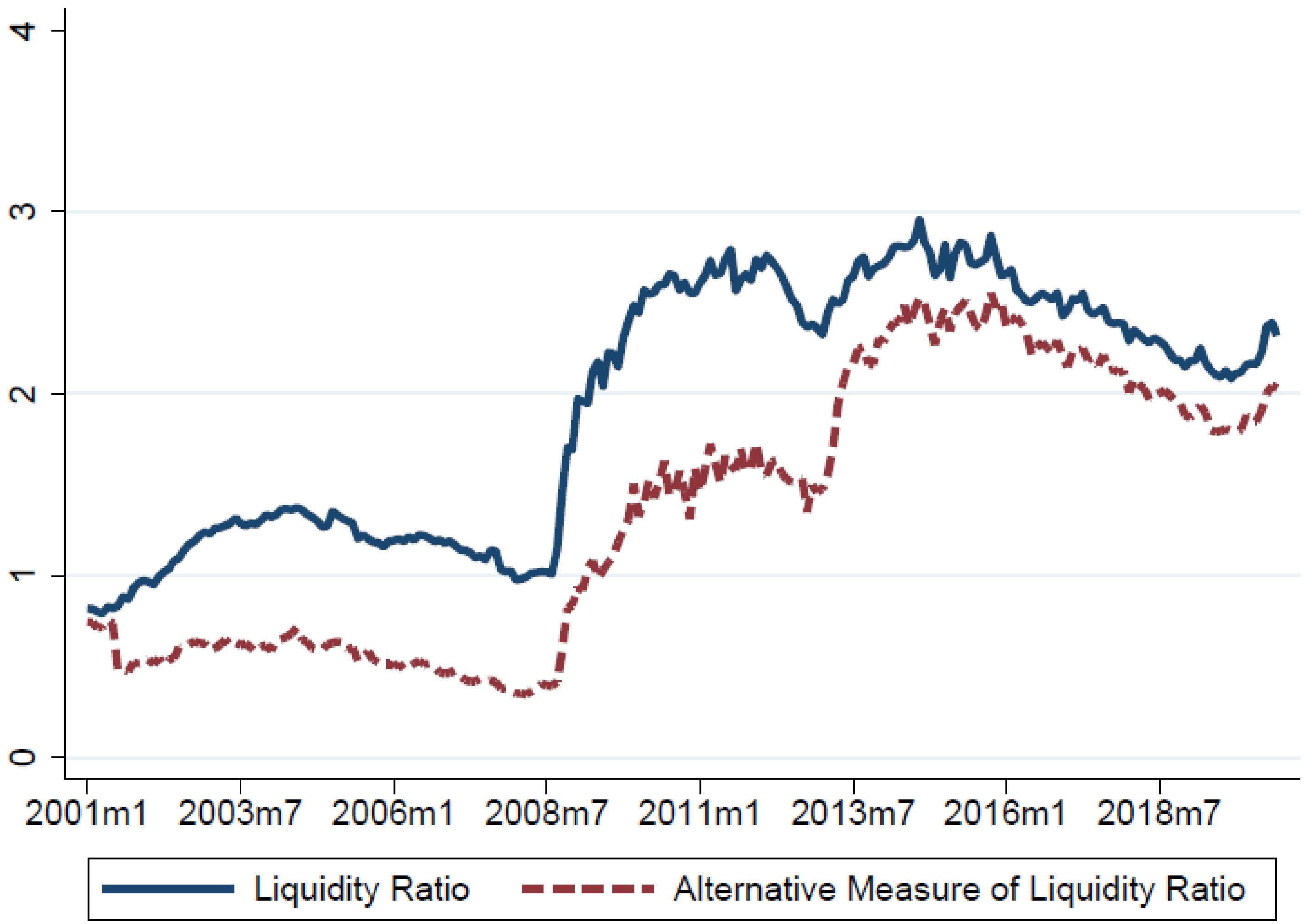


Figure 1: The ratio of liquid assets to short-term liabilities

Table 1: Relationship of Exchange Rates and Banking Liquidity Ratio Feb. 2001 – July 2020

	Euro	Australia	Canada	Japan	New Zealand	Norway	Sweden	Switz	U.K.
$\Delta(\text{LiqRat}_t)$	0.225***	0.243***	0.131***	-0.152***	0.295***	0.189***	0.213***	0.145***	0.165***
	(4.525)	(3.597)	(2.643)	(-3.036)	(4.302)	(3.023)	(3.555)	(2.654)	(3.320)
$\pi_t - \pi_t^*$	-0.542***	-0.422**	-0.412*	0.008	-0.718***	-0.117	-0.492**	-0.666***	-0.390**
	(-3.718)	(-2.226)	(-1.928)	(0.055)	(-3.757)	(-0.803)	(-2.521)	(-2.803)	(-2.114)
LiqRat_{t-1}	0.011**	0.006	0.007	0.002	0.009	0.010*	0.006	0.005	0.009*
	(2.425)	(1.065)	(1.578)	(0.315)	(1.508)	(1.763)	(1.145)	(0.990)	(1.735)
Constant	-0.012***	-0.004	-0.006*	-0.001	-0.009**	-0.007*	-0.009**	-0.017***	-0.006
	(-3.452)	(-1.053)	(-1.832)	(-0.108)	(-2.095)	(-1.653)	(-2.069)	(-3.169)	(-1.597)
N	234	232	234	234	232	234	234	234	234
adj. R^2	0.11	0.05	0.03	0.03	0.10	0.03	0.05	0.04	0.04

t statistics in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Liquidity ratio variable "works" for all countries but Japan. (Adding interest rates to the equation does not help – they are not significant, but this is the near-ZLB period.)

Is it just capturing a measure of uncertainty?

- On the one hand, our model does say that a major driver of the liquidity ratio is uncertainty
- Many others have found that uncertainty as measured by VIX is closely correlated with exchange rates, and attribute it loosely to a risk premium.

Add ΔVIX, but Liquidity Ratio's significance and size does not decline:

Table 2: Relationship of Exchange Rates and Banking Liquidity Ratio with VIX Feb. 2001 – July 2020

	Euro	Australia	Canada	Japan	New Zealand	Norway	Sweden	Switz	U.K.
$\Delta(\text{LiqRat}_t)$	0.195***	0.163***	0.086*	-0.137***	0.232***	0.139**	0.173***	0.129**	0.140***
	(3.999)	(2.798)	(1.909)	(-2.741)	(3.674)	(2.358)	(3.017)	(2.337)	(2.831)
$\pi_t - \pi_t^*$	-0.427***	-0.185	-0.277	-0.016	-0.519***	-0.032	-0.415**	-0.595**	-0.304*
	(-2.950)	(-1.130)	(-1.436)	(-0.112)	(-2.941)	(-0.235)	(-2.234)	(-2.491)	(-1.660)
ΔVIX_t	0.001***	0.004***	0.002***	-0.001**	0.003***	0.002***	0.002***	0.001*	0.001***
	(3.881)	(9.339)	(7.513)	(-2.250)	(6.909)	(5.934)	(5.153)	(1.928)	(3.116)
LiqRat_{t-1}	0.011**	0.007	0.007*	0.002	0.009*	0.010*	0.007	0.005	0.008
	(2.492)	(1.427)	(1.829)	(0.334)	(1.696)	(1.892)	(1.390)	(1.063)	(1.617)
Constant	-0.011***	-0.005	-0.006*	-0.001	-0.009**	-0.007*	-0.008**	-0.016***	-0.005
	(-3.277)	(-1.504)	(-1.943)	(-0.212)	(-2.210)	(-1.711)	(-2.128)	(-2.973)	(-1.459)
N	234	232	234	234	232	234	234	234	234
adj. R^2	0.16	0.31	0.22	0.05	0.25	0.16	0.15	0.05	0.07

t statistics in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Three important points:

1. These regressions are notable in that a "quantity" variable is explaining the exchange rate, rather than just prices.
2. The liquidity ratio is an endogenous variable, in the data and in our model. We will see that the model can replicate these regression findings.
3. Please note the dependent variable is $s_t - s_{t-1}$, not $s_{t+1} - s_t$. We are not forecasting. We are trying to account for contemporaneous changes in the exchange rate.

Next, we instrument for the liquidity ratio using measures of the cross-sectional variation of inflation and depreciation.

- This is not to find "exogenous" variation in the liquidity ratio
- Instead, we are asking whether, when we look only at the component of the liquidity ratio driven by this type of uncertainty, it still has explanatory when ΔVIX is in the regression

Table 3A: Relationship of Exchange Rates and Banking Liquidity Ratio Instrumental Variable Regression: StDev(Inf) and StDev(XRate) instrument for Δ(LiquidityRatio) Feb. 2001 – July 2020

	Euro	Australia	Canada	Japan	New Zealand	Norway	Sweden	Switz	U.K.
$\Delta(\text{LiqRat}_t)$	0.450***	0.593***	0.441***	-0.306**	0.507***	0.526***	0.473***	0.019	0.717***
	(3.150)	(3.182)	(3.274)	(-2.266)	(2.804)	(2.831)	(2.800)	(0.121)	(3.547)
$\pi_t - \pi_t^*$	-0.566***	-0.444**	-0.496**	0.051	-0.658***	-0.242	-0.595***	-0.476	-0.981***
	(-3.339)	(-2.111)	(-2.149)	(0.328)	(-3.250)	(-1.370)	(-2.728)	(-1.640)	(-3.034)
LiqRat_{t-1}	0.014***	0.013**	0.013**	-0.002	0.013**	0.017**	0.011*	0.004	0.024***
	(2.912)	(2.119)	(2.589)	(-0.255)	(2.123)	(2.596)	(1.897)	(0.733)	(2.922)
ΔVIX_t	0.001***	0.003***	0.002***	-0.001*	0.003***	0.002***	0.002***	0.001**	0.000
	(2.693)	(6.879)	(5.423)	(-1.680)	(5.659)	(4.278)	(3.971)	(2.049)	(0.856)
Constant	-0.015***	-0.010**	-0.011***	0.003	-0.012***	-0.013**	-0.013***	-0.013*	-0.017***
	(-3.641)	(-2.263)	(-2.859)	(0.433)	(-2.645)	(-2.528)	(-2.708)	(-1.834)	(-2.896)
N	234	232	234	234	232	234	234	234	234

t statistics in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

We also consider an alternative measure of liquidity, in which we include “net financing" of broker-dealer banks, and results are the same

The Model

- Based on Bianchi-Bigio (2019) closed-economy model
- 2-country (Europe is home, U.S. is foreign)
- General equilibrium, stochastic, infinite horizon, discrete time
- There is a single good, law of one price holds, prices flexible
- Households consume, supply labor, save in both currencies
- Firms produce using labor, have working capital requirement that requires loans
- Preferences, technology and environment are rigged up so that household and firm decisions are essentially static
- The action comes from bank behavior
  - Continuum of "global banks"
  - Assets: Loans to firms, euro "reserves" and dollar "reserves"
  - Liabilities: euro deposits, dollar deposits
- A vector of aggregate shocks, but will focus on shocks to volatility of withdrawals/deposits and to interest on reserves

Two preliminary comments:

- This is not a banking model with Kiyotaki-Moore balance-sheet constraints. (Not like Gertler-Karadi or Gabaix-Maggiori.)
- Agents are risk-neutral. No risk premiums.

So what is going on?

- Banks hold liquid assets in case of unexpected deposit withdrawals
- If they run out of liquid assets they must undertake costly borrowing on interbank market, or even more costly borrowing from central bank discount window
- Increased volatility of dollar withdrawal/deposits leads to:
    - Higher liquid asset/deposit ratio for dollars
    - Higher “liquidity yield” on liquid dollar assets
    - Appreciation of the dollar

Banks

Each period there is an investment stage and a balancing stage. In the investment stage at time *t*, banks maximize $\sum_{j=0}^{\infty} \beta^t E_t\left(Div_{t+j}\right)$ and choose:

loans to firms (b_{t+1}), (in real terms)

home (foreign) reserves m_{t+1} (m^*_{t+1}) in home (foreign) currency units

home (foreign) deposits d_{t+1} (d^*_{t+1}) in home (foreign) currency units

dividends, Div_t, (in real terms)

(Note, households are risk-neutral.
And, law of one price holds: $P_t = e_t P_t^*$)

Subject to constraint:

$$P_t^* Div_t + \frac{m_{t+1} - d_{t+1}}{e_t} + P_t^* b_{t+1} + m_{t+1}^* - d_{t+1}^* \leq P_t^* b_t R_t^b + m_t^* \left(1 + i_t^{m,*}\right)$$
$$- d_t^* \left(1 + i_t^{d,*}\right) + f_t^* \left(1 + i_t^{f,*}\right) - w_t^* \left(1 + i_t^{w,*}\right)$$
$$+ \frac{m_t \left(1 + i_t^m\right) - d_t \left(1 + i_t^d\right) + f_t \left(1 + i_t^f\right) - w_t \left(1 + i_t^w\right)}{e_t}$$

$f_t \left(f_t^*\right)$ are home (foreign) currency loans in balancing stage.

- A positive number indicates a lender

$w_t \left(w_t^*\right)$ are discount window loans.

$i_t^w - i_t^m \left(i_t^{w*} - i_t^{m*}\right)$ is the difference between interest on reserves and discount window interest rate – "corridor" – for home (foreign)

In the balancing stage, deposits are either added to or withdrawn. If there is a withdrawal, bank *j* makes transfers to another bank out of reserves. Must use euros if euro deposits are withdrawn, dollars if dollar deposits are withdrawn:

$$s_t^j = m_{t+1} + \omega_t^j d_{t+1} \qquad\qquad s_t^{j,*} = m_{t+1}^* + \omega_t^{j*} d_{t+1}^*$$

where ω_t^j (ω_t^{j*}) is a random variable, mean-zero, adds to zero over all banks.

It is helpful to think of things this way: Depositors take their money out of one bank and put it into another. One bank must transfer reserves to another – i.e., the money doesn't leave the system.

Focusing on home (foreign is analogous), if $s_t^j < 0$ must go to interbank market and search for funds from banks for whom $s_t^k > 0$.

There is a search and matching problem. Banks must find counterparties that they trust. Modeled as in Bianchi and Bigio (2019).

Only a fraction of the surplus (deficit) will be lent (borrowed). A bank with a surplus can lend a fraction ψ^+ to other banks. The rest they hold as reserves. Interbank loans will pay a higher interest rate than reserves in equilibrium.

Banks with a deficit can borrow a fraction ψ^- from other banks. The rest is borrowed at the discount window. The discount window rate is higher than the interbank rate.

That is, $i_t^m \le i_t^f \le i_t^w$

Probability of a lending bank finding a match depends on market tightness and on the matching efficiency:

$$\theta_t = S_t^- / S_t^+$$

S_t^- (S_t^+) is aggregate shortfall (surplus) of borrowing (lending) banks.

$$\psi^+ = \psi^+(\theta) \text{ and } \psi^- = \psi^-(\theta)$$

The interbank rate is determined by bargaining between borrowing banks and lending banks. It is a weighted average of the interest on reserves and the discount window interest rate.

The bargaining power of each depends on the tightness of the market. The more excess reserves, the less the bargaining power of the lender so the closer the interbank rate is to the interest rate on reserves.

The expected real cost of a shortfall (relative to real returns on reserves) is given by:

$$\chi^{-}(\theta)=\psi^{-}(\theta)\left(R^{f}-R^{m}\right)+\left(1-\psi^{-}(\theta)\right)\left(R^{w}-R^{m}\right)$$

Expected real gain for a bank with a surplus is:

$$\chi^{+}(\theta)=\psi^{+}(\theta)\left(R^{f}-R^{m}\right)$$

where i^{f} is interbank rate (determined by Nash bargaining),
i^{m} is interest on reserves (set by central bank)
i^{w} is discount window rate (set by central bank)
$i^{m}<i^{f}<i^{w}$, and $R^{z}=E\left[\left(1+i^{z}\right)/\left(1+\pi\right)\right]$

Real Economy

Supply of deposits from households (arising from CIA constraint):

$$R_{t+1}^{d} = \Theta^{d}\left(D_t^s\right)^{-\varsigma} \qquad R_{t+1}^{*,d} = \Theta^{*,d}\left(D_t^s\right)^{-\varsigma^*}$$

And demand for working capital loans from firms:

$$R_{t+1}^{B} = \Theta^{b}\left(B_t\right)^{\varepsilon}$$

Government/ Central Bank

Each central chooses the two interest rates previously mentioned, as well as the nominal reserve supply, *M*. Let *W* denote discount-window loans. Government budget constraint:

$$M_t + T_t + W_{t+1} = M_{t-1}\left(1+i_t^m\right) + W_t\left(1+i_t^w\right)$$

Equilibrium

- F.O.C's for banks hold.
- Real economies' supply of loans and demand for loans are satisfied.
- Supply of deposits equals demand for deposits.
- Demand for reserves equals supply of reserves.
- Law of one price holds.

Market tightness θ_t is consistent with the portfolios and the distribution of withdrawals while the matching probabilities, $\psi^-(\theta)$, $\psi^+(\theta)$ and the interbank rate, i^f, are consistent with market tightness θ_t.

Returns in Equilibrium

Let $\Phi\left(\frac{m}{d}\right)$ be the probability a bank ends up in deficit in reserves in the home currency, which is an endogenous object.

The expected liquidity yield from one more unit of reserves is:

$$E\chi_m(s;\theta)=\left[\left(1-\Phi\left(\frac{m}{d}\right)\right)\chi^{+}(\theta)+\Phi\left(\frac{m}{d}\right)\chi^{-}(\theta)\right]$$

Suppose, for intuition, the banks with a shortfall almost always borrow on the interbank market (i.e., $\psi^{-}(\theta)\approx 1$). Then

$$E\chi_m(s;\theta)\approx\left[\left(1-\Phi\left(\frac{m}{d}\right)\right)\psi^{+}(\theta)+\Phi\left(\frac{m}{d}\right)\right]\left(R^{f}-R^{m}\right)$$

which is proportional to the usual measure of convenience yield.

Discussion

The cost of a shortfall is related to the "convenience" yield of reserves/TBills relative to interbank rates. The gain from holding excess reserves is proportional to this convenience yield.

The expected liquidity yield is the probability of having excess reserves times the convenience yield on those reserves plus the probability of running short times the cost of running short.

Similarly, we can define the expected excess return on one more unit of reserves in the foreign currency:

$$E\chi_{m^*}\left(s^*;\theta^*\right)=\left[\left(1-\Phi^*\left(\frac{m^*}{d^*}\right)\right)\chi^{+,*}\left(\theta^*\right)+\Phi^*\left(\frac{m^*}{d^*}\right)\chi^{-,*}\left(\theta^*\right)\right]$$

Then, in equilibrium we have:

$$R^b = R^m + E\chi_m(s;\theta) \quad \text{and} \qquad R^b = R^{m,*} + E\chi_{m^*}(s^*;\theta^*)$$

We can use these two to write the deviation from UIP (in real terms):

$$R^m - R^{m,*} = \underbrace{E\chi_{m^*}(s^*;\theta^*) - E\chi_m(s;\theta)}_{\text{Dollar Liquidity Premium (DLP)}}$$

The euro (home) reserves pay a higher expected return when the dollar liquidity premium is higher.

$$R^m - R^{m,*} \equiv E_t\left(\frac{1+i_t^m}{1+\pi_{t+1}}\right) - E_t\left(\frac{\left(1+i_t^{*,m}\right)e_{t+1}}{\left(1+\pi_{t+1}\right)e_t}\right) = \underbrace{E\chi_{m^*}(s^*;\theta^*) - E\chi_m(s;\theta)}_{\text{Dollar Liquidity Premium (DLP)}}$$

A Couple of Results

Proposition 1:

A temporary increase in supply of dollar deposits increases the DLP.

- An unexpected temporary increase in dollar deposits means banks are more likely to have a shortfall of dollar reserves
- Here, the liquidity ratio falls
- This increases the marginal value of dollar reserves – hence, the DLP
- In turn, this appreciates the dollar
- Note that in this case, the relation between the liquidity ratio and the exchange rate is opposite of our regressions. This emphasizes that the role of different shocks matters.

Proposition 3:

A temporary increase in the interest on dollar reserves (while holding constant the width of the corridor) lowers the DLP

- Higher interest on dollar reserves makes them more attractive, and so banks hold more (in real terms), thus lowering their marginal value. The liquidity ratio increases and the DLP falls.
- The dollar appreciates (as usual when a country raises interest rates.)
- Note that the liquidity premium and value of dollar go in "wrong" direction – we need to control for the interest rate

The central bank has an *extra* instrument here, in that they can influence the DLP.

Proposition 2:

Greater Volatility Appreciates the Dollar

Suppose ϖ (the fraction of deposits withdrawn/increased) takes on values δ or $-\delta$ with equal probability.

An increase in δ (i.e., an increase in volatility)

- increases the ratio of reserves/deposits
- increases the DLP
- appreciates the dollar

As volatility of deposits rise, the value of liquidity rises, and banks acquire more reserves.

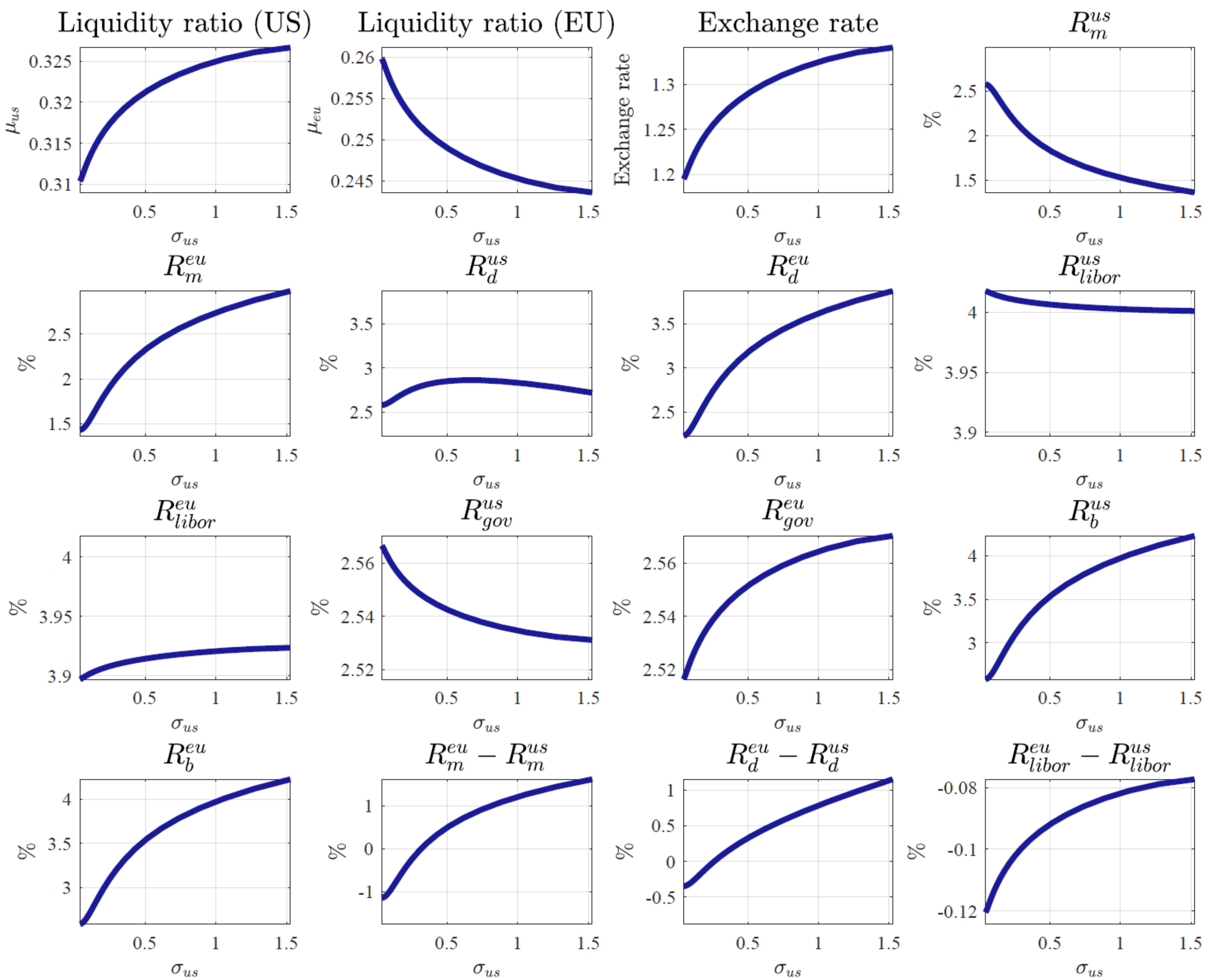
This is the key relationship that we see in the data.

Table 6B: Parametrization

Parameter	Description	Target
Fixed Parameters		
$i_t^m = 2.14\%$	EU Safe Asset Rate	data
M^*/M	Relative Supplies of Reserves	normalized to match average e
$\Theta^b = 100$	Global loan demand scale	normalization
$\epsilon = -35$	Loan Elasticity	Bianchi and Bigio (2020)
$\Theta^{d,*} = 40$	US Deposit Demand Scale	Liquidity ratio of 20%
$\varsigma^* = 35$	US Deposit Demand Elasticity	Bianchi and Bigio (2020)
$\Theta^d = 40$	EU Deposit Demand Scale	symmetry
$\varsigma = 35$	US Deposit Demand Elasticity	symmetry
$\sigma = 4\%$	EU withdrawal risk	$R^b - R^d = 2\%$
$\lambda^* = 3.1$	US interbank market matching efficiency	$\mathcal{EBP} = R^b - R^{*,m} = 1\%$
$\lambda = 3.1$	EU interbank market matching efficiency	symmetric value of λ^*
Process for US withdrawal volatility (AR(1) process)		
$\mathbb{E}(\sigma_t^*) = 4\%$	average US withdrawal risk	empirical average $\mathcal{LP}$
$std(\sigma_t^*) = 0.12\%$	standard deviation	empirical std of $log(e)$
$\rho(\sigma_t^*) = 0.98$	mean reversion coefficient	empirical autocorrelation of $log(e)$
Process for US policy rate $i^{m,*}$ (AR(1) process)		
$\mathbb{E}(i_t^{*,m}) = 1.95\%$	average annual US policy rate	data
$std(i_t^{*,m}) = 2.1652\%$	std annual US policy rate	data
$\rho(i_t^{*,m})$=0.99	autocorrelation annual US policy rate	data

Table 6B: Model and Data Moments

Statistic	Description	Data/Target	Model
Targets			
$std(\log e)$	Std. Dev. of log exchange rate	0.1538	0.154
$\rho\,(\log e)$	Autocorrelation of log exchange rate	0.9819	0.9922
$\mathbb{E}\,(\mathcal{LP})$	Average bond premium	20bps	19.8bps
$\mathbb{E}\,(\mathcal{EBP})$	Average bond premium	100bps	100.1bps
Non-Targeted			
$std(\log \mu^{*})$	Std. Dev. of dollar liquidity ratio	0.422	0.0656
$\rho\,(\log \mu)$	Autocorrelation of dollar liquidity ratio	0.9961	0.9924
$std(\pi_{eu} - \pi_{us})$	Std. Dev. of inflation differential	1.29	1.84
$\rho\,(\pi_{eu} - \pi_{us})$	Autocorrelation of inflation differential	0.925	0.98

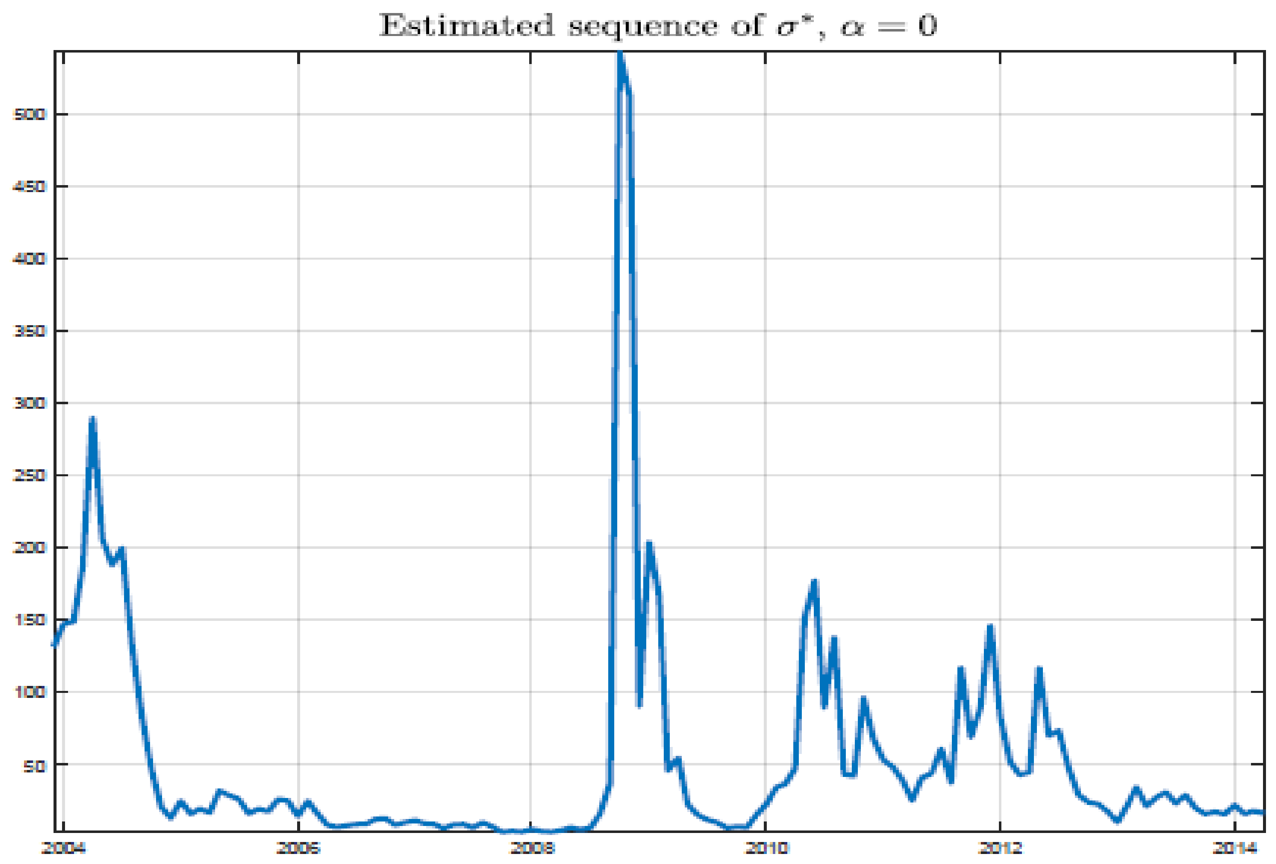

Liquidity ratio (US)
Liquidity ratio (EU)
Exchange rate
R_m^{us}
R_m^{eu}
R_d^{us}
R_d^{eu}
R_{libor}^{us}
R_{libor}^{eu}
R_{gov}^{us}
R_{gov}^{eu}
R_b^{us}
R_b^{eu}
$R_m^{eu} - R_m^{us}$
$R_d^{eu} - R_d^{us}$
$R_{libor}^{eu} - R_{libor}^{us}$
μ_{us}
μ_{eu}
Exchange rate
%
σ_{us}
0.5
1
1.5
0.31
0.315
0.32
0.325
0.245
0.25
0.255
0.26
1.2
1.25
1.3
2.5
2
1.5
3.5
3
4
3.95
3.9
2.52
2.54
2.56
0
-1
0.5
-0.5
-0.08
-0.1
-0.12

Regression from Model

Table 6B: Regression Coefficients with Simmulated Data

	Data Euro/Dollar	Model	Model
$\Delta(\text{LiqRat}_t)$	0.225***	0.3043***	0.2393***
	(4.525)	(0.0409)	(0.0362)
$\Delta\left(i_t - i_t^*\right)$			-4.1858***
			(0.4867)
$\pi_{t-1} - \pi_{t-1}^*$	-0.542***	0.1931***	0.1500***
	(-3.718)	(0.1050)	(0.0863)
LiqRat_{t-1}	0.011**	0.0129	0.0100
	(2.425)	(0.0174)	(0.0145)
constant	-0.012***	0.0154	0.0119
	(-3.452)	(0.0213)	(0.0177)
adj. R^2	0.11	0.2018 (0.0437)	0.3939 (0.0468)

Implied Volatility Shock



Extension 1

We've heard several times already that our paper is not about UIP, but instead about CIP (covered interest parity).

Here, we introduce a forward market that is open in the investment stage:

$$P_t^* Div_t + \frac{m_{t+1} - d_{t+1}}{e_t} + P_t^* \tilde{b}_{t+1} + m_{t+1}^* - d_{t+1}^* \leq P_t^* \tilde{b}_t R_t^b + m_t^* \left(1 + i_t^{m,*}\right)$$

$$- d_t^* \left(1 + i_t^{d,*}\right) - f_t^* \left(1 + i_t^{f,*}\right) - w_t^* \left(1 + i_t^{w,*}\right) + q_t \left(f_{t-1,t} - e_t\right)$$

$$+ \frac{m_t \left(1 + i_t^m\right) - d_t \left(1 + i_t^d\right) - f_t \left(1 + i_t^f\right) - w_t \left(1 + i_t^w\right)}{e_t}$$

We derive the standard condition under risk neutrality:

$$f_{t,t+1} E_t \left(\frac{1}{P_{t+1}^*} \right) = E_t \left(\frac{e_{t+1}}{P_{t+1}^*} \right)$$

Then, under the simple case of no goods price uncertainty, the UIP deviation for reserves equals the CIP deviation. That is, the CIP deviation is equal to the dollar liquidity premium.

There is also a CIP deviation for interbank rates.

Discussion

The dollar and euro are modeled symmetrically here. So if there were an increase in volatility of euro deposits, ceteris paribus, the euro would appreciate.

Why do we associate times of global volatility especially with times of increased demand for dollar liquidity?

Because the most volatile funding is disproportionately in dollars in global markets.

It is also possible that the larger size of the dollar market makes dollars more liquid, e.g. with lower search costs in the funding market.

Conclusions

- Many recent papers have looked at convenience yields or liquidity yields, but not with strong microfoundations
    - We locate the source of the convenience yield in the value of liquidity for financial institutions
    - Our model then draws a link between observed liquidity ratios and the value of the dollar
- Empirically we find that connection – a link between exchange rates and a balance sheet quantity