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Emerging Markets Group

FX market illiquidity and funding liquidity constraints

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Motivation

- Trading volume in FX market is large. Does it translate to a highly liquid FX market? That depends on the definition of liquidity adopted and the proxy used
- Recent studies found a time-varying common component in FX market liquidity across currencies (Banti, Phylaktis and Sarno (2012); Mancini, Ranaldo and Wrampelmeyer (2011))
- Recent literature on the interaction of market liquidity and funding liquidity emerged to explain the severity of liquidity drop during the latest financial crisis (Brunnermeier and Pedersen (2009); Hameed, Kang and Viswanathan (2010); Acharya and Viswanathan (2011))

Research questions

- What are the determinants of time variation in FX market illiquidity?
- Is it affected by changes in investors' funding liquidity constraints?
- In particular, does a tightening in the funding liquidity constraints cause an increase in FX market illiquidity?

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Literature Review: determinants of FX market illiquidity

- Identification of a systematic and time-varying component in FX market liquidity
  - Mancini et al. (2011)
  - Banti et al. (2012)
- Positive relationship between the VIX and TED spread measures and FX market liquidity for the most traded currencies during the recent financial crisis
  - Mancini et al. (2011)
- Positive relationship between volatility and the bid-ask spreads of some currencies in different frequencies and time periods
  - Bollerslev and Melvin (1994)
  - Bessembinder (1994); Ding (1999)

Literature Review: market illiquidity & funding liquidity

- Traders financial constraints influence the liquidity of financial markets. Funding liquidity constraints affect their operations creating a systematic source of variation in liquidity across financial assets

  - Shleifer and Vishny (1997) introduce financially constrained arbitrageurs that are unable to fully exploit opportunities due to the risk of investors redemption
  - Gromb and Vayanos (2002) model the financial constraints, arguing that margin requirements affect arbitrageurs' ability to provide liquidity to the market
  - (Brunnermeier and Pedersen (2009)Under certain conditions, the interaction between market and funding liquidity leads to illiquidity spirals and finally to liquidity dry-ups

Contributions

- Identification of the determinants of changes in the common component of FX market illiquidity across 20 currencies
  - Transaction costs: bid-ask spread
  - Market depth : Pastor-Stambaugh liquidity measure
- Investigation of the relationship between FX market illiquidity and changes in investors' financing conditions
  - Are funding conditions related to market declines?
  - Do changes in funding liquidity constraints have a strong positive impact on FX market illiquidity during crisis periods?
- Document other important determinants such as declining market returns, volatility and day-of-the-week effects

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Methodology: measuring FX market illiquidity

- Among the liquidity proxies developed, we measure illiquidity as transaction costs: the percentage bid-ask spreads of the USD against the currencies following the American system.
- We estimate the changes in the common component across currencies by differencing the cross-sectional average:

$$PS_t = \frac{1}{N}\sum_{i=1}^{N} PS_{i,t}$$

$$\Delta PS_t = \log(PS_t) - \log(PS_{t-1})$$

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Methodology: funding liquidity constraints proxy

- Among the proxies for funding liquidity conditions, we employ the interest rate on financial commercial papers, available daily.
- Since we are interested in the changes in funding liquidity, we take the first difference of the logs of the FCP rates:

$$\Delta FCP_t = \log(FCP_t) - \log(FCP_{t-1})$$

- So, an increase in FCP interest rates is a proxy for a tightening of funding liquidity constraints.

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Methodology: measures for the other determinants

- Global FX volatility (Menkhoff, Sarno, Schmeling and Schrimpf (2012)):

$$VOL_t = \log(VXY_t) - \log(VXY_{t-1})$$

- FX market returns (Chordia et al. (2001); Hameed et al. (2010)):

$$MKT_t = \sum_{i=1}^{20} \left(\frac{r_{i,t}}{20} \right)$$

- Weekly seasonality (Bessembinder (1994)

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Data

- 20 currencies (10 developed countries and 10 emerging markets) for a time period of 13 years, Jan 1998 to Dec 2010
- Daily foreign exchange bid, ask and mid rates of the USD versus the currencies are obtained from Datastream
- (WM/Reuters Closing Spot, provided by Reuters at 16 GMT)
- Daily FCP interest rate is available from the U.S. Federal Reserve Board
- Proxies for margin requirements:
  - Federal Funds rate: available from the U.S. Federal Reserve Board
  - TED spread: 3-month LIBOR from Datastream and the 3-month Treasury rate from the U.S. Federal Reserve Board
- Daily VXY is obtained from Bloomberg

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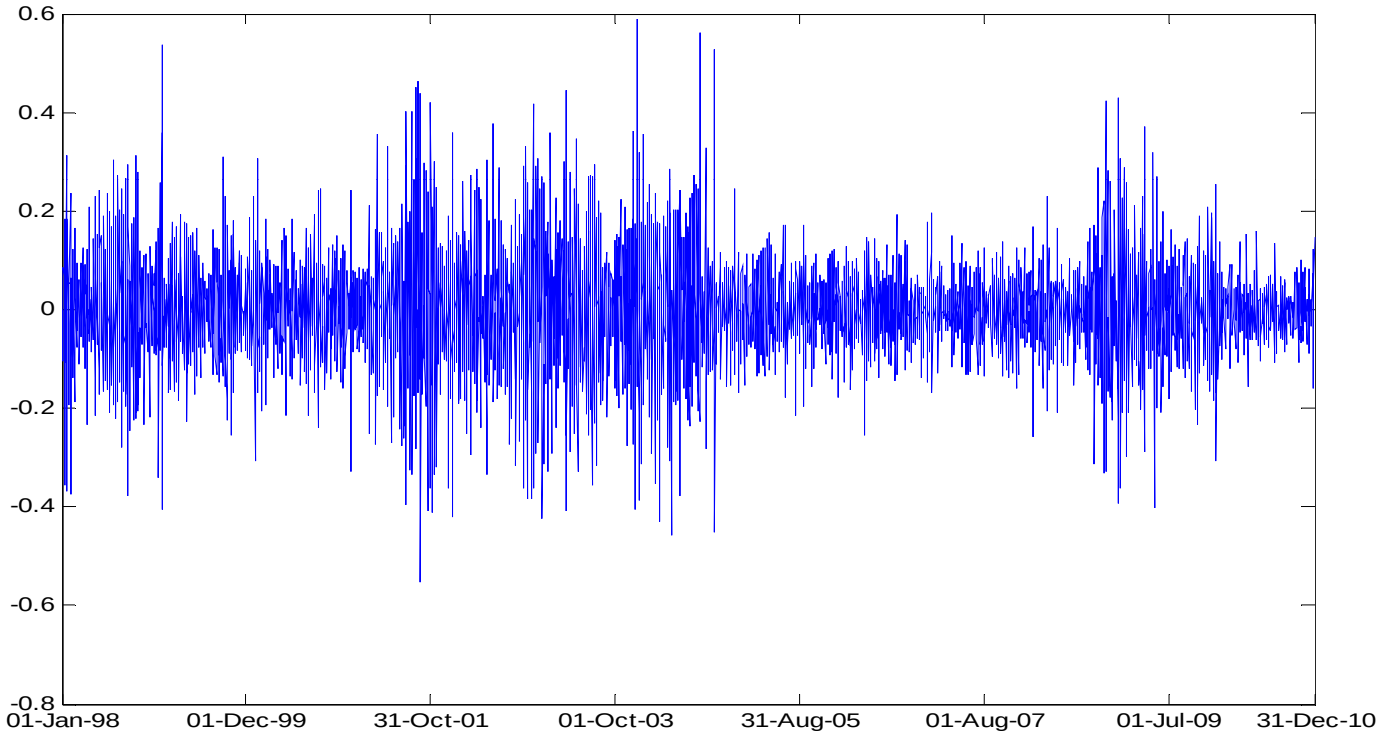
Descriptive statistics of main variables

	Δilliq	ΔFCP
mean	-0.00003	-0.00369
median	0.70948	0
st dev	0.11454	0.09241
min	-0.55196	-2.07944
max	0.58896	1.50408
skew	-0.01154	-4.00308
kurt	2.32023	147.02724
AC(1)	-0.46000	-0.06987

	D FCP	*D FF*	*D TED spread*
D FF	**0.2686**		
D TED spread	**-0.0379**	**-0.0383**	
D VXY	**0.0322**	**0.0794**	**0.1781**

Changes in FX market illiquidity



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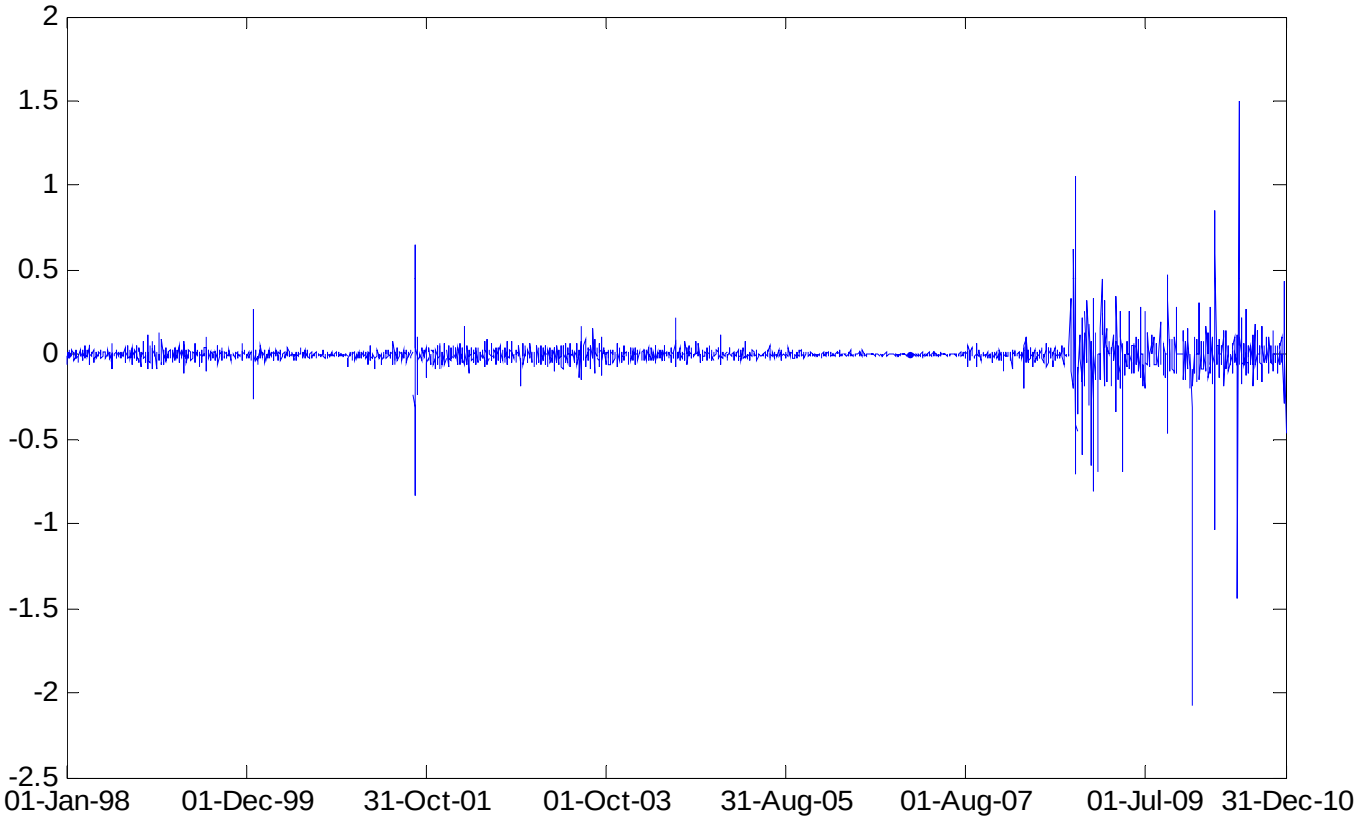
Changes in FCP interest rates



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FX market illiquidity and funding liquidity constraints

Run the following regression:

$$\Delta illiq_t = \alpha + \beta \Delta FCP_t + \delta VOL_t + \varphi \Delta TS_t + \varsigma \Delta FF_t + \mu MKT_{t-1} +$$

$$\gamma_1 d_t^{MON} + \gamma_2 d_t^{TUE} + \gamma_3 d_t^{WED} + \gamma_4 d_t^{THUR} + \sum_{i=1}^{4} \theta_i \Delta illiq_{t-i} + \varepsilon_t$$

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Results of the main regression analysis

	1	2
D FCP t	0.03892	0.03752
VOL t		0.1761
MKT t-1		-1.0724
dummy mon	-0.02847	-0.02952
dummy tue	-0.02814	-0.02903
dummy wed	-0.02018	-0.02167
dummy thur	-0.00001	-0.01426
constant	0.01752	0.01848
Rbar	0.35	0.35

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Market illiquidity, market declines and funding liquidity

- To test if the impact of market returns is symmetric, we interact lagged market returns with a dummy for negative and positive market returns:

$$\Delta illiq_t = \alpha + \beta \Delta FCP_t + \mu_1 d^{+}_{t-1} MKT_{t-1} + \mu_2 d^{-}_{t-1} MKT_{t-1} + \delta VOL_t +$$

$$\gamma_1 d_t^{MON} + \gamma_2 d_t^{TUE} + \gamma_3 d_t^{WED} + \gamma_4 d_t^{THUR} + \sum_{i=1}^{4} \theta_i \Delta illiq_{t-i} + \varepsilon_t$$

- To test if the impact of market declines is indicative of capital constraints, we interact market returns with a dummy for lagged positive changes in funding constraints:

$$\Delta illiq_t = \alpha + \beta \Delta FCP_t + \mu d^{+FUND}_{t-1} MKT_{t-1} + \delta VOL_t +$$

$$\gamma_1 d_t^{MON} + \gamma_2 d_t^{TUE} + \gamma_3 d_t^{WED} + \gamma_4 d_t^{THUR} + \sum_{i=1}^{4} \theta_i \Delta illiq_{t-i} + \varepsilon_t$$

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Market illiquidity, market declines and funding liquidity

	1	2	3	4
D FCP t	0.03953	0.03811	0.03737	0.03606
lag dummy pos MKT ret	0.070			
lag dummy neg MKT ret	-2.224	-2.186		
dummy for pos fund constraints			-2.137	-2.067
VOL t		0.171		0.167
dummy mon	-0.029	-0.029	-0.028	-0.029
dummy tue	-0.028	-0.029	-0.029	-0.029
dummy wed	-0.020	-0.021	-0.019	-0.020
dummy thur	-0.013	-0.014	-0.013	-0.013
constant	0.014	0.015	0.016	0.016
Rbar	0.35	0.35	0.35	0.35

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Crisis episodes and FX market illiquidity

- In order to test if during crisis periods the changes in funding liquidity constraints have a strong positive impact on FX market illiquidity, we take the level of the TED spread as an indicator for crisis periods

- We interact it with our measure of changes in funding constraints in the following regression:

$$\Delta illiq_t = \alpha + \beta(TS_t * \Delta FCP_t) + \delta VOL_t + \mu MKT_{t-1}$$

$$\gamma_1 d_t^{MON} + \gamma_2 d_t^{TUE} + \gamma_3 d_t^{WED} + \gamma_4 d_t^{THUR} + \sum_{i=1}^{4} \theta_i \Delta illiq_{t-i} + \varepsilon_t$$

- We expect the beta to be positive and statistically significant

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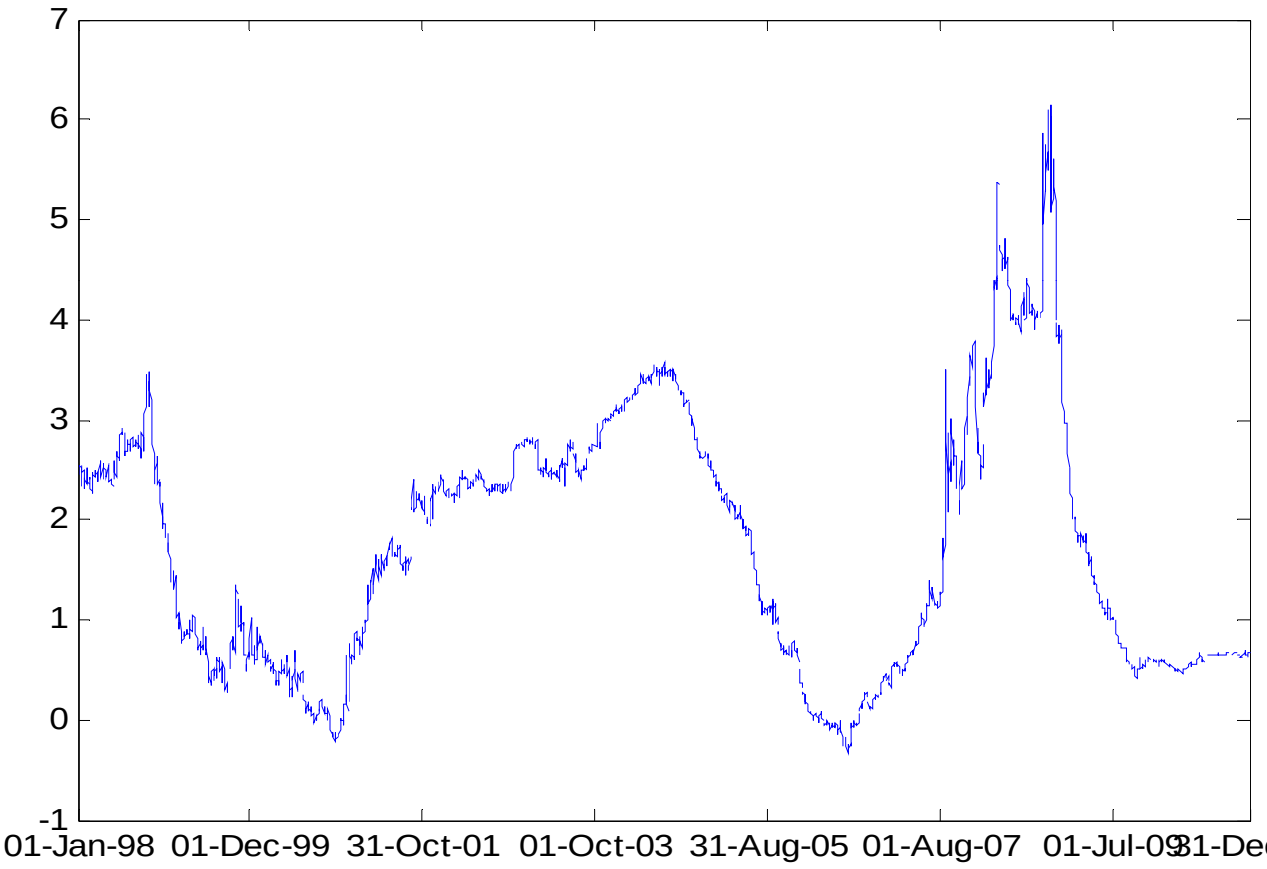
TED SPREAD



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Crisis episodes and FX market illiquidity

TED t * D FCP t	**0.0208**
VOL t	**0.1687**
MKT t-1	**-1.0564**
dummy mon	**-0.0297**
dummy tue	**-0.0291**
dummy wed	**-0.0216**
dummy thur	**-0.0140**
Constant	**0.0185**
Rbar	0.35

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Robustness tests

- Repeat estimation using GMM: results are qualitatively the same
- Investigate determinants of shocks to FX market illiquidity:

  Determinants are the same as in the main analysis
- Use an alternative measure of liquidity, market depth:
  - Pastor-Stambaugh proxy for liquidity

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GMM estimation

	1	2
D FCP t	0.039	0.038
VOLt		0.176
lag MKT		-1.072
dummy mon	-0.028	-0.030
dummy tue	-0.028	-0.029
dummy wed	-0.020	-0.022
dummy thur	-0.013	-0.014
constant	0.018	0.018
Rbar	0.35	0.35

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Determinants of shocks to FX market illiquidity

D FCP t	**0.0340**
VOL t	**0.1705**
MKT t-1	**-1.0257**
dummy mon	**-0.0306**
dummy tue	**-0.0279**
dummy wed	**-0.0200**
dummy thur	**-0.0131**
constant	**0.0179**
Rbar	0.02

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Pastor-Stambaugh proxy for liquidity

- Temporary price change in terms of expected return reversal accompanying order flow

$$r_{i,t} = \alpha_i + \beta_i \Delta x_{i,t} + \gamma_i \Delta x_{i,t-1} + \varepsilon_{i,t}$$

$$L_{i,m} = \hat{\gamma}_{i,m}$$

$$\Delta L_m = \alpha + \gamma \Delta REPO_m + \beta \Delta FCP_m + \delta VOL_m +$$

$$+ \varphi \Delta TS_m + \varsigma \Delta FF_m + \mu MKT_{m-1} + \theta \Delta L_{m-1} + \varepsilon_m .$$

- Analysis at a different frequency, monthly
- Funding liquidity measured as changes in amount outstanding of REPOs and changes in monthly FCP rates
- Volatility is the monthly standard deviation of FX currency returns

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Pastor-Stambaugh proxy for liquidity

	1	2
REPOS	**0.0089**	**0.0085**
FCP	-0.0003	0.0000
VOLt		**-0.4405**
constant	-0.0001	**0.0016**
Rbar	0.37	0.41

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Conclusions

- We find a strong impact of the changes in funding liquidity conditions on the time variation of FX market illiquidity, controlling for global FX volatility and market returns
- We identify a strong weekly seasonality in FX market illiquidity
- We document an asymmetric effect of market returns on illiquidity in the FX market; inventory accumulation concerns are more important in declining markets, and this relates to periods when the suppliers of liquidity face capital tightness
- We show that liquidity dry-ups during crisis times impact on FX market illiquidity

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Conclusions

- Funding liquidity together with the other explanatory variables are found to explain shocks to FX market illiquidity as well
- The relationship between funding liquidity and FX market illiquidity holds true for another liquidity proxy at a lower frequency

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