Strains on money market makers and money market tensions

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Motivation

▶ Failures in the money market stressed in the literature:

1. Elevated counterparty credit risk
   (Flannery JMCB 1996, Afonso et al. JF 2011)
2. Informational asymmetry about counterparty credit risk
   (Freixas&Jorge JMCB 2008, Abbassi et al. 2014)
3. Liquidity hoarding
   (Allen et al. JME 2009, Acharya&Merrouche RoF 2013)
4. Search costs (Afonso&Lagos 2012; Ashcraft&Duffie AER 2007)

▶ But middlemen (i.e. MM or arbitrageurs) emerge in OTC markets to mitigate search costs (e.g. Rubinstein&Wolinsky QJE 1987)

▶ Evidence for core-periphery structure (Craig&von Peter JFI 2014)

▶ If MM and arbitrageurs are important for allocation, then their ability to take further positions is crucial (Gromb&Vayanos JFE 2002, Brunnermeier&Pedersen RFS 2009)

⇒ Do assumed risk and funding constraints of MMs in unsecured markets affect the pricing of liquidity and the market liquidity?

Contribution

- ▶ We use trading book data of a key market maker in the unsecured money market of the Euro area
- ▶ We study how the liquidity risk accumulated by the MM over past trades affects the pricing of interbank liquidity
- ▶ We find that a higher accumulated liquidity risk ...

    increases the price the MM pays *and* charges for liquidity ...
    in particular for longer maturities,

    increases the bid-ask spread the MM charges ...
    in particular for longer maturities.

Implications

- ▶ Allocation of liquidity risks within the banking sector matters for the pricing of liquidity and for the liquidity of the money market
- ▶ Elevated liquidity risks of money center banks generate externalities
- ⇒ Regulating their assumed liquidity risk and its volatility might be advisable
- ⇒ Reducing the assumed liquidity risk (of MMs) through LTROs important in mitigating amplification effects

Dataset

- ▶ Trade-by-trade data of one of the key market makers in the Euro area's money market from January 2007 to December 2008
- ▶ Data comprises only transactions of the Frankfurt desk: 17,712 transactions
- ▶ Data reports for each trade: volume, rate, maturity, time stamp (by minute), trader ID, clear name of the counterpart
- ▶ Match with rating data for the counterparts
- ▶ Match with market data (daily frequency): Eurepo rates, Euribor-Eurepo spread, MM's CDS

Key variables

- Accumulated maturity mismatch in past transactions:

$$LIQ_{t+i} = \sum_{C=0}^{t+i}(m_C^l - \bar{m})V_C^l - \sum_{C=0}^{t+i}(m_C^d - \bar{m})V_C^d, \qquad (1)$$

where m_C^l and m_C^d: remaining maturity of all outstanding loans and deposits at $t + i$
$\bar{m}$ volume weighted average maturity

- Net money market funding:

$$NMMF_{t+i} = \sum_{C \leq t+i}^{M} V_C^d - \sum_{C \leq t+i}^{M} V_C^l. \qquad (2)$$

Empirical approach

- ▸ Estimate for transaction *i* with counterpart *j* and maturity *m* on date *t* the fixed rate $\hat{r}_{i,j,m,t,c}$ where $c \in \{d; l\}$:

$$
\begin{aligned}
\hat{r}_{i,j,m,t,c} &= \beta_1 Eurepo_{m,t} + \beta_2 Amount_i + \beta_3 Maturity_i \\
&\quad \beta_4 LIQ_{t+i} + \beta_5 NMMF_{-i} + \beta_6 LIQ_{t+i} \times Maturity_i \\
&\quad \gamma' X_j + \alpha' X_t + \beta_0 + \epsilon_{i,j,m,t,c}
\end{aligned}
$$

- ▸ We also allow for counterparty FE and monthly time FE
- ▸ We allow for a different effects in the different subperiods:

    Precrisis (1/2007-8/2007)
    Subprime Crisis (8/2007-9/2008)
    Lehman (9/2008-12/2008)

Baseline Results

	LIQ * Maturity (M3)		Rating (M4)		Relationships (M7)	
	Deposits	*Loans*	*Deposits*	*Loans*	*Deposits*	*Loans*
Order book data						
Eurepo (in logs)	1.12***	0.96***	1.04***	1.22***	1.04***	1.22***
	(0.0044)	(0.011)	(0.010)	(0.036)	(0.010)	(0.036)
Amount (in EUR)	-4.0e-12	-9.8e-13	1.5e-11***	-5.5e-13	1.6e-11***	-1.2e-12
	(5.2e-12)	(2.1e-12)	(4.5e-12)	(2.1e-12)	(4.5e-12)	(2.1e-12)
Maturity (in days)	0.0016***	0.00027	0.0015***	0.000053	0.0016***	0.00010
	(0.000086)	(0.00034)	(0.000072)	(0.00032)	(0.000073)	(0.00032)
Liquidity and NMMF						
Funding liquidity risk (LIQ)	1.8e-13***	5.3e-14*	3.9e-13***	1.6e-13*	3.8e-13***	2.2e-13**
	(1.7e-14)	(2.9e-14)	(3.5e-14)	(8.3e-14)	(3.6e-14)	(8.7e-14)
Net money market funding	5.5e-12***	1.6e-12***	5.7e-12***	3.0e-12**	5.6e-12***	3.9e-12***
	(2.5e-13)	(4.1e-13)	(5.1e-13)	(1.2e-12)	(5.2e-13)	(1.3e-12)
LIQ * Maturity	4.8e-15***	9.0e-15***	4.7e-15***	7.9e-15***	4.8e-15***	7.5e-15***
	(6.4e-16)	(3.0e-15)	(5.3e-16)	(2.8e-15)	(5.3e-16)	(2.8e-15)
Control Varibales						
Counterparty Credit Rating			yes	yes	yes	yes
Five year CDS (one-day change)					yes	yes
3 months Euribor-Eurepo spread					yes	yes
Relationship dummy					yes	yes
Observations	15208	2512	15208	2512	15208	2512
Time fixed effects (monthly)	No	No	Yes	Yes	Yes	Yes
R2 (adjusted)	0.90	0.78	0.93	0.81	0.93	0.81

Effects in subperiods

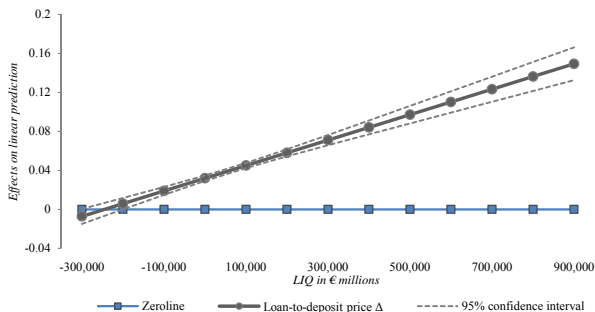| | Panel regression by Bank ID (M8b) | | | |
| | *Deposits* | | *Loans* | |
	FE	RE	FE	RE
Order book data				
Eurepo (in logs)	1.08***	1.08***	1.17***	1.20***
	(0.0099)	(0.0099)	(0.034)	(0.036)
Amount (in EUR)	-5.9e-13	1.4e-11**	3.3e-12	-2.3e-12
	(6.6e-12)	(5.7e-12)	(2.4e-12)	(2.2e-12)
Maturity (in days)	0.0012***	0.0013***	-0.0043***	-0.00017
	(0.000089)	(0.000082)	(0.0012)	(0.00034)
Liquidity and NMMF				
LIQ main effect (0)	-1.2e-13**	-1.3e-13***	-5.0e-14	-5.4e-14
	(4.7e-14)	(4.7e-14)	(1.5e-13)	(1.6e-13)
LIQ main effect (1)	3.7e-13***	3.7e-13***	1.8e-13*	2.4e-13**
	(4.2e-14)	(4.2e-14)	(9.6e-14)	(1.0e-13)
LIQ main effect (2)	1.1e-12***	1.1e-12***	1.1e-13	4.3e-13
	(6.8e-14)	(6.8e-14)	(3.7e-13)	(3.9e-13)
LIQ * Maturity (0)	1.2e-15	2.7e-15*	3.5e-14***	-5.7e-16
	(2.0e-15)	(1.5e-15)	(1.3e-14)	(4.7e-15)
LIQ * Maturity (1)	1.8e-15*	1.8e-15*	3.1e-14***	1.9e-14**
	(1.0e-15)	(1.0e-15)	(1.0e-14)	(9.4e-15)
LIQ * Maturity (2)	3.1e-15***	3.6e-15***	9.7e-15*	9.6e-15**
	(6.2e-16)	(6.0e-16)	(5.7e-15)	(3.9e-15)
NMMF (0)	-2.0e-12***	-2.1e-12***	-3.3e-14	-6.1e-13
	(7.4e-13)	(7.3e-13)	(2.2e-12)	(2.3e-12)
NMMF (1)	6.1e-12***	6.2e-12***	3.7e-12***	4.5e-12***
	(6.2e-13)	(6.2e-13)	(1.3e-12)	(1.4e-12)
NMMF (2)	1.5e-11***	1.5e-11***	2.2e-12	7.2e-12
	(9.8e-13)	(9.8e-13)	(5.3e-12)	(5.5e-12)
Control variables				
Full set of control variables	yes	yes	yes	yes
Summary statistics				
Observations	15208	15208	2512	2512
Time fixed effects	Yes	Yes	Yes	Yes
Number of groups	414	414	130	130
R2 (adjusted/overall)	0.93	0.94	0.78	0.82

Mid price effects

- With a higher accumulated liquidity risk, the MM pays a higher price for liquidity (...but only in the crisis)
- Also price he charges for liquidity increases (...but only in crisis)
- $\Rightarrow$ Liquidity becomes pricier when MM bears a higher liquidity risk
- $\Rightarrow$ Indication for liquidity hoarding

- Effects are stronger for longer maturities (...but only in the crisis)
- $\Rightarrow$ MM seems to actively manage his liquidity risk
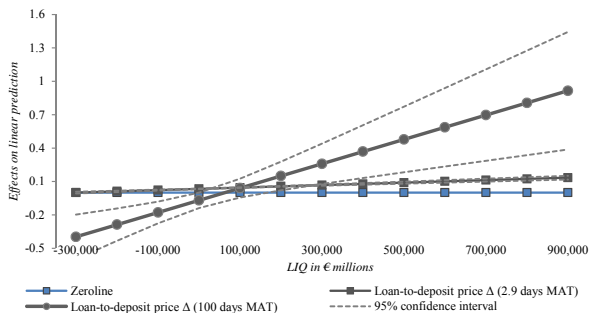- $\Rightarrow$ It becomes costlier to offload liquidity risk with the MM

- Interesting further effect: A higher CDS spread for the MM not only increases his deposit rate but also his loan rate
- $\Rightarrow$ MM rolls over idiosyncratic funding cost increases

Marginal effect on bid-ask spread

Effects on linear prediction vs. LIQ in € millions

Legend: Zeroline — Loan-to-deposit price Δ — 95% confidence interval

- ► With a higher accumulated liquidity risk, the predicted difference between the loan and deposit rate (bid-ask-spread) increases
- ⇒ Transaction costs in the unsecured money market increase

Marginal effect on bid-ask spread across maturities

Effects on linear prediction vs. LIQ in € millions

- Zeroline
- Loan-to-deposit price Δ (100 days MAT)
- Loan-to-deposit price Δ (2.9 days MAT)
- 95% confidence interval

▶ The bid-ask-spread is sensitive to the accumulated liquidity risk across the maturity buckets

▶ For longer maturities the sensitivity is higher

Robustness Checks

- ▶ Results are robust to sample split for subperiods, which allow for different sensitivity to control variables (particularly CCR)
- ▶ Results are robust to the calculation of the LIQ measure on a daily basis (rather then a trade-by-trade basis)
- ▶ Results are also robust to the inclusion of trader fixed effects

Conclusion

- Allocation of liquidity risks within the banking sector matters for the pricing of liquidity and for the liquidity of the money market
- Liquidity spirals might emerge in money markets: If other market participants respond to higher costs of obtaining liquidity by hoarding liquidity ($\rightarrow$ MM's liquidity risk further increases)
- $\Rightarrow$ LTROs important to mitigate spirals

- Elevated liquidity risk of MM increases the spread between the unsecured rates (in decentralized market) and secured rates (in centralized market)
- $\Rightarrow$ LTROs helpful in reducing the spread