

Interbank Market Frictions and Banks' Recourse to the LOLR

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Introduction - Motivation I

- ▶ Money market failure at the heart of the recent financial crisis
- ▶ Central banks provided liquidity support to contain crisis
- ▶ But massive liquidity injections did not revitalize interbank markets

- ▶ Several reasons for money market failure:
 - Rationing due to adverse selection [Freixas and Jorge (JMCB, 2009)]
 - Precautionary liquidity hoarding [Allen, Carletti and Gale (JME, 2009)]
 - Market power [Nyborg and Strebulaev (RFS, 2004)]

Introduction - Motivation II

- ▶ For optimal policy design thorough understanding of the reason for money market failure
- ▶ If adverse selection issues and rationing are key, massive liquidity injection fail revitalizing interbank market

- ▶ Few empirical papers disentangle money market frictions
- Afonso, Kovner, Schoar (JF, 2011):
 - Data: bilateral interbank lending
 - Finding: Rationing but no freeze due to precautionary hoarding
 - Problem: Disentangle demand/supply effects if lenders' risk sensitivity changes
- Fecht, Nyborg and Rocholl (JFE, 2011):
 - Data: Bidding data on ECB's money auction to infer market frictions
 - Finding: Market power and fear of squeezes
 - Problem: Approach not pursuable after Oct 2008

Introduction - Contribution

- ▶ We use banks' recourses to LOLR as a indication for unmet liquidity demand
- ▶ We study which bank characteristics and measures of money market frictions affect banks recourse to LOLR and which banks were most severely affected by tensions in money markets
- ▶ We study which banks' LOLR recourses were mitigated through ECB liquidity injection and how the sensitivity of different banks to money market frictions was affected by ECB injections

Institutional Background

- ▶ Marginal lending facility (MLF) is ECB's discount window; permits banks to borrow unlimited amounts against collateral at penalty rate
- ▶ ECB mainly allots liquidity through weekly repo auctions; between auctions banks rely on interbank market (or MLF) to cover liquidity needs
- ▶ Reserve demand largely driven by reserve requirements: Banks have to hold on a monthly average remunerated reserves meeting a minimum reserve requirement

Data set

- ▶ We match at the bank level:
 - daily MLF recourse: incl. amount from 26. January 2004 to 11. October 2010
 - daily reserve data: daily requirement, actual holdings, cumulative fulfilment of reserve requirement
 - monthly bank balance sheet statistics
- ▶ We focus on the main parts of the German banking sector
- ▶ We drop observations for a bank *after* its fifth recourse to the MLF in a row
(distorted the results as those banks would be overrepresented)
- ▶ Our final data set: 1,999 bank observations, 3,177,293 reserve and balance sheet observations, and 4,671 recourse observations

Key variables

Endogenous variables:

$LOLR_{it}$

- ▶ $Stress_{it}$: Dummy for MLF recourse of bank i on day t ($\rightarrow Stress_{it}^{adj}$)
- ▶ $MLFAmount_{it}$: Amount received by i on t from MLF

Exogenous variables:

MR_{it}

- ▶ *Fulfillment ratio*: Fulfillment of the cumulated daily reserve requirements by the cumulated actual reserve holding since beginning of the maintenance period
- ▶ *NetEXcessreserves*: Actual reserve holding relative to the required amounts over the remaining days
- ▶ *FundingLiquidityRisk*: Fluctuation of the actual holdings relative to requirements over last 5 days

BSS_{it}

- ▶ *Equity ratio* (not risk weighted)
- ▶ *Interbank Obligations*: Interbank borrowing relative to balance sheet total

Key variables

$MM_TENSION_t$

- ▶ *MLF-Eurepo*: Spread between MLF rate and overnight repo
→ Aggregate scarcity of liquidity
- ▶ *VolaEurepo*: 5 days Volatility of the overnight repo
→ Market uncertainty
- ▶ *CounterpartyCreditRisk*: Spread between EONIA and ON repo rate
→ Credit risk premium
- ▶ *AsymResHolding*: Concentration of excess reserves
→ Market power, fear of squeeze

$ECB - Liq_t$

- ▶ *ECB's excess liquidity provision*:

$$ECB - Liq_t = \frac{\text{Allotted liquidity} - \text{required reserves}}{\text{required reserves}}$$

Approach

- ▶ Panel Logit model to estimate propensity of a bank to draw on MLF
- ▶ Panel model with Heckman correction to estimate MLF amounts

$$\begin{aligned} LOLR_{it} = & u_{it} + \alpha_j + \beta_1 MR_{it} + \beta_2 BSS_{it} + \beta_3 MM_TENSION_t \\ & + \beta_4 MR_{it} \times MM_TENSION_t + \beta_5 BSS_{it} \times MM_TENSION_t \\ & + \beta_6 MR_{it} \times ECB - Liq_t + \beta_7 BSS_{it} \times ECB - Liq_t \\ & + \beta_8 MR_{it} \times MM_TENSION_t \times ECB - Liq_t \\ & + \beta_9 BSS_{it} \times MM_TENSION_t \times ECB - Liq_t \end{aligned}$$

- ▶ We use 1) bank fixed effects and 2) random effects as well as fixed effects for each reserve maintenance period

Results I: Recourse Propensity

	ECB LIQ Interventions (Model 6)			ECB LIQ Interactions (Model 7)			
	Model 6 (a)	Model 6 (b)	Model 6 (c)	Model 7 (a)	Model 7 (b)	Model 7 (c)	Model 7 (d)
	ECB (FE)	ECB (RE)	ECB (TFE)	CCR	EV	DME	LIQ-I
MR-NEX	-0.0126*** (0.00218)	-0.0121*** (0.00220)	-0.0124*** (0.00219)	-0.0131*** (0.00223)	-0.00583** (0.00293)	0.00830 (0.0141)	-0.0112*** (0.00402)
MR-FLR	0.0127*** (0.00198)	0.000252 (0.000192)	0.0133*** (0.00195)	0.0126*** (0.00205)	0.0102*** (0.00249)	-0.0419*** (0.0143)	0.0172*** (0.00633)
LastDay	1.739*** (0.0440)	1.738*** (0.0440)	1.765*** (0.0449)	1.787*** (0.0458)	1.748*** (0.0442)	1.742*** (0.0441)	1.800*** (0.0451)
BSS-Size	5.52e-09*** (1.31e-09)	6.38e-09*** (1.24e-09)	9.15e-09*** (1.35e-09)	5.17e-09*** (1.33e-09)	4.50e-09*** (1.39e-09)	2.55e-09 (2.19e-09)	2.11e-09 (1.47e-09)
BSS-Equity	4.519*** (0.321)	4.243*** (0.306)	3.892*** (0.332)	4.518*** (0.321)	4.780*** (0.327)	4.748*** (0.941)	5.183*** (0.393)
BSS-IO	1.369*** (0.166)	1.425*** (0.159)	1.214*** (0.169)	1.380*** (0.166)	1.622*** (0.174)	2.682*** (0.395)	1.967*** (0.204)
MM-EV	1.442*** (0.324)	1.450*** (0.324)	0.877** (0.365)	1.688*** (0.325)	4.600*** (0.677)	1.422*** (0.326)	1.611*** (0.323)
MM-CCR	0.748*** (0.114)	0.748*** (0.114)	0.431*** (0.124)	0.727*** (0.240)	0.764*** (0.115)	0.766*** (0.114)	0.691*** (0.115)
MM-DME	0.159** (0.0779)	0.150* (0.0778)	0.296** (0.134)	0.132* (0.0781)	0.148* (0.0785)	0.490*** (0.177)	0.241*** (0.0794)
MM-REXVol	0.597*** (0.0831)	0.600*** (0.0830)	0.287*** (0.110)	0.615*** (0.0833)	0.611*** (0.0835)	0.586*** (0.0839)	0.611*** (0.0831)
MM-LIQ-I	4.34e-10* (2.26e-10)	4.22e-10* (2.26e-10)	1.30e-09*** (2.43e-10)	3.48e-10 (2.29e-10)	3.55e-10 (2.29e-10)	4.49e-10** (2.29e-10)	1.34e-09** (5.28e-10)

Results II: Recourse Propensity

NER * ECB-Liq	-0.0185*** (0.00616)	-0.0199*** (0.00614)	-0.0183*** (0.00634)	-0.0169** (0.00691)	-0.00683 (0.00678)	0.0600** (0.0253)	-0.0346*** (0.00839)
FLR * ECB-Liq	0.0147* (0.00770)	0.00414*** (0.00112)	0.0121 (0.00742)	0.0305** (0.0155)	0.0364** (0.0147)	0.0946 (0.0630)	0.00719 (0.0145)
Bss * ECB-Liq	-1.09e-10 (7.28e-10)	-3.46e-10 (7.24e-10)	-1.01e-09 (7.28e-10)	-3.19e-10 (8.49e-10)	-1.57e-10 (9.41e-10)	-5.55e-09 (4.51e-09)	4.59e-09*** (1.23e-09)
ER * ECB-Liq	-4.130*** (0.556)	-4.148*** (0.553)	-3.704*** (0.545)	-3.845*** (0.601)	-3.424*** (0.631)	8.310*** (2.929)	-2.094** (0.910)
IO * ECB-Liq	-1.311*** (0.185)	-1.275*** (0.183)	-1.228*** (0.179)	-1.287*** (0.214)	-1.589*** (0.236)	-1.514 (1.065)	-1.408*** (0.268)
NER x CCR—EV—DME—LIQ-I				-0.0181** (0.00733)	-0.189*** (0.0599)	-0.0200 (0.0145)	-8.49e-12 (2.72e-11)
FLR x CCR—EV—DME—LIQ-I				0.0400 (0.0739)	0.0725 (0.0825)	0.0643*** (0.0161)	-5.42e-11 (7.26e-11)
Size x CCR—EV—DME—LIQ-I				7.94e-09*** (2.00e-09)	1.63e-08*** (4.94e-09)	2.54e-09* (1.41e-09)	2.00e-17*** (3.40e-18)
ER x CCR—EV—DME—LIQ-I				0.668 (1.297)	-16.25*** (3.364)	-0.265 (0.930)	-9.28e-09*** (3.01e-09)
IO x CCR—EV—DME—LIQ-I				0.0690 (0.486)	-7.328*** (1.488)	-1.383*** (0.378)	-6.16e-09*** (1.23e-09)
CCR—EV—DME—LIQ-I x ECB-Liq				-0.635 (0.553)	-1.935* (1.031)	0.316 (0.382)	1.64e-09*** (5.95e-10)
NEX x CCR—EV—DME—LIQ-I x ECB-Liq				0.0155 (0.0423)	-0.262** (0.107)	-0.0514** (0.0223)	7.07e-11*** (2.72e-11)
FLR x CCR—EV—DME—LIQ-I x ECB-Liq				-0.142 (0.118)	-0.236 (0.219)	-0.0771* (0.0416)	6.88e-11 (9.16e-11)
Size x CCR—EV—DME—LIQ-I x ECB-Liq				-4.68e-09 (3.97e-09)	-4.56e-09 (6.80e-09)	2.86e-09 (3.25e-09)	-3.26e-17*** (7.06e-18)
ER x CCR—EV—DME—LIQ-I x ECB-Liq				-5.027 (4.071)	-13.68* (8.248)	-9.166*** (2.376)	-1.02e-08* (6.02e-09)
IO x CCR—EV—DME—LIQ-I x ECB-Liq				-0.428 (1.182)	6.716*** (2.277)	0.643 (0.814)	3.06e-09** (1.31e-09)

Summary Statistics

Model	FE	RE	FE + TFE	FE	FE	FE	FE
Observations	828117	3024109	828117	828117	828117	828117	828117
Group average	1580.4	1512.8	1580.4	1580.4	1580.4	1580.4	1580.4
Degree of freedom (model)	16	23	95	27	27	27	20
Log-Likelihood	-20279.2	-22553.2	-20000.2	-20258.0	-20228.7	-20240.1	-20222.8
Pseudo R2	0.0537	—	0.0667	0.0547	0.0561	0.0555	0.0563

Standard errors in parentheses

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

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MM-LIQ-I	4.34e-10* (2.26e-10)	4.22e-10* (2.26e-10)	1.30e-09*** (2.43e-10)	3.48e-10 (2.29e-10)	3.55e-10 (2.29e-10)	4.49e-10** (2.29e-10)	1.34e-09** (5.28e-10)

Banks short in liquidity, with higher liquidity risk
as well as larger and more IB market dependent banks higher recourse propensity
But also better capitalized banks!

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BSS-Size	5.52e-09*** (1.31e-09)	6.38e-09*** (1.24e-09)	9.15e-09*** (1.35e-09)	5.17e-09*** (1.33e-09)	4.50e-09*** (1.39e-09)	2.55e-09 (2.19e-09)	2.11e-09 (1.47e-09)
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MM-LIQ-I	4.34e-10* (2.26e-10)	4.22e-10* (2.26e-10)	1.30e-09*** (2.43e-10)	3.48e-10 (2.29e-10)	3.55e-10 (2.29e-10)	4.49e-10** (2.29e-10)	1.34e-09** (5.28e-10)

In periods of elevated market uncertainty, higher credit risk spreads in IB market and more concentrated excess reserves the recourse propensity was higher
 But also in phases of relative low repo rates!

Results II: Recourse Propensity

NER * ECB-Liq	-0.0185*** (0.00616)	-0.0199*** (0.00614)	-0.0183*** (0.00634)	-0.0169** (0.00691)	-0.00683 (0.00678)	0.0600** (0.0253)	-0.0346*** (0.00839)
FLR * ECB-Liq	0.0147* (0.00770)	0.00414*** (0.00112)	0.0121 (0.00742)	0.0305** (0.0155)	0.0364** (0.0147)	0.0946 (0.0630)	0.00719 (0.0145)
Bss * ECB-Liq	-1.09e-10 (7.28e-10)	-3.46e-10 (7.24e-10)	-1.01e-09 (7.28e-10)	-3.19e-10 (8.49e-10)	-1.57e-10 (9.41e-10)	-5.55e-09 (4.51e-09)	4.59e-09*** (1.23e-09)
ER * ECB-Liq	-4.130*** (0.556)	-4.148*** (0.553)	-3.704*** (0.545)	-3.845*** (0.601)	-3.424*** (0.631)	8.310*** (2.929)	-2.094** (0.910)
IO * ECB-Liq	-1.311*** (0.185)	-1.275*** (0.183)	-1.228*** (0.179)	-1.287*** (0.214)	-1.589*** (0.236)	-1.514 (1.065)	-1.408*** (0.268)
NER x CCR—EV—DME—LIQ-I				-0.0181** (0.00733)	-0.189*** (0.0599)	-0.0200 (0.0145)	-8.49e-12 (2.72e-11)
FLR x CCR—EV—DME—LIQ-I				0.0400 (0.0739)	0.0725 (0.0825)	0.0643*** (0.0161)	-5.42e-11 (7.26e-11)
Size x CCR—EV—DME—LIQ-I				7.94e-09*** (2.00e-09)	1.63e-08*** (4.94e-09)	2.54e-09* (1.41e-09)	2.00e-17*** (3.40e-18)
ER x CCR—EV—DME—LIQ-I				0.668 (1.297)	-16.25*** (3.364)	-0.265 (0.930)	-9.28e-09*** (3.01e-09)
IO x CCR—EV—DME—LIQ-I				0.0690 (0.486)	-7.328*** (1.488)	-1.383*** (0.378)	-6.16e-09*** (1.23e-09)
CCR—EV—DME—LIQ-I x ECB-Liq				-0.635 (0.553)	-1.935* (1.031)	0.316 (0.382)	1.64e-09*** (5.95e-10)
NEX x CCR—EV—DME—LIQ-I x ECB-Liq				0.0155 (0.0423)	-0.262** (0.107)	-0.0514** (0.0223)	7.07e-11*** (2.72e-11)
FLR x CCR—EV—DME—LIQ-I x ECB-Liq				-0.142 (0.118)	-0.236 (0.219)	-0.0771* (0.0416)	6.88e-11 (9.16e-11)
Size x CCR—EV—DME—LIQ-I x ECB-Liq				-4.68e-09 (3.97e-09)	-4.56e-09 (6.80e-09)	2.86e-09 (3.25e-09)	-3.26e-17*** (7.06e-18)
ER x CCR—EV—DME—LIQ-I x ECB-Liq				-5.027 (4.071)	-13.68* (8.248)	-9.166*** (2.376)	-1.02e-08* (6.02e-09)
IO x CCR—EV—DME—LIQ-I x ECB-Liq				-0.428 (1.182)	6.716*** (2.277)	0.643 (0.814)	3.06e-09** (1.31e-09)

Elevated credit risk premium affects liquidity short and large banks

Increases in market uncertainty impairs liquidity short, large and poorly capitalized banks

Larger concentration in excess liquidity holdings affect large and poorly capitalized banks

Results II: Recourse Propensity

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FLR * ECB-Liq	0.0147*	0.00414***	0.0121	0.0305**	0.0364**	0.0946	0.00719
	(0.00770)	(0.00112)	(0.00742)	(0.0155)	(0.0147)	(0.0630)	(0.0145)
Bss * ECB-Liq	-1.09e-10	-3.46e-10	-1.01e-09	-3.19e-10	-1.57e-10	-5.55e-09	4.59e-09***
	(7.28e-10)	(7.24e-10)	(7.28e-10)	(8.49e-10)	(9.41e-10)	(4.51e-09)	(1.23e-09)
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	(0.185)	(0.183)	(0.179)	(0.214)	(0.236)	(1.065)	(0.268)
NER x CCR—EV—DME—LIQ-I				-0.0181**	-0.189***	-0.0200	-8.49e-12
				(0.00733)	(0.0599)	(0.0145)	(2.72e-11)
FLR x CCR—EV—DME—LIQ-I				0.0400	0.0725	0.0643***	-5.42e-11
				(0.0739)	(0.0825)	(0.0161)	(7.26e-11)
Size x CCR—EV—DME—LIQ-I				7.94e-09***	1.63e-08***	2.54e-09*	2.00e-17***
				(2.00e-09)	(4.94e-09)	(1.41e-09)	(3.40e-18)
ER x CCR—EV—DME—LIQ-I				0.668	-16.25***	-0.265	-9.28e-09***
				(1.297)	(3.364)	(0.930)	(3.01e-09)
IO x CCR—EV—DME—LIQ-I				0.0690	-7.328***	-1.383***	-6.16e-09***
				(0.486)	(1.488)	(0.378)	(1.23e-09)
CCR—EV—DME—LIQ-I x ECB-Liq				-0.635	-1.935*	0.316	1.64e-09***
				(0.553)	(1.031)	(0.382)	(5.95e-10)
NEX x CCR—EV—DME—LIQ-I x ECB-Liq				0.0155	-0.262**	-0.0514**	7.07e-11***
				(0.0423)	(0.107)	(0.0223)	(2.72e-11)
FLR x CCR—EV—DME—LIQ-I x ECB-Liq				-0.142	-0.236	-0.0771*	6.88e-11
				(0.118)	(0.219)	(0.0416)	(9.16e-11)
Size x CCR—EV—DME—LIQ-I x ECB-Liq				-4.68e-09	-4.56e-09	2.86e-09	-3.26e-17***
				(3.97e-09)	(6.80e-09)	(3.25e-09)	(7.06e-18)
ER x CCR—EV—DME—LIQ-I x ECB-Liq				-5.027	-13.68*	-9.166***	-1.02e-08*
				(4.071)	(8.248)	(2.376)	(6.02e-09)
IO x CCR—EV—DME—LIQ-I x ECB-Liq				-0.428	6.716***	0.643	3.06e-09**
				(1.182)	(2.277)	(0.814)	(1.31e-09)

Higher ECB liquidity allotment actually increases the recourse probability of liquidity short and poorly capitalized banks and banks with a higher liquidity risk
Only banks more dependent on interbank funding benefited!

Results II: Recourse Propensity

NER * ECB-Liq	-0.0185*** (0.00616)	-0.0199*** (0.00614)	-0.0183*** (0.00634)	-0.0169** (0.00691)	-0.00683 (0.00678)	0.0600** (0.0253)	-0.0346*** (0.00839)
FLR * ECB-Liq	0.0147* (0.00770)	0.00414*** (0.00112)	0.0121 (0.00742)	0.0305** (0.0155)	0.0364** (0.0147)	0.0946 (0.0630)	0.00719 (0.0145)
Bss * ECB-Liq	-1.09e-10 (7.28e-10)	-3.46e-10 (7.24e-10)	-1.01e-09 (7.28e-10)	-3.19e-10 (8.49e-10)	-1.57e-10 (9.41e-10)	-5.55e-09 (4.51e-09)	4.59e-09*** (1.23e-09)
ER * ECB-Liq	-4.130*** (0.556)	-4.148*** (0.553)	-3.704*** (0.545)	-3.845*** (0.601)	-3.424*** (0.631)	8.310*** (2.929)	-2.094** (0.910)
IO * ECB-Liq	-1.311*** (0.185)	-1.275*** (0.183)	-1.228*** (0.179)	-1.287*** (0.214)	-1.589*** (0.236)	-1.514 (1.065)	-1.408*** (0.268)
NER x CCR—EV—DME—LIQ-I				-0.0181** (0.00733)	-0.189*** (0.0599)	-0.0200 (0.0145)	-8.49e-12 (2.72e-11)
FLR x CCR—EV—DME—LIQ-I				0.0400 (0.0739)	0.0725 (0.0825)	0.0643*** (0.0161)	-5.42e-11 (7.26e-11)
Size x CCR—EV—DME—LIQ-I				7.94e-09*** (2.00e-09)	1.63e-08*** (4.94e-09)	2.54e-09* (1.41e-09)	2.00e-17*** (3.40e-18)
ER x CCR—EV—DME—LIQ-I				0.668 (1.297)	-16.25*** (3.364)	-0.265 (0.930)	-9.28e-09*** (3.01e-09)
IO x CCR—EV—DME—LIQ-I				0.0690 (0.486)	-7.328*** (1.488)	-1.383*** (0.378)	-6.16e-09*** (1.23e-09)
CCR—EV—DME—LIQ-I x ECB-Liq				-0.635 (0.553)	-1.935* (1.031)	0.316 (0.382)	1.64e-09*** (5.95e-10)
NEX x CCR—EV—DME—LIQ-I x ECB-Liq				0.0155 (0.0423)	-0.262** (0.107)	-0.0514** (0.0223)	7.07e-11*** (2.72e-11)
FLR x CCR—EV—DME—LIQ-I x ECB-Liq				-0.142 (0.118)	-0.236 (0.219)	-0.0771* (0.0416)	6.88e-11 (9.16e-11)
Size x CCR—EV—DME—LIQ-I x ECB-Liq				-4.68e-09 (3.97e-09)	-4.56e-09 (6.80e-09)	2.86e-09 (3.25e-09)	-3.26e-17*** (7.06e-18)
ER x CCR—EV—DME—LIQ-I x ECB-Liq				-5.027 (4.071)	-13.68* (8.248)	-9.166*** (2.376)	-1.02e-08* (6.02e-09)
IO x CCR—EV—DME—LIQ-I x ECB-Liq				-0.428 (1.182)	6.716*** (2.277)	0.643 (0.814)	3.06e-09** (1.31e-09)

ECB injections reduced overall sensitivity of banks to elevated money market uncertainty but increased it to more concentrated excess reserve holdings.

Results II: Recourse Propensity

NER * ECB-Liq	-0.0185*** (0.00616)	-0.0199*** (0.00614)	-0.0183*** (0.00634)	-0.0169** (0.00691)	-0.00683 (0.00678)	0.0600** (0.0253)	-0.0346*** (0.00839)
FLR * ECB-Liq	0.0147* (0.00770)	0.00414*** (0.00112)	0.0121 (0.00742)	0.0305** (0.0155)	0.0364** (0.0147)	0.0946 (0.0630)	0.00719 (0.0145)
Bss * ECB-Liq	-1.09e-10 (7.28e-10)	-3.46e-10 (7.24e-10)	-1.01e-09 (7.28e-10)	-3.19e-10 (8.49e-10)	-1.57e-10 (9.41e-10)	-5.55e-09 (4.51e-09)	4.59e-09*** (1.23e-09)
ER * ECB-Liq	-4.130*** (0.556)	-4.148*** (0.553)	-3.704*** (0.545)	-3.845*** (0.601)	-3.424*** (0.631)	8.310*** (2.929)	-2.094** (0.910)
IO * ECB-Liq	-1.311*** (0.185)	-1.275*** (0.183)	-1.228*** (0.179)	-1.287*** (0.214)	-1.589*** (0.236)	-1.514 (1.065)	-1.408*** (0.268)
NER x CCR—EV—DME—LIQ-I				-0.0181** (0.00733)	-0.189*** (0.0599)	-0.0200 (0.0145)	-8.49e-12 (2.72e-11)
FLR x CCR—EV—DME—LIQ-I				0.0400 (0.0739)	0.0725 (0.0825)	0.0643*** (0.0161)	-5.42e-11 (7.26e-11)
Size x CCR—EV—DME—LIQ-I				7.94e-09*** (2.00e-09)	1.63e-08*** (4.94e-09)	2.54e-09* (1.41e-09)	2.00e-17*** (3.40e-18)
ER x CCR—EV—DME—LIQ-I				0.668 (1.297)	-16.25*** (3.364)	-0.265 (0.930)	-9.28e-09*** (3.01e-09)
IO x CCR—EV—DME—LIQ-I				0.0690 (0.486)	-7.328*** (1.488)	-1.383*** (0.378)	-6.16e-09*** (1.23e-09)
CCR—EV—DME—LIQ-I x ECB-Liq				-0.635 (0.553)	-1.935* (1.031)	0.316 (0.382)	1.64e-09*** (5.95e-10)
NEX x CCR—EV—DME—LIQ-I x ECB-Liq				0.0155 (0.0423)	-0.262** (0.107)	-0.0514** (0.0223)	7.07e-11*** (2.72e-11)
FLR x CCR—EV—DME—LIQ-I x ECB-Liq				-0.142 (0.118)	-0.236 (0.219)	-0.0771* (0.0416)	6.88e-11 (9.16e-11)
Size x CCR—EV—DME—LIQ-I x ECB-Liq				-4.68e-09 (3.97e-09)	-4.56e-09 (6.80e-09)	2.86e-09 (3.25e-09)	-3.26e-17*** (7.06e-18)
ER x CCR—EV—DME—LIQ-I x ECB-Liq				-5.027 (4.071)	-13.68* (8.248)	-9.166*** (2.376)	-1.02e-08* (6.02e-09)
IO x CCR—EV—DME—LIQ-I x ECB-Liq				-0.428 (1.182)	6.716*** (2.277)	0.643 (0.814)	3.06e-09** (1.31e-09)

ECB injection increased liquidity short and poorly capitalized banks sensitivity to elevated market uncertainty
 The sensitivity of MLF recourses to elevated counterparty credit risk premia not mitigated through ECB's allotment policy

Results III: Recourse Propensity

- ▶ Banks short in liquidity, with a higher liquidity risk, larger banks and banks' more dependent on interbank funding more likely to turn to MLF
- ▶ Surprisingly better capitalized banks also more likely to take recourse to MLF
- ▶ In periods of elevated market uncertainty, counterparty credit risk premium and also more concentrated excess reserve holdings banks' recourse propensity was higher
- ▶ Surprisingly, a higher difference between MLF rate and repo rate was associated with a higher recourse tendency
- ▶ Elevated credit risk premium affects liquidity short and large banks
- ▶ Increases in market uncertainty impairs liquidity short, large and poorly capitalized banks
- ▶ Larger concentration in excess liquidity holdings affect large and poorly capitalized banks

Results IV: Recourse Propensity

- ▶ Higher ECB liquidity allotment actually increases the recourse probability of liquidity short and poorly capitalized banks and banks with a higher liquidity risk
- ▶ Only banks more dependent on interbank funding benefited
- ▶ ECB injections reduced overall sensitivity of banks to elevated money market uncertainty but increased it to more concentrated excess reserve holdings.
- ▶ ECB injection increased liquidity short and poorly capitalized banks sensitivity to elevated market uncertainty
- ▶ The sensitivity of MLF recourses to elevated counterparty credit risk premia not mitigated through ECB's allotment policy

Results V: Recourse Propensity

- ▶ Overall the results for the amounts borrowed from the MLF facility are similar to the results for the MLR recourse propensity, however somewhat less pronounced
- ▶ But poorly capitalized banks borrow more from MLF, even though they are less likely to borrow

Conclusion

- ▶ Liquidity short banks more susceptible to rationing and market failures, not the banks hoarding liquidity
- ▶ Risk spreads and market uncertainty played important role
- ⇒ Also German interbank market rather 'stressed' than 'frozen'

- ▶ ECB allotment policy did largely not mitigate the extent to which banks of specific types (risky, liquidity short) were rationed in the interbank market
- ▶ Nor did it contain the extent to which liquidity short banks and poorly capitalized banks suffered from tensions in money markets
- ▶ Monetary policy interventions only contain detrimental effects of money market dry-ups; they did not help revitalize interbank market