A Network View on Money Market Freezes[1]

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[1] Joint work with Puriya Abbassi (Deutsche Bundesbank) and Silvia Gabrieli (Banque de France). The views presented are not necessarily the views of Deutsche Bundesbank, Banque de France, the ECB or the ESCB.

What are Money Market Freezes?

- Money markets are major source of liquidity for Euroarea banks
  $\Rightarrow$ secured+unsecured interbank lending $\approx 2/3$ of turnover
- Market freezes threaten financial stability, impair monetary policy transmission, and compromise market discipline
- **However:** Very little empirical literature on money market freezes, almost nothing on Euroarea (except Angelini, Nobili, Picillo (2011))

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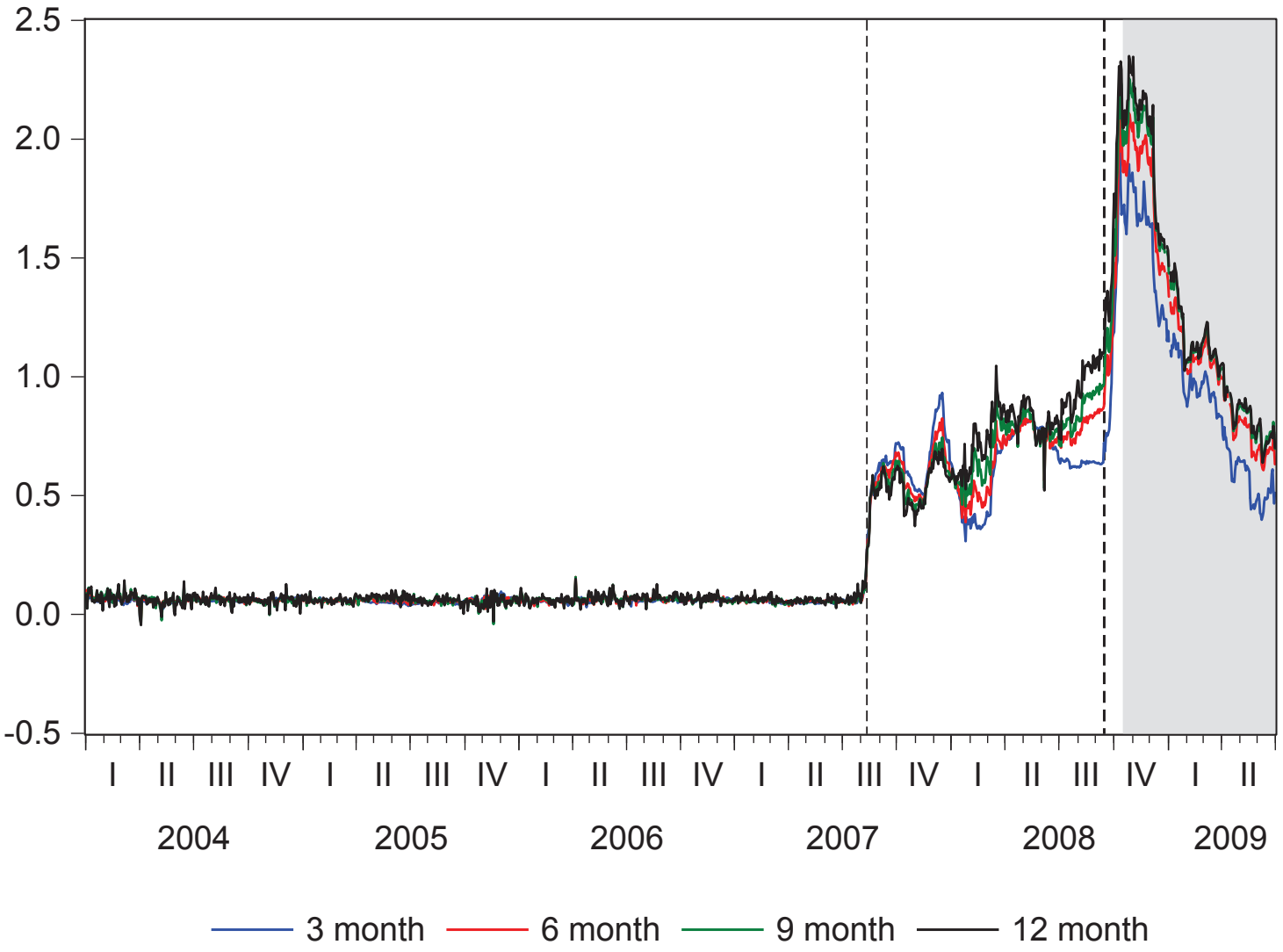
- Our **definition** of a market freeze: significant drop in turnover volume following an exogenous event

Motivation - Soaring Money Market Risk Premia



Which Data do we Use?

- To understand the implications of the surge in risk premia, an in-depth analysis of unsecured money market is required
- Problem: OTC market $\Rightarrow$ **Payment system data**
- TARGET2: 354,185 daily payments on average, with EUR 2,477 billion turnover
- Each transaction contains ultimate originator, settlement banks, date and time of transaction, ultimate beneficiary, and amount
- Furfine (1999) algorithm with modifications by Arciero et al. (2013) and matching on ultimate **originator** and **beneficiary** level
- Individual institutions are aggregated on banking group level, accounting for mergers and acquisitions

From Raw Data to the Money Market Database

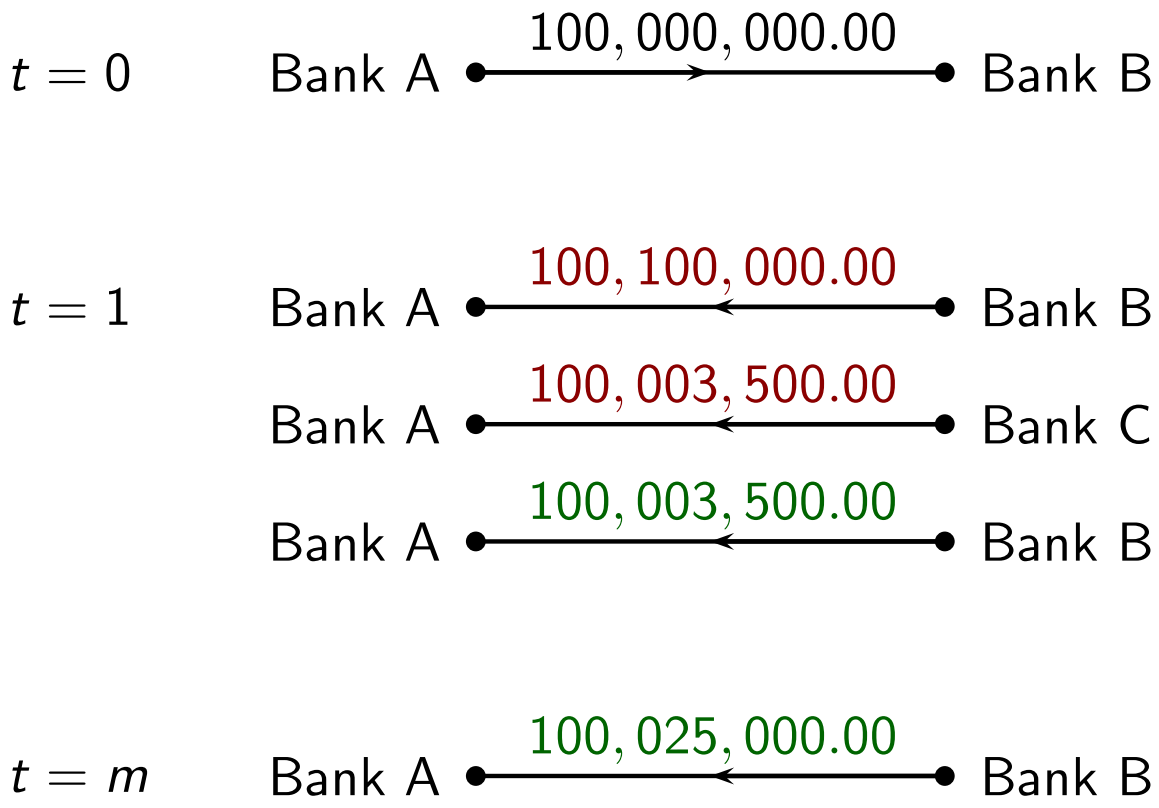


Figure: The Furfine (1999) algorithm in action

Main Results

- Drop in turnover volume only in term segments: 50% in longer-term (m>1M), 27% in short-term (ON<m<1M), but **increase** in ON segment
  $\Rightarrow$ Market freeze is maturity shortening
- When analysing local network measures, we find that a bank's position within the interbank money market (pre-Lehman) is a significant variable to explain which banks reduced their lending the most and which banks borrowed less
- Network analysis of different maturity segments reveals that banks have different roles in the different segments (i.e. being a market maker only in one maturity segment)
- The extensive liquidity support by the ECB significantly reduced the turnover in ON markets, but stabilized longer-term segment turnover

Related Literature

- The papers closest to ours: Afonso, Kovner, and Schoar (2011) $\rightarrow$ "stressed, not frozen"
- Empirical work on UK money market freeze: Acharya and Merrouche (2013) $\rightarrow$ precautionary liquidity hoarding
- Precautionary liquidity hoarding:
  Acharya and Skeie (2011), Acharya, Gale, and Yorulmazer(2011) $\rightarrow$ precautionary demand for liquidity
  Acharya, Shin, and Yorulmazer (2011), Gale and Yorulmazer (2013) $\rightarrow$ strategic liquidity hoarding
- Asymmetric information & Counterparty risk:
  Jorge and Freixas (2008); Heider, Hoerova, and Holthausen (2009)

More Related Literature

- Literature on financial networks: Allen and Gale (2000), Leitner (2005), Brusco and Castiglionesi (2007), Elliott, Golub, and Jackson (2013), Acemoglu, Ozdaglar, and Tabaz-Salehi (2013)
- Literature on OTC Markets: Duffie, Garleanu and Pedersen (2005), Gofman (2011), Glode and Opp (2013), Babus and Kondor (2013)
- Literature on relationship lending: Bräuning und Fecht (2012), Abbassi et al. (2013), Afonso, Kovner, and Schoar (2013),

Our Contribution to the Literature

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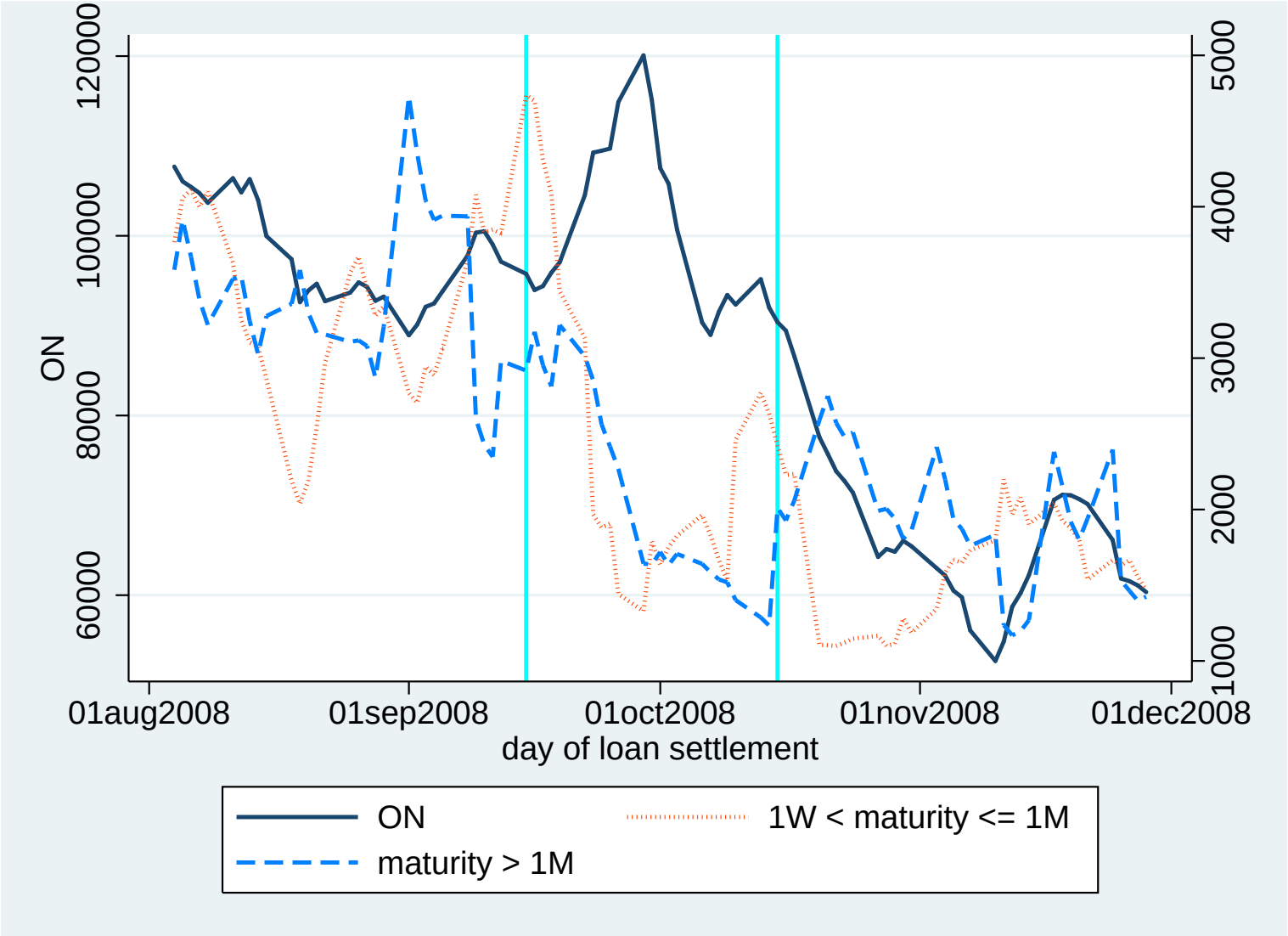


Warm up: A Couple of Stylized Facts

maturity = ON

	Pre-lehman				Post-lehman				Full allotment			
	mean	median	std.	obs.	mean	median	std.	obs.	mean	median	std.	obs.
No. Borrowers	157	159	13	54	143	145	9	22	141	143	10	54
No. Lenders	353	352	27	54	334	333	33	22	295	301	26	54
No. Loans	906	904	107	54	906	883	134	22	687	702	81	54
Volume (in EUR millions)	**89527.35**	88202.09	12916.15	54	**90815.56**	91265.01	13989.49	22	**67072.45**	66343.88	10305.69	54

ON < maturity ≤ 1M

	Pre-lehman				Post-lehman				Full allotment			
	mean	median	std.	obs.	mean	median	std.	obs.	mean	median	std.	obs.
No. Borrowers	79	78	11	54	70	68	9	22	74	71	12	54
No. Lenders	110	106	20	54	92	88	15	22	97	94	22	54
No. Loans	162	152	43	54	127	122	27	22	136	129	42	54
Volume (in EUR millions)	**10621.14**	9801.91	3825.37	54	**7778.87**	6609.88	4012.66	22	**7316.39**	6748.64	3016.05	54

1M < maturity

	Pre-lehman				Post-lehman				Full allotment			
	mean	median	std.	obs.	mean	median	std.	obs.	mean	median	std.	obs.
No. Borrowers	46	44	12	54	32	32	10	22	30	29	7	54
No. Lenders	54	50	18	54	34	32	12	22	34	32	10	54
No. Loans	74	64	30	54	44	41	17	22	42	41	14	54
Volume (in EUR millions)	**2714.47**	2480.94	1602.67	54	**1401.87**	1027.14	1208.79	22	**1526.22**	1238.82	1234.24	54

Why Should the Network Structure Matter?

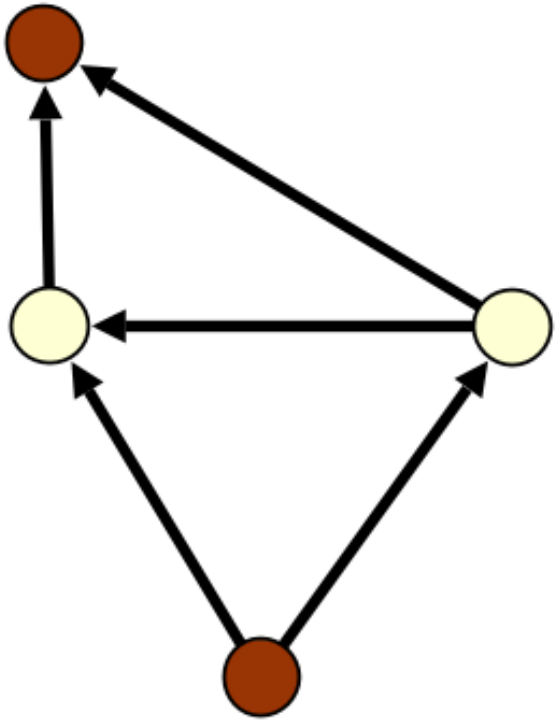


Figure: An example of clustering

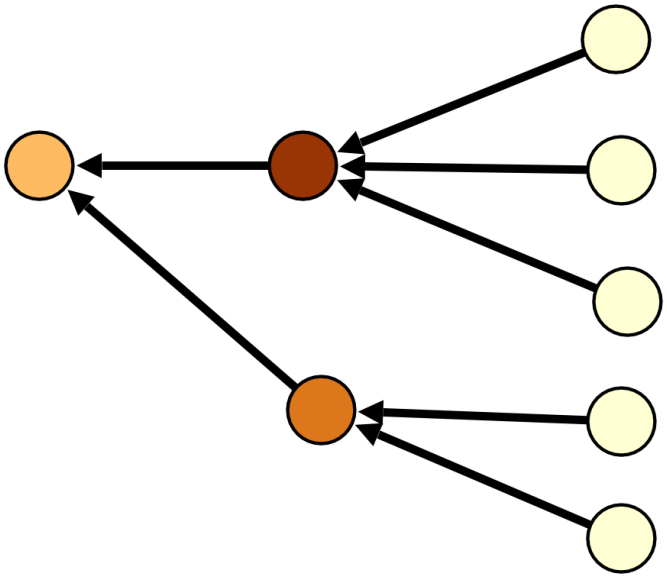
Clustering:

- Neighborhood:
  $N_i = \{v_j : e_{ij} \in E \text{ or } e_{ji} \in E\}$
- Degree: $k_i = |\{N_i\}|$
- Local clustering coefficient:

$$c_i = \frac{|\{e_{jk} : v_j, v_k \in N_i; e_{jk} \in E\}|}{k_i(k_i - 1)}$$

$\Rightarrow$ Clustering measures the extent of a **counterparty risk externality**

Why Should the Network Structure Matter?



Betweenness:

- Shortest path between nodes j and k: σ_{jk}
- Betweenness of node i:

$$b_i = \sum_{j \neq i \neq k} \frac{\sigma_{jk}(i)}{\sigma_{jk}}$$

Figure: An example of betweenness

$\Rightarrow$ Betweenness measures a bank's **access to (interbank) liquidity**

The Econometric Specification

- Baseline regression:

$$\overline{Vol}_{i,t} - \overline{Vol}_{i,\text{pre-Lehman}} = c + \alpha' \overline{X}_{i,pre-Lehman} + \beta' Z_{i,2007} + \epsilon_{i,t}$$

where:

- $t = \{\text{post-Lehman}, \text{full-allotment}\}$
- $\overline{Vol}_{i,t}$: per sub-period average of interbank loan amount of bank i (in logs)
- X is a vector of network measures (**clustering coefficient**, **betweenness centrality**, average nearest neighbor degree, closeness centrality, diversification)

$\Rightarrow$ **non-local variables**

- Z are bank-specific control variables (log(total assets), equity ratio, short-term/long-term borrowing, average pre-Lehman CDS (in logs) of countries of origin)

Local Network Measures – Overnight Segment

	maturity = ON							
	Dependent variable: change in loan amount **lent** OLS regression							
	From pre-Lehman to post-Lehman				From pre-Lehman to full allotment			
	all		<10%		all		<10%	
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Clustering	**3.87977****	**3.65480****	1.62870	-0.94560	4.03878**	3.42655**	-2.87918	-1.16126
	(2.393)	(2.295)	(0.574)	(-0.401)	(2.306)	(1.986)	(-1.452)	(-0.676)
Average neighbor degree	-0.16328	-0.09116	-0.17366	-0.09376	-0.11323	-0.22350***	0.02567	-0.11042
	(-1.340)	(-1.157)	(-1.106)	(-1.295)	(-0.860)	(-2.617)	(0.164)	(-1.394)
In-degree		0.02443		0.15682		0.01629		-0.00180
		(0.992)		(1.568)		(0.610)		(-0.037)
Out-degree		0.10843		-1.67089***		0.00929		-0.54240***
		(1.589)		(-3.087)		(0.126)		(-3.599)
Closeness	12.49438		-16.74028		-17.36353		-28.07863	
	(0.884)		(-0.695)		(-1.137)		(-1.376)	
Betweenness	44.48866		-4,486.20481		48.64634		-209.09947	
	(1.112)		(-0.678)		(1.126)		(-1.448)	
Assets (in logs)	-0.00822	-0.01560	-0.25242*	-0.38042***	-0.05212	-0.06248	-0.15436	-0.18594
	(-0.092)	(-0.172)	(-1.772)	(-3.143)	(-0.540)	(-0.637)	(-1.150)	(-1.531)
Equity Ratio	0.56141	0.06132	14.96246**	5.09714	-0.65621	-1.05792	4.30298	8.70396
	(0.185)	(0.020)	(2.574)	(0.945)	(-0.200)	(-0.317)	(0.671)	(1.445)
Borrowing structure	0.00000	0.00000	0.00001	-0.00001	-0.00000*	-0.00000*	0.00000	0.00000
	(1.081)	(1.061)	(0.897)	(-0.973)	(-1.761)	(-1.733)	(0.555)	(0.581)
CDS (in logs)	0.13492	0.13654	0.14280	0.21433	-0.05712	-0.07131	0.50749**	0.45382**
	(0.770)	(0.781)	(0.605)	(1.106)	(-0.302)	(-0.377)	(2.258)	(2.219)
cons.	-1.49575	-1.46342	-5.70827***	-3.40750**	0.09210	0.10031	-7.18585***	-6.94637***
	(-1.283)	(-1.260)	(-3.235)	(-2.130)	(0.073)	(0.080)	(-3.926)	(-4.195)
Observations	325	325	37	37	325	325	35	35
R-squared	0.040	0.043	0.541	0.701	0.047	0.043	0.498	0.598

Local Network Measures – Overnight Segment

	maturity = ON							
	Dependent variable: change in loan amount **borrowed** OLS regression							
	From pre-Lehman to post-Lehman				From pre-Lehman to full allotment			
	all		<10%		all		<10%	
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Clustering	-1.06	-1.60	0.81	-0.58	-1.66	-1.67	-2.38	-5.04**
	(-0.733)	(-1.086)	(0.865)	(-0.686)	(-0.988)	(-0.972)	(-1.151)	(-2.371)
Average neighbor degree	0.20***	0.08	0.28*	0.06	0.26***	0.21	0.28*	-0.23
	(2.814)	(0.704)	(1.934)	(0.353)	(3.135)	(1.616)	(1.813)	(-1.000)
In-degree		16.90		70.40***		11.09		90.74***
		(1.314)		(4.839)		(0.742)		(4.116)
Out-degree		-0.92		-5,936.39*		-12.53		-720.52***
		(-0.025)		(-1.805)		(-0.296)		(-6.118)
Closeness	0.03		-0.92***		-0.01		-0.29***	
	(1.201)		(-3.126)		(-0.217)		(-5.808)	
Betweenness	0.01		0.12		0.07		0.32***	
	(0.184)		(1.469)		(0.944)		(3.011)	
Assets (in logs)	0.17**	0.19**	-0.42***	-0.52***	0.07	0.08	-0.27**	-0.27**
	(2.081)	(2.315)	(-4.392)	(-4.701)	(0.725)	(0.806)	(-2.202)	(-2.316)
Equity Ratio	1.26	1.59	-6.79	-9.28*	2.85	2.93	2.35	1.49
	(0.449)	(0.575)	(-1.346)	(-1.716)	(0.875)	(0.911)	(0.403)	(0.263)
Borrowing structure	-0.00	-0.00	-0.00	-0.00	0.00	0.00	-0.00	-0.00
	(-1.263)	(-1.187)	(-0.664)	(-0.940)	(0.754)	(0.759)	(-0.502)	(-0.297)
CDS (in logs)	0.23	0.22	0.33	-0.07	0.23	0.23	-0.34	-0.31
	(1.422)	(1.368)	(1.358)	(-0.328)	(1.234)	(1.225)	(-1.611)	(-1.443)
cons.	-3.71***	-3.86***	-3.16***	-2.12	-3.14**	-3.22***	-4.05***	-4.43***
	(-3.498)	(-3.643)	(-2.840)	(-1.665)	(-2.552)	(-2.616)	(-2.775)	(-3.103)
Observations	325	325	39	39	325	325	40	40
R-squared	0.071	0.072	0.739	0.718	0.056	0.055	0.703	0.717

Results – Local Network Measures in ON Segment

- Clustering is significant and positive for lenders: heightened sensitivity to counterparty risk
- Amongst top 10% of reductions, banks with better diversified liability side suffer least

$\Rightarrow$ Heightened sensitivity to counterparty risk

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- Amongst top 10% of reductions, banks with better diversified liability side suffer least

$\Rightarrow$ Heightened sensitivity to counterparty risk

$\Rightarrow$ But really **not much** happening here...

Local Network Measures – Short-Term Segment

	ON $<$ maturity $\leq$ 1M							
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	all		<10%		all		<10%	
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Clustering	0.21	0.29	-4.42	-2.97	8.06	8.33	-2.96	-3.00
	(0.039)	(0.052)	(-0.975)	(-0.617)	(1.565)	(1.606)	(-0.356)	(-0.349)
Average neighbor degree	**-0.77***	**-1.13*****	0.04	**-0.22***	-0.07	-0.62**	-0.36	-0.31
	(-1.824)	(-3.920)	(0.209)	(-1.681)	(-0.180)	(-2.284)	(-0.809)	(-1.025)
In-degree		0.29		0.43		0.19		0.38
		(1.525)		(1.137)		(1.066)		(1.492)
Out-degree		**-0.62***		**-0.60****		-0.68**		0.19
		(-1.902)		(-2.194)		(-2.203)		(0.216)
Closeness	**-87.11***		**-59.91****		-111.62***		-0.59	
	(-1.895)		(-2.239)		(-2.599)		(-0.010)	
Betweenness	1,541.12		**4,557.41****		1,242.94		3,009.90	
	(1.361)		(2.371)		(1.175)		(1.512)	
Assets (in logs)	0.08	0.06	-0.24**	-0.24*	0.02	0.02	0.13	0.09
	(0.699)	(0.532)	(-2.053)	(-1.953)	(0.215)	(0.136)	(0.645)	(0.389)
Equity Ratio	4.24	4.26	-0.04	-0.14	1.98	2.14	-1.65	-2.62
	(1.016)	(1.017)	(-0.007)	(-0.022)	(0.509)	(0.543)	(-0.129)	(-0.205)
Borrowing structure	0.00	0.00	-0.00	-0.00	0.00	0.00	-0.00	-0.00
	(1.169)	(1.066)	(-1.354)	(-1.290)	(0.725)	(0.657)	(-0.625)	(-0.655)
CDS (in logs)	-0.06	-0.10	0.55***	0.46**	0.19	0.14	0.51	0.45
	(-0.267)	(-0.414)	(3.226)	(2.619)	(0.847)	(0.642)	(1.173)	(1.032)
cons.	-1.76	-1.61	-6.14***	-5.80***	-1.18	-1.07	-8.84***	-8.51**
	(-1.144)	(-1.059)	(-3.964)	(-3.719)	(-0.821)	(-0.750)	(-3.011)	(-2.579)
Observations	313	313	74	74	313	313	58	58
R-squared	0.105	0.114	0.390	0.414	0.066	0.068	0.145	0.144

Local Network Measures – Short-Term Segment

	ON $<$ maturity $\leq$ 1M							
	Dependent variable: change in loan amount **borrowed** OLS regression							
	From pre-Lehman to post-Lehman				From pre-Lehman to full allotment			
	all		<10%		all		<10%	
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Clustering	-4.65	-5.05	-13.86	-8.92	-7.68	-7.68	3.87	6.11
	(-1.032)	(-1.117)	(-1.159)	(-0.632)	(-1.632)	(-1.627)	(0.368)	(0.653)
Average neighbor degree	0.01	0.19	-0.22	0.25	-0.47	0.07	-0.34	-0.22
	(0.043)	(0.826)	(-0.263)	(0.350)	(-1.285)	(0.266)	(-0.413)	(-0.393)
In-degree		-0.03		-1.14		-0.30*		-1.33***
		(-0.205)		(-0.879)		(-1.833)		(-2.926)
Out-degree		0.40		0.38		0.64**		0.08
		(1.512)		(0.474)		(2.285)		(0.151)
Closeness	42.80		**163.82***		113.82***		95.95	
	(1.140)		(1.953)		(2.901)		(1.097)	
Betweenness	209.58		-4,845.60		-1,213.00		-2,330.66	
	(0.227)		(-0.540)		(-1.255)		(-0.713)	
Assets (in logs)	0.06	0.07	0.01	0.06	0.11	0.14	-0.50**	-0.27
	(0.599)	(0.738)	(0.049)	(0.272)	(1.059)	(1.403)	(-2.375)	(-1.304)
Equity Ratio	-1.27	-1.26	2.93	3.28	2.09	2.37	-17.83	-12.36
	(-0.371)	(-0.366)	(0.200)	(0.222)	(0.586)	(0.663)	(-1.292)	(-0.979)
Borrowing structure	-0.00	-0.00	-0.00	0.00	-0.00	-0.00	0.00	0.00
	(-0.082)	(-0.009)	(-0.069)	(0.012)	(-0.234)	(-0.135)	(0.033)	(0.074)
CDS (in logs)	0.01	0.02	0.10	0.24	0.00	0.06	0.02	0.12
	(0.063)	(0.131)	(0.231)	(0.482)	(0.002)	(0.289)	(0.061)	(0.333)
cons.	-1.57	-1.81	-7.38**	-7.07**	-2.18*	-2.48*	-1.00	-2.39
	(-1.246)	(-1.455)	(-2.492)	(-2.357)	(-1.654)	(-1.913)	(-0.343)	(-0.892)
Observations	313	313	50	50	313	313	45	45
R-squared	0.018	0.021	0.144	0.148	0.043	0.051	0.181	0.332

Results – Local Network Measures in Short-Term Segment

Lenders in the short-term segment:

- Average nearest neighbor degree statistically significant and negatively signed
  $\Rightarrow$ Lenders with better diversified counterparties decrease their lending less
- Banks with higher mean out-degree pre-Lehman reduce their lending less
  $\Rightarrow$ Better diversified lenders reduce lending less
- Lenders which are closer to the rest of the system reduce their lending less
  $\Rightarrow$ Fewer possibilities to be hit by a shock
- Betweenness centrality is positively significant in top 10% reductions
  $\Rightarrow$ Banks with better access to liquidity reduced lending more

Local Network Measures – Longer-Term Segment

	1M < maturity							
	Dependent variable: change in loan amount **lent** OLS regression							
	From pre-Lehman to post-Lehman				From pre-Lehman to full allotment			
	all		<10%		all		<10%	
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Clustering	2.66	0.79	-1.00	-1.64	2.93	2.00	-7.64	-9.11*
	(0.812)	(0.247)	(-0.359)	(-0.664)	(0.943)	(0.647)	(-1.558)	(-1.993)
Average neighbor degree	0.19	-0.44	0.16	-0.14	1.24**	0.41	1.07*	-0.04
	(0.299)	(-0.818)	(0.643)	(-0.749)	(2.073)	(0.800)	(1.943)	(-0.091)
In-degree		**1.85*** **		**1.11*** **		0.95***		1.52***
		(5.014)		(3.551)		(2.684)		(4.132)
Out-degree		**-0.77***		-0.43		-1.44***		-0.94***
		(-1.849)		(-1.454)		(-3.600)		(-2.669)
Closeness	**-156.37*** **		**-71.09*** **		-170.21***		-162.42***	
	(-4.780)		(-3.852)		(-5.500)		(-5.759)	
Betweenness	**3,565.33*** **		1,191.24		2,032.51**		5,213.10**	
	(3.655)		(0.314)		(2.202)		(2.613)	
Assets (in logs)	0.09	-0.06	-0.38***	-0.44***	-0.07	-0.14	-0.10	-0.19
	(0.744)	(-0.449)	(-4.338)	(-5.646)	(-0.592)	(-1.147)	(-0.791)	(-1.537)
Equity Ratio	0.69	-0.21	-4.41	0.00	-0.85	-0.97	-5.20	-5.02
	(0.146)	(-0.047)	(-0.972)	(0.000)	(-0.192)	(-0.219)	(-0.821)	(-0.850)
Borrowing structure	0.00	0.00	-0.00	-0.00	0.00	0.00	0.00***	0.00***
	(0.058)	(0.089)	(-0.427)	(-0.350)	(0.537)	(0.560)	(3.095)	(3.474)
CDS (in logs)	0.04	-0.09	0.16	0.03	0.22	0.16	0.30	0.31
	(0.129)	(-0.344)	(1.005)	(0.223)	(0.841)	(0.613)	(1.387)	(1.576)
cons.	-2.54	-2.49	-3.17***	-3.31***	-0.23	-0.26	-4.93***	-5.35***
	(-1.500)	(-1.527)	(-2.795)	(-3.408)	(-0.145)	(-0.168)	(-2.751)	(-3.279)
Observations	284	284	92	92	284	284	68	68
R-squared	0.128	0.178	0.324	0.485	0.114	0.133	0.531	0.593

Local Network Measures – Longer-Term Segment

	1M < maturity							
	Dependent variable: change in loan amount **borrowed** OLS regression							
	From pre-Lehman to post-Lehman				From pre-Lehman to full allotment			
	all		<10%		all		<10%	
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Clustering	1.46	1.71	-17.59	-7.03	-0.62	-0.24	4.04	10.35
	(0.516)	(0.606)	(-1.206)	(-0.449)	(-0.227)	(-0.089)	(0.309)	(0.795)
Average neighbor degree	-0.34	0.30	1.18	1.33	0.08	0.70	0.07	-0.05
	(-0.630)	(0.642)	(1.106)	(1.330)	(0.159)	(1.536)	(0.044)	(-0.038)
In-degree		-0.25		-1.50		-0.37		-2.45**
		(-0.763)		(-1.431)		(-1.183)		(-2.398)
Out-degree		**1.53*** **		0.64		1.33***		-0.36
		(4.216)		(0.868)		(3.764)		(-0.425)
Closeness	**126.99*** **		**128.99*** **		120.33***		82.11	
	(4.508)		(3.736)		(4.402)		(1.559)	
Betweenness	-112.17		-2,965.57		-318.77		-8,622.87	
	(-0.134)		(-0.490)		(-0.391)		(-1.404)	
Assets (in logs)	0.17	0.19*	-0.21*	-0.17	0.13	0.17	-0.05	0.00
	(1.594)	(1.774)	(-1.945)	(-1.616)	(1.316)	(1.617)	(-0.340)	(0.006)
Equity Ratio	1.63	1.51	-5.60	-3.83	-1.07	-0.98	-2.54	-0.59
	(0.405)	(0.376)	(-1.667)	(-1.136)	(-0.274)	(-0.250)	(-0.548)	(-0.135)
Borrowing structure	0.00	0.00	0.00	0.00	0.00	0.00	-0.00	-0.00
	(0.679)	(0.680)	(0.963)	(0.812)	(0.735)	(0.739)	(-0.009)	(-0.007)
CDS (in logs)	-0.22	-0.21	0.21	0.31	0.28	0.31	-0.10	0.10
	(-0.938)	(-0.882)	(0.969)	(1.353)	(1.215)	(1.321)	(-0.314)	(0.322)
cons.	-3.83***	-4.02***	-5.64***	-4.91***	-4.38***	-4.56***	-5.93***	-4.78**
	(-2.629)	(-2.807)	(-4.044)	(-3.341)	(-3.097)	(-3.274)	(-3.140)	(-2.667)
Observations	284	284	68	68	284	284	54	54
R-squared	0.108	0.127	0.401	0.427	0.105	0.122	0.167	0.241

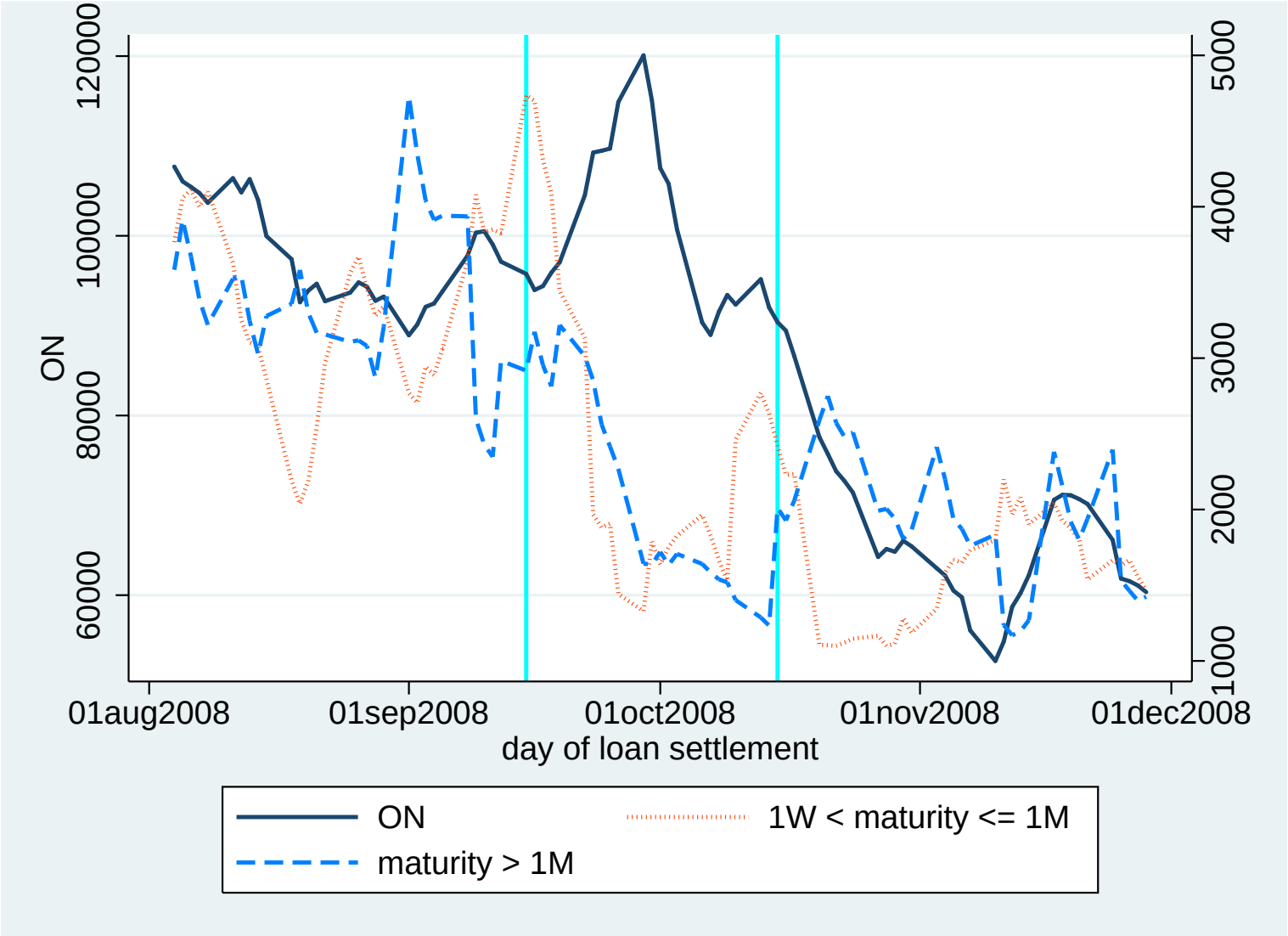
Results – Local Network Measures in Long-Term Segment

Lenders in the long-term segment:

- Very similar picture to short-term segment (betweenness, closeness, out-degree); larger reduction in lending for banks with better diversified liability side
- Similar for the borrowers, same picture as for short-term segment

  $\Rightarrow$ Overall picture indicates heightened sensitivity to counterparty risk

What About ECB Intervention?



What About ECB Intervention?

- 15 September: Default of Lehman Brothers $\Rightarrow$ Highest surge in interbank risk premia
- 26 September: ECB/BoE/SNB/Fed dollar liquidity provision
- 29 September: Further dollar liquidity provision
- **29 September: Special term refinancing operation**
  "The aim of this operation is to improve the overall liquidity position of the euro area banking system."
- 8 October: ECB Decision on full-allotment and cut interest rates
- 15 October: Eurosystem changed from the regular variable-rate tender to a fixed-rate full-allotment regime

Conclusion

- Three results: (i) Market freeze in EU shortening of maturities; (ii) Lenders became more sensitive to counterparty risk; (iii) Non-local variables (clustering, betweenness, etc. significantly influences banks' lending decisions;
- **Good news**: Even during times of extreme risk-premia, money markets don't completely dry up
- Policy: Liquidity provision by ECB stabilized longer-term money markets but did not lead to a stabilization of overnight turnover

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- Policy: Liquidity provision by ECB stabilized longer-term money markets but did not lead to a stabilization of overnight turnover

$\Rightarrow$ **Thank you!**