Liquidity Shocks, Dollar Funding Costs, and the Bank Lending Channel during the European Sovereign Crisis

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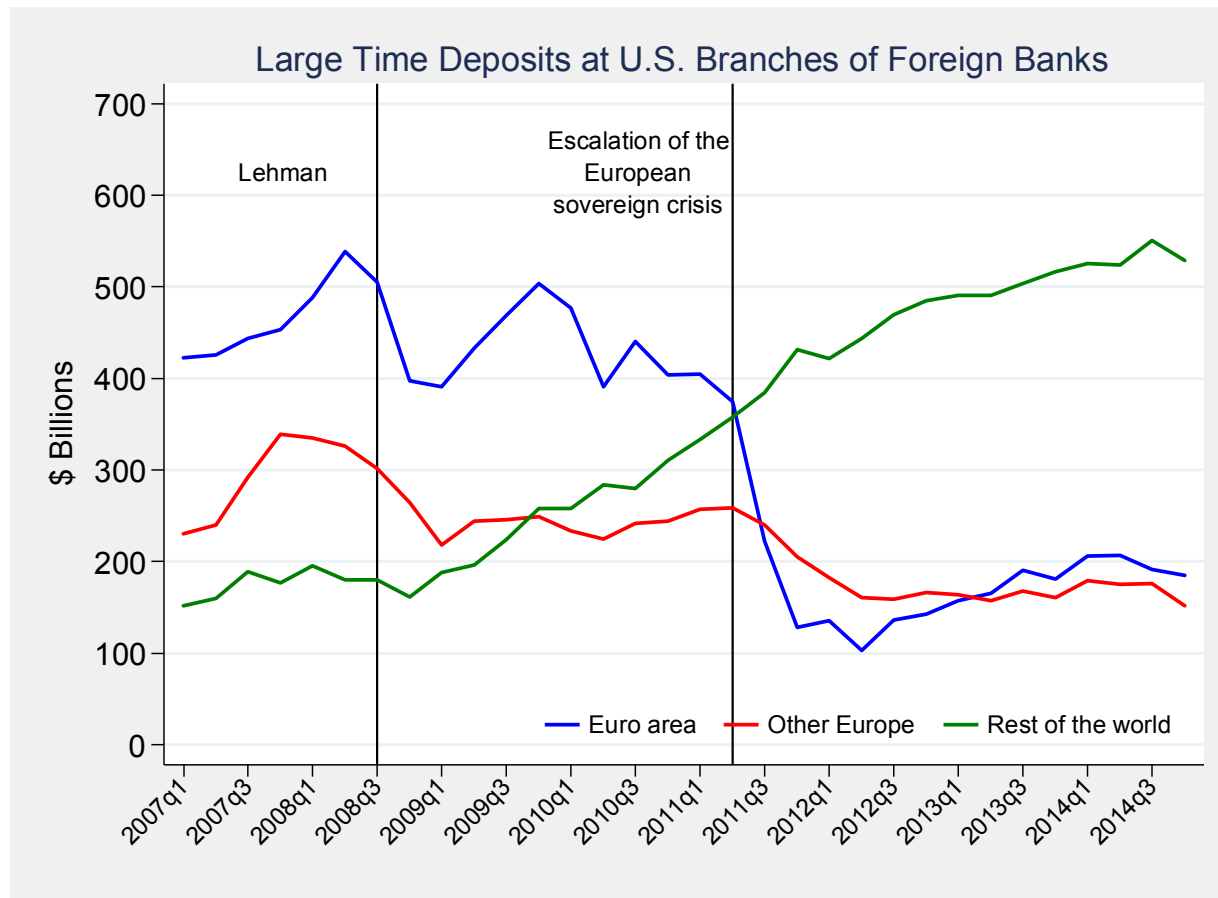Econometric Society Meetings @ ASSA 2016
January 3-5, 2016
San Francisco, CA

Motivation (1)

▸ As sovereign stresses in Europe increased in the summer of 2011, U.S. branches of euro-area banks suffered a liquidity shock.

Source: Federal Reserve Board, FFIEC 002.

Motivation (2)

▸ U.S. money market mutual funds (MMMF) cut their holdings of large time deposits issued by these branches.

US MMMF exposure to the US branches of foreign banks

Escalation of the European Sovereign Crisis

Legend: Euro area — Other Europe — Rest of the world
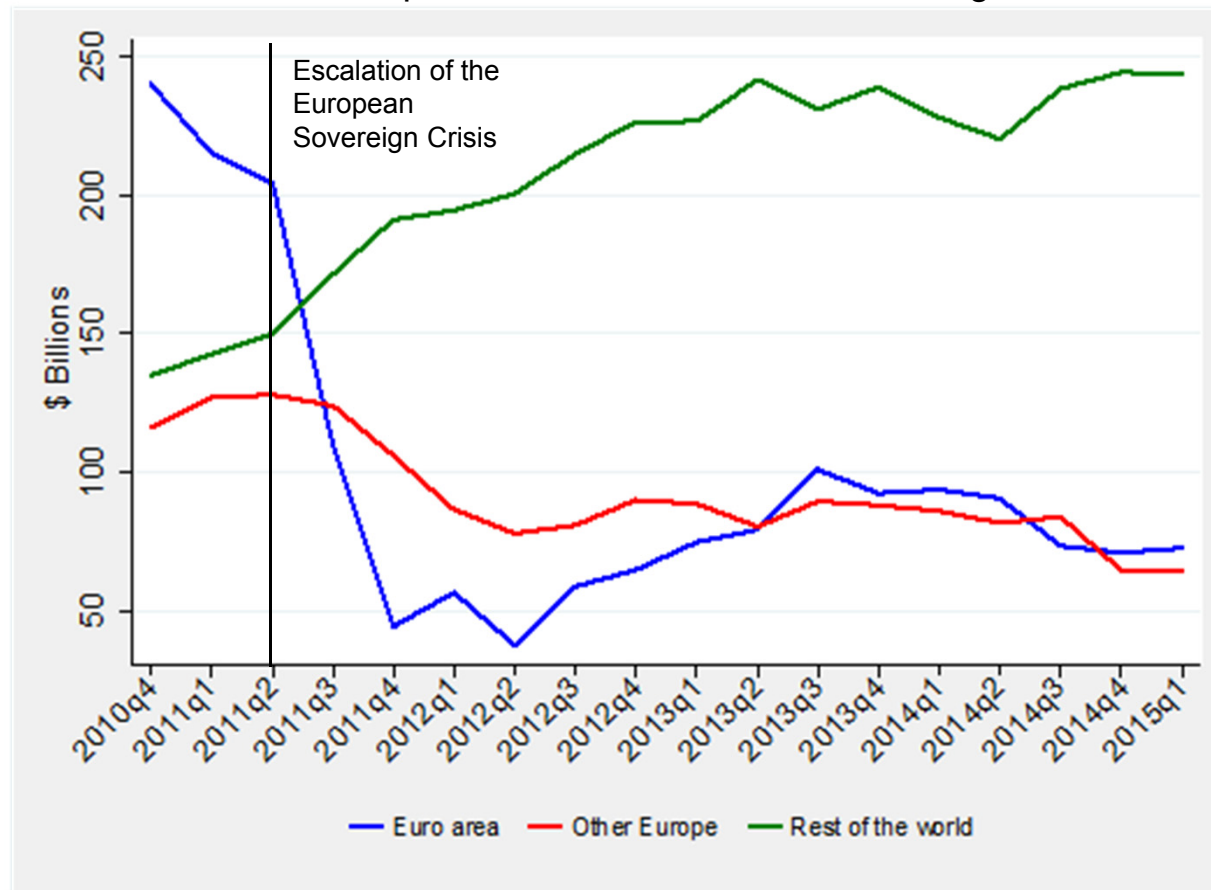
Source: Securities and Exchange Commission

Motivation (3)

▸ As the U.S. branches of euro area banks lost access to dollar funding, parent banks had to fund them.
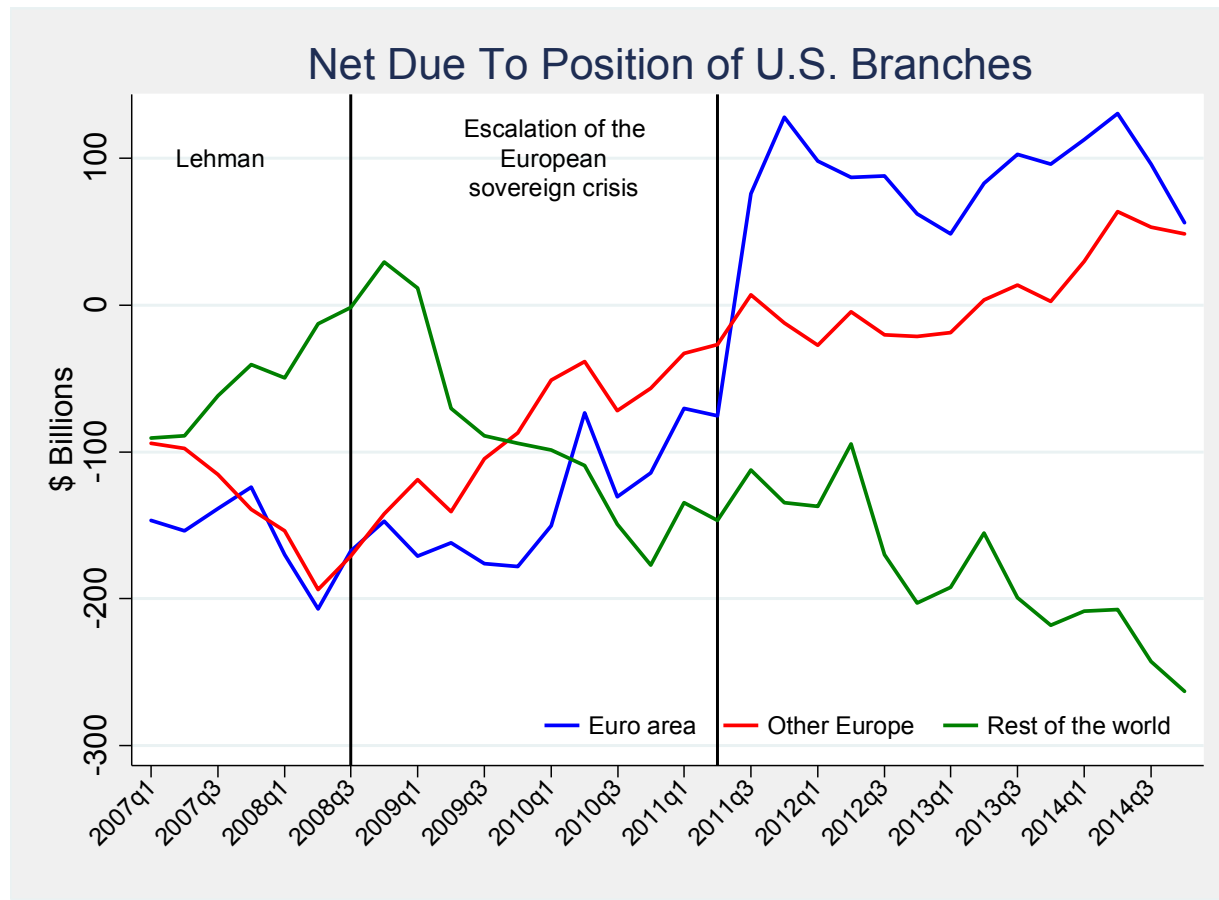
Source: Federal Reserve Board, FFIEC 002.

Motivation (4)

▸ As the U.S. branches of euro area banks lost access to dollar funding, parents had to fund them;

▸ But swapping EUR into USD became expensive.

"Net Due To" Position of the U.S. Branches of Euro Area Banks and the Cost of Dollar Funding
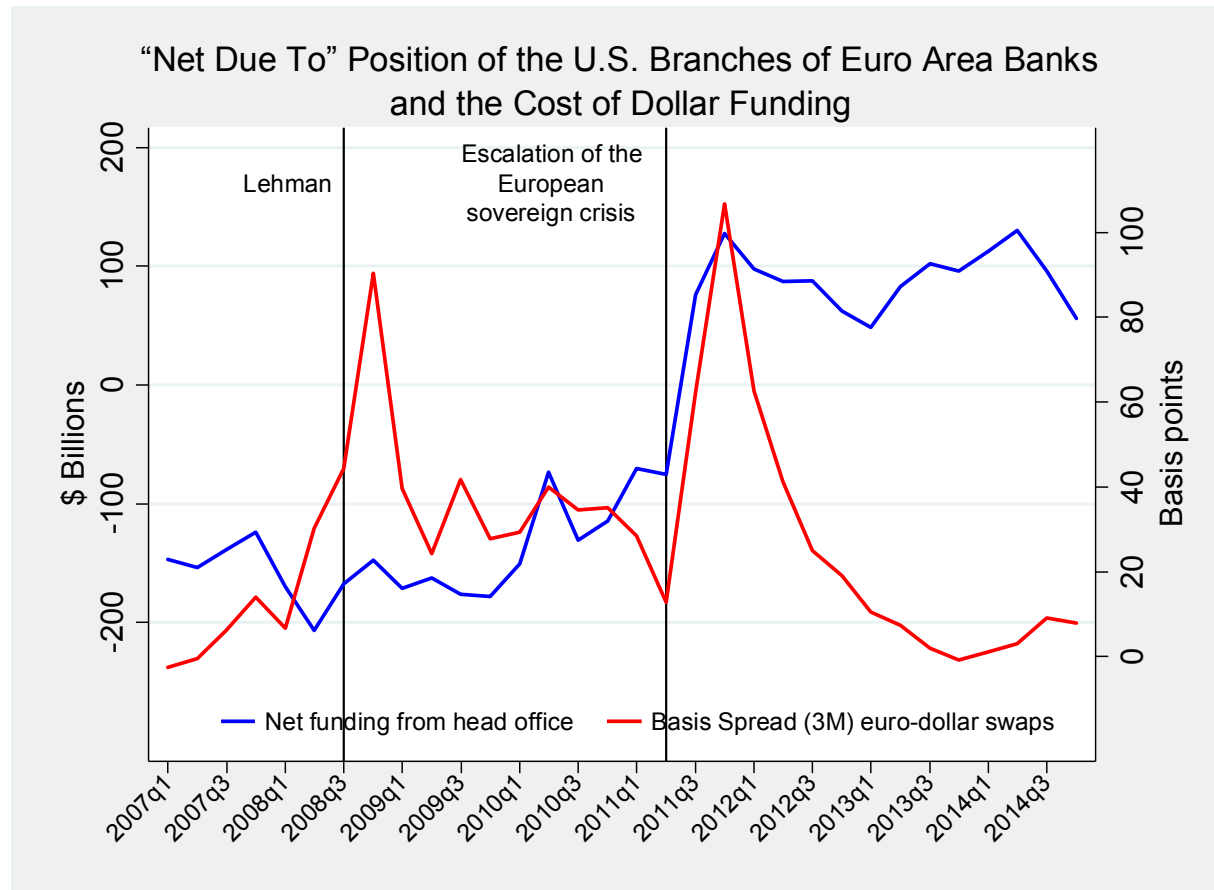
Source: Federal Reserve Board, FFIEC 002.

Motivation (5)

▸ Branches were not able to fully substitute external funds with internal financing and cut lending to U.S. entities, providing evidence for a new type of bank lending channel.

C&I loans to U.S. addressees outstanding at foreign bank branches
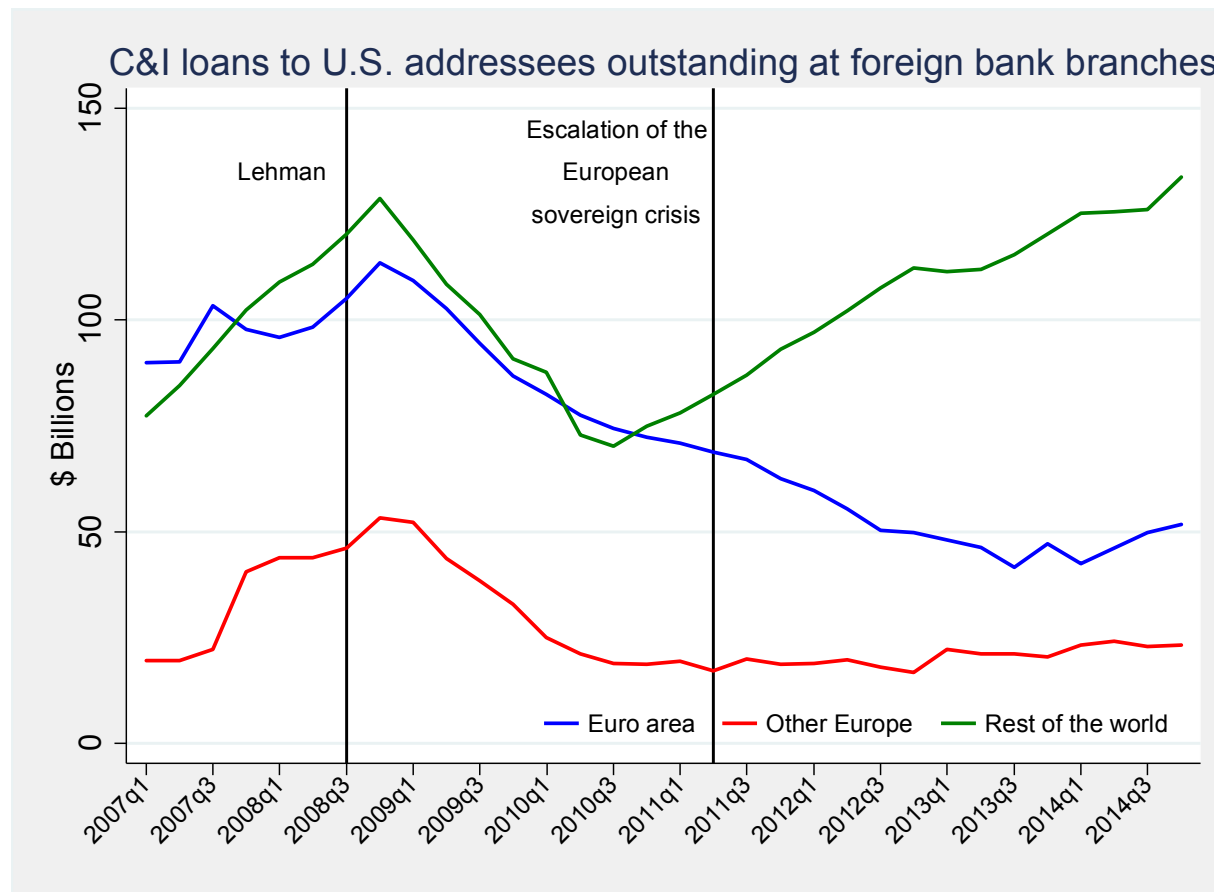
Source: Federal Reserve Board, FFIEC 002.

Questions

1. How was the liquidity shock related to financial stress in Europe?

2. Did branches rely more on funding from parents?

3. Was the liquidity shock associated with a decline in branch lending?

Results

1. The liquidity shock was related to the increase in sovereign risk in the euro area.

    - Shock unrelated to own sovereign risk (only within the euro area), government support, bank-specific risk, bank capital.

2. Branches with larger liquidity shocks relied more on funding from parent banks, but such funding did not fully offset the shock.

3. Branches of euro-area banks that suffered larger liquidity shock reduced U.S. lending by more.

    - Result robust to controlling for demand at the sector- and firm-level.
    - Reduction in lending mostly along the extensive margin.
    - Affected firms reduced investment.

Contribution to literature

▸ The "quiet run" on MMFs with exposure to Eurozone banks in mid-2011:

- Chernenko and Sunderam (2012)

▸ International transmission of shocks through global banks:

- Peek and Rosengren (1997)
- Schnabl (2012)
- Cetorelli and Goldberg (AER P&P, 2012)
- Ivashina, Scharfstein, and Stein (2012)
- De Haas and Van Horen (2013)

▸ Banks' internal liquidity management to mitigate shocks:

- Campello (2002)
- Cetorelli and Goldberg (JIE 2012, AER P&P 2012)

Contribution to literature

Peek and Rosengreen, AER 1997: capital shock to Japanese parent banks arising from the stock market downturn in early 1990s

U.S. BRANCH

Assets	Liabilities
Loans	Deposits
	Other funding
Other liqudid assets	

JAPANESE PARENT BANK

Assets	Liabilities
Loans	Deposits
	Other funding
Other assets	Capital ↓

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Other assets		Capital	↓

Cetorelli and Goldberg, AER P&P 2012: funding shock to Euro parent banks arising from ABCP exposure in 2008-09

U.S. BRANCH

Assets	Liabilities
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	Other funding
Other liqudid assets	
Internal lending	

EUROPEAN PARENT BANK

	Assets	Liabilities
	Loans	Deposits
		Other funding
↑	Other assets	Capital
		Internal borrowing

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This paper: funding shock to US. FBO arising from sovereign risk in country of origin in mid-2011

U.S. BRANCH

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	Other funding	
Other liqudid assets		
	Internal borrowing	

EUROPEAN PARENT BANK

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EUROPEAN PARENT BANK

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impaired due to dollar funding costs

Data

- Branch information:
    - *Federal Financial Institutions Examination Council* (FFIEC) 002 report.
    - *Shared National Credit* (SNC) program data on syndicated loans.
        - Each loan has to aggregate to $20 million or more.
        - It is shared by 3 or more unaffiliated federally supervised institutions.
    - Data on bank branches aggregated at the top bank level within the organization.

- Parent bank information:
    - FR Y-7Q report collected by the Federal Reserve Board.

- Sovereign debt exposure of parent banks:
    - European Banking Authority 2011 stress test exercise.

- Government support: difference (in rating notches) between Moody's *bank-specific financial strength ratings (BFSR)* and *bank-specific deposit ratings (BDR)*.

- Country and bank 5-year CDS premiums: Markit.

Data: U.S. branches of foreign banks, by region/country

▸ End-2011, the U.S. branches of foreign banks represented:

  ▸ 14 percent of total U.S. banking assets;
  ▸ 17 percent of Commercial and Industrial (C&I) loans;
  ▸ 131 parents banks from 42 countries.

Country	Number of banks with U.S. branches	Total branch assets ($ billions)
Europe	46	1,233.1
Australia	4	71.4
Canada	7	320.0
Japan	9	355.5
Africa	2	1.2
Asia (ex. Japan)	49	64.1
Latin America	14	35.9
Total	131	2,081.2

Data: summary statistics

▸ **Branch-level information (FFIEC, 131 banks from 42 countries)**

	2010			2011		
	Mean	Median	Std. dev.	Mean	Median	Std. dev.
Total assets ($ billions)	13.9	1.2	25.5	15.9	1.4	30.2
Total loans ($ billions)	3.5	0.5	7.3	3.7	0.5	8.1
C&I loans ($ billions)	1.8	0.3	3.8	1.8	0.3	3.9
C&I loans to U.S. residents ($ billions)	1.3	0.2	3.0	1.3	0.2	3.0
Large time deposits ($ billions)	7.1	0.1	14.3	6.8	0.2	13.5
Net due to related offices ($ billions)	-3.1	0.1	11.2	-0.2	0.1	11.0
Net due to head-office ($ billions)	-2.4	0.0	10.5	-1.2	0.1	9.0
Net due to U.S. non-branch offices ($ billions)	-0.1	0.0	0.6	0.0	0.0	0.5
Deposits to assets (percent)	34.4	30.3	27.1	31.8	26.8	24.9
Loans to assets (percent)	33.1	24.7	28.2	33.2	27.6	27.9
Relative size of branch network (percent)	3.5	1.9	4.2	4.4	1.8	8.6
Parent Tier 1 capital ratio (percent)	13.1	10.9	15.8	12.0	11.2	3.8

▸ **Loan-level information (SNC, 102 banks from 34 countries)**

	2010				2011			
	Obs.	Mean	Median	Std. dev.	Obs.	Mean	Median	Std. dev.
Commitments ($ millions)	7730	44.6	25.0	65.0	7838	51.8	30.0	71.2
Utilization ($ millions)	7730	13.5	5.1	26.8	7838	14.3	5.1	27.3

Data: aggregate balance sheet of U.S. branches of foreign banks (2011)

Assets	*All*	*European*	Liabilities	*All*	*European*
Cash	35%	40%	Deposits	50%	48%
			of which: Large time deposits	43%	42%
Fed Funds Sold	0%	0%			
			Fed Funds Purchased	1%	1%
Resale Agreements	5%	6%			
			Repurchase Agreements	11%	7%
U.S. Gov. Securities	4%	4%			
			Trading Liabilities	5%	5%
Other Securities	10%	11%			
			Other Liabilities	14%	17%
Loans	24%	23%			
of which: C&I loans	12%	10%			
Other Assets	2%	2%			
Total Claims on Non-Related Parties	80%	86%	***Total Liabilities to Non-Related Parties***	81%	77%
Net Funding to Related Depository Institutions	20%	14%	Net Funding from Related Depository Institutions	19%	23%
Total Assets ($ billions)	2,081	1,233	***Total Liabilities ($ billions)***	2,081	1,233

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Question 1: Origin of the liquidity shock

- Regional effect: **Yes**.

- Sovereign risk: **No**.

- Bank-specific risk: **No**.

- Bank-specific government support: **No**.

- Bank capital: **No**.

Question 1: Origin of the liquidity shock

Specification	(1) Dummy euro area	(2) Own-sovereign CDS premiums	(3) Bank CDS premiums	(4) SRISK	(5) Government support
Dependent variable			Δ Large time deposits		
Dummy euro area	-5.207**	-5.814**	-5.225*	-8.981**	-7.622**
	[2.218]	[2.646]	[2.964]	[3.383]	[3.166]
Δ Own-sovereign CDS premium		0.006			0.000
		[0.006]			[0.007]
Δ Idiosyncratic component of bank CDS premiums			0.005		
			[0.017]		
SRISK$_{(t-1)}$				0.568	
				[0.339]	
Government support$_{(t-1)}$					0.200
					[0.159]
Government support$_{(t-1)}$ x Δ Own-sovereign CDS premium					0.002
					[0.001]
Observations	129	129	75	54	104
R-squared	0.21	0.21	0.27	0.35	0.29
Bank sample	All	All	All	All	All
Countries	42	42	28	19	37

Robust standard errors in brackets

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

Question 1: Liquidity shock vs. bank capital

Figure 2: MMF deposits at US branches of foreign banks

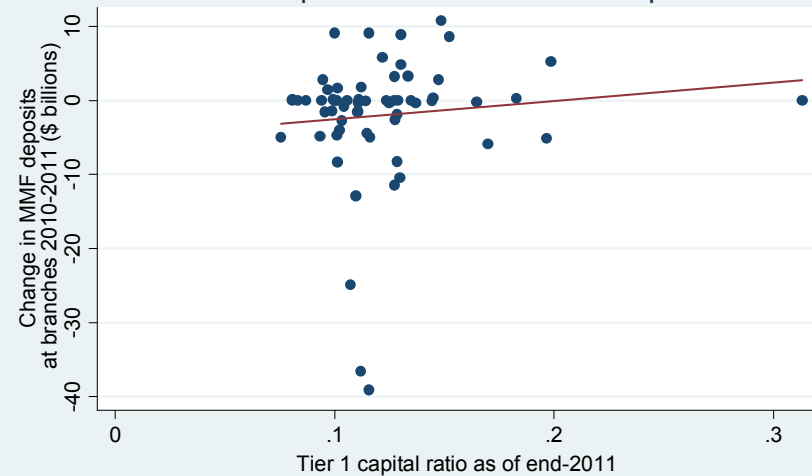Low Tier 1 (below 50th percentile)   High Tier 1 (above 50th percentile)
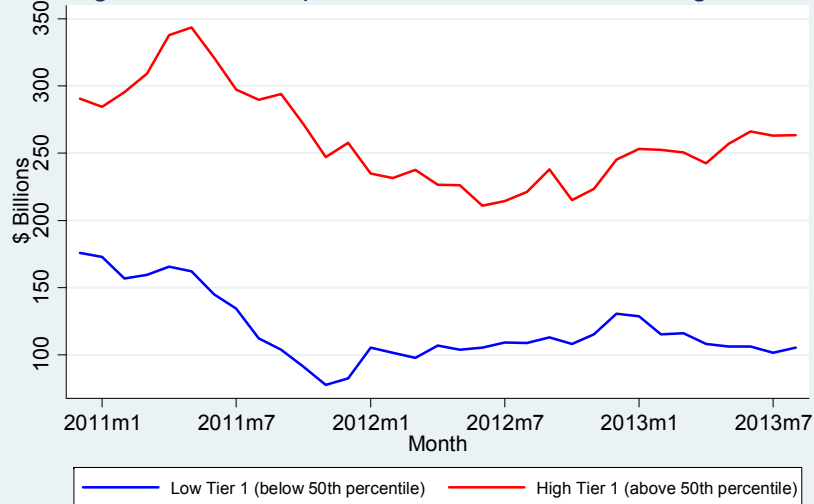
Source: SEC N-MFP form

Figure 3: Change in total large time deposits and Tier 1 capital ratio of the branches' parent
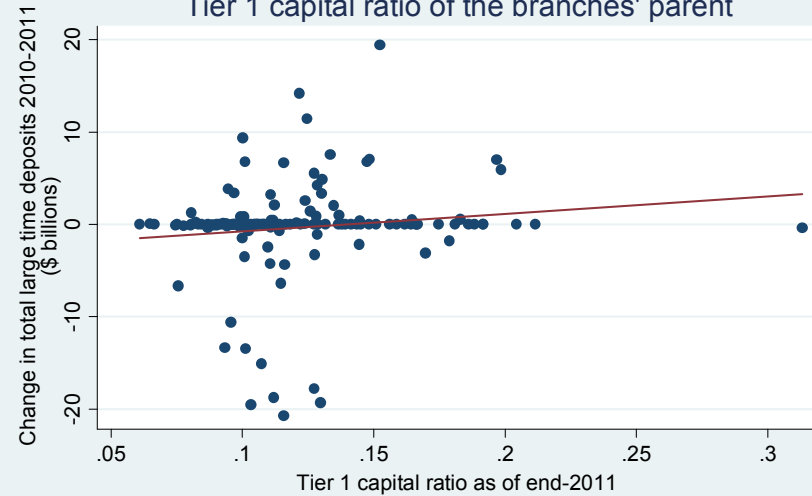
Source: FFIEC 002 form and FR Y-7Q form

Figure 4: Change in MMF deposits at branches and Tier 1 capital ratio of the branches' parent

Source: SEC N-MFP form and FR Y-7Q form

Question 2: Liquidity shocks & internal capital markets

- **In response to the liquidity shock, did branches rely more on funding from foreign parent banks?**

$$\Delta NetFunding_{ij} = \beta_0 + \beta_1 \Delta LargeTimeDeposits_{ij} + \beta_2 X_{ij} + \varepsilon_{ij}$$

- *$\Delta NetFunding_{ij}$ = {All related, head office, U.S. non-branch offices},* shows the increase in financing from related parties.

- *$\Delta LargeTimeDeposits_{ij}$* over 2010-11 as proxy for the liquidity shock.

Question 2: Liquidity shocks & internal capital markets

Dependent variable	(1) Δ Net due to related offices	(2) Δ Net due to head office	(3) Δ Net due to related U.S. non-branch offices	(4) Δ Net due to related offices	(5) Δ Net due to head office	(6) Δ Net due to related U.S. non-branch offices
Δ Large time deposits	-0.926*** [0.236]	-0.526*** [0.159]	-0.006 [0.003]	-0.881*** [0.129]	-0.531*** [0.111]	-0.006** [0.003]
Log branch assets (t-1)				1.426*** [0.268]	0.341* [0.170]	0.012 [0.007]
Loans to assets (t-1)				-1.223 [1.083]	-1.010 [0.625]	0.027* [0.014]
Deposits to assets (t-1)				-0.720 [1.152]	-0.608 [0.872]	-0.058* [0.034]
Relative size of branch (t-1)				21.060* [11.242]	22.163 [15.033]	0.548 [0.396]
Parent Tier 1 capital ratio (t-1				1.013 [1.009]	-0.430 [0.846]	0.015 [0.016]
Observations	129	129	129	129	129	129
R-squared	0.34	0.29	0.04	0.56	0.39	0.11
Countries	42	42	42	42	42	42

Robust standard errors in brackets

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

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Question 3: Was the liquidity shock associated with a decline in branch lending? (a) __Bank-level data__

- **Fixed effects for country of origin:**

$$\Delta Loans_{ij} = \beta_0 + \beta_1 \Delta LargeTimeDeposits_{ij} + \beta_2 X_{ij} + \eta_j + \varepsilon_{ij}$$

- Dependent and explanatory variables constructed from FFIEC data:

  - i = parent bank, j = country of origin.

  - $\Delta Loans_{ij} = \{\Delta TotLoans_{ij}, \Delta C\&ILoans_{ij}, \Delta C\&ILoansUS_{ij}\}$ over 2010-11.

  - $\Delta LargeTimeDeposits_{ij}$ over 2010-11 as proxy for the liquidity shock.

  - X_{ij} = branch/parent bank characteristics.

  - Omitted variable bias if $corr\,(\Delta LargeTimeDeposits_{ij},\, \varepsilon_{ij}) \neq 0$.

  - Therefore, η_j captures the change in loan demand common to borrowers working with all banks from country j.

Question 3: Was the liquidity shock associated with a decline in branch lending? (a) **Bank-level data**

Dependent variable	(1) Δ Total loans	(2) Δ Total C&I Loans	(3) Δ U.S. C&I Loans
Δ Large time deposits	0.146*	0.060*	0.043**
	[0.077]	[0.030]	[0.020]
Log branch assets (t-1)	0.430	0.117	0.032
	[0.300]	[0.068]	[0.042]
Loans to assets (t-1)	-0.017	-0.026	-0.028
	[0.411]	[0.285]	[0.217]
Deposits to assets (t-1)	0.528	0.331	0.077
	[0.799]	[0.350]	[0.124]
Relative size of branch (t-1)	-8.944	-3.177	-1.821*
	[9.638]	[2.306]	[1.055]
Parent Tier 1 capital ratio (t-1)	-5.276*	-5.846**	-2.563
	[2.825]	[2.274]	[1.774]
Observations	113	113	113
R-squared	0.48	0.50	0.45
Fixed effects	Country	Country	Country
Countries	26	26	26

Robust standard errors in brackets

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

Question 3: Was the liquidity shock associated with a decline in branch lending? (a) <u>Bank-level data (IV)</u>

- **Instrument** *$\Delta LargeTimeDeposits_{ij}$* :

$$\Delta Loans_{ij} = \beta_0 + \beta_1 \Delta LargeTimeDeposits_{ij} + \beta_2 X_{ij} + \varepsilon_{ij}$$

- Instrument *$\Delta LargeTimeDeposits_{ij}$* with *Dummy euro area* * Share of large time deposits coming from MMMFs as of the end of 2010.

Question 3: Was the liquidity shock associated with a decline in branch lending? (a) <u>Bank-level data (IV)</u>

Dependent variable	(1) Δ Total loans	(2) Δ Total C&I Loans	(3) Δ U.S. C&I Loans
Δ Large time deposits (IV)	0.290*	0.130**	0.076**
	[0.169]	[0.060]	[0.037]
Log branch assets (t-1)	0.410*	0.092	0.011
	[0.227]	[0.060]	[0.030]
Loans to assets (t-1)	-0.501	-0.368	-0.181
	[0.817]	[0.357]	[0.226]
Deposits to assets (t-1)	0.133	0.221	0.191
	[0.748]	[0.273]	[0.160]
Relative size of branch (t-1)	-16.998	-5.305	-1.127
	[11.195]	[3.581]	[1.961]
Parent Tier 1 capital ratio (t-1)	-8.426	-5.931*	-3.461*
	[6.194]	[3.566]	[2.104]
Observations	111	111	111
Kleiberger-Paap LM stat.	4.898	4.898	4.898
Cragg-Donald Wald F stat.	9.452	9.452	9.452
Fixed effects	None	None	None
Countries	26	26	26

Robust standard errors in brackets
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Question 3: Was the liquidity shock associated with a decline in branch lending? (a) __Bank-level data (RES)__

- **Estimate the liquidity shock net of intra-bank funding:**

$$\Delta Loans_{ij} = \beta_0 + \beta_1 \Delta LargeTimeDeposits\ (RES)_{ij} + \beta_2 X_{ij} + \eta_j + \varepsilon_{ij}$$

- Estimate the portion of large time deposits that is not explained by normal liquidity management activities of global banks.

- $\Delta LargeTimeDeposits = f(\Delta NetFunding_{ij,}$ other controls)

- Use residual in equation above.

Question 3: Was the liquidity shock associated with a decline in branch lending? (a) __Bank-level data (RES)__

Dependent variable	(1) Δ Total loans	(2) Δ Total C&I Loans	(3) Δ U.S. C&I Loans
Δ Large time deposits (RES)	0.113	0.044**	0.034***
	[0.088]	[0.016]	[0.012]
Log branch assets (t-1)	0.309	0.068	-0.003
	[0.290]	[0.071]	[0.035]
Loans to assets (t-1)	0.378	0.142	0.080
	[0.454]	[0.277]	[0.190]
Deposits to assets (t-1)	0.737	0.394	0.122
	[0.779]	[0.336]	[0.116]
Relative size of branch (t-1)	-8.291	-2.813	-1.706
	[10.496]	[2.972]	[1.522]
Parent Tier 1 capital ratio (t-1)	-4.153**	-5.352**	-2.176
	[1.706]	[1.932]	[1.523]
Observations	113	113	113
R-squared	0.44	0.47	0.41
Fixed effects	Country	Country	Country
Countries	26	26	26

Robust standard errors in brackets

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

Question 3: Was the liquidity shock associated with a decline in branch lending? (b) <u>Sector-level data</u>

- **Specification with loan-level data and sector fixed effects:**

$$\Delta Loans_{ijs} = \beta_0 + \beta_1 \Delta LargeTimeDeposits_{ij} + \beta_2 X_{ij} + \eta_s + \varepsilon_{ij}$$

- For the dependent variable, use <u>SNC data on syndicated loans by sector</u>:

  ➢ i = parent bank; j = country; s = sector 3-digit NAICS.

  ➢ $\Delta Loans_{ijs} = \{\Delta C\&ICommitmentsUS_{ijs}, \Delta C\&ILoansUS_{ijs}\}$ over 2010-11.

- Add <u>sector fixed effects</u> η_s.

- For explanatory variables, same FFIEC data as before.

Question 3: Was the liquidity shock associated with a decline in branch lending? (b) <u>Sector-level data</u>

Dependent variable	(1)	(2)		(3)	(4)
	ΔCommitments			ΔUtilization	
Δ Large time deposits	2.486*	2.601*		0.745***	0.730**
	[1.312]	[1.434]		[0.276]	[0.301]
Log branch assets (t-1)	25.943***	27.825***		6.777***	6.846***
	[6.211]	[7.461]		[1.844]	[2.271]
Loans to assets (t-1)	77.733**	83.834**		35.187***	37.374***
	[36.753]	[34.472]		[11.374]	[11.157]
Deposits to assets (t-1)	100.963**	87.905*		35.209***	32.260**
	[49.582]	[51.033]		[12.427]	[13.186]
Relative size of branch (t-1)		-24.399			20.104
		[145.720]			[44.080]
Parent Tier 1 capital ratio (t-1)		-112.494			-26.813
		[294.073]			[162.896]
Observations	1,661	1,636		1,661	1,636
R-squared	0.12	0.12		0.09	0.09
Fixed effects	NAICS 3 digit	NAICS 3 digit		NAICS 3 digit	NAICS 3 digit
Banks	102	100		102	100

Robust standard errors in brackets

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

Question 1: Was the liquidity shock associated with a decline in branch lending? (c) <u>Loan-level data</u>

- **Specification with loan-level data and firm fixed effects**

- **Estimated for the intensive and extensive margins:**

$$\Delta Loans_{ijf} = \beta_0 + \beta_1 \Delta LargeTimeDeposits_{ij} + \beta_2 X_{ij} + \eta_f + \varepsilon_{ij}$$

- For the dependent variable, use <u>SNC data on syndicated loans by firm</u>:

  ➢ i = parent bank; j = country; f = firm.

  ➢ $\Delta Loans_{ijf} = \{\Delta C\&ICommitmentsUS_{ijf}, \Delta C\&ILoansUS_{ijf}\}$ over 2010-11.

- Add <u>firm fixed effects</u> η_f.

- For explanatory variables, same FFIEC data as before.

Question 1: Was the liquidity shock associated with a decline in branch lending? (c) Loan-level data: the intensive mg.

Dependent variable	(1)	(2)		(3)	(4)
	ΔCommitments			ΔUtilization	
Δ Large time deposits	0.113	0.128		0.062*	0.044
	[0.091]	[0.096]		[0.037]	[0.045]
Log branch assets (t-1)	1.561***	1.670***		0.049	-0.071
	[0.351]	[0.472]		[0.288]	[0.325]
Loans to assets (t-1)	-2.569	-2.815		1.309	1.994
	[3.733]	[3.829]		[1.741]	[1.731]
Deposits to assets (t-1)	4.113	4.874		0.452	1.605
	[4.602]	[4.644]		[1.937]	[1.683]
Relative size of branch (t-1)		-19.771*			-0.803
		[11.342]			[5.374]
Parent Tier 1 capital ratio (t-1)		54.810			43.436*
		[37.691]			[24.045]
Observations	4,302	4,259		4,302	4,259
R-squared	0.31	0.31		0.51	0.51
Fixed effects	Firm	Firm		Firm	Firm
Banks	100	98		100	98

Robust standard errors in brackets

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

Question 1: Was the liquidity shock associated with a decline in branch lending? (c) <u>Loan-level data: the extensive mg.</u>

- Logistic regression, dep. var.=1 if lending relation existed in 2010 but ceased in 2011, 0 if it continued; "odds ratios" reported instead of "log odds" ratios.

	(1)	(2)		(3)	(4)		(5)	(6)
	All loans			**Revolving credit**			**Term loans**	
Δ Large time deposits	0.985***	0.982***		0.982***	0.979***		0.987	0.985
	[0.004]	[0.004]		[0.004]	[0.005]		[0.009]	[0.010]
Log branch assets (t-1)	0.758***	0.736***		0.734***	0.716***		0.929	0.887
	[0.026]	[0.028]		[0.029]	[0.032]		[0.062]	[0.074]
Loans to assets (t-1)	0.493***	0.524**		0.591	0.620		0.295**	0.287**
	[0.135]	[0.150]		[0.191]	[0.209]		[0.146]	[0.146]
Deposits to assets (t-1)	0.322***	0.383***		0.270***	0.283***		0.550	0.740
	[0.071]	[0.090]		[0.069]	[0.076]		[0.216]	[0.315]
Relative size of branch (t-1)		3.363			6.545*			8.164
		[3.514]			[7.395]			[20.085]
Parent Tier 1 capital ratio (t-1)		10.344			0.292			4.888
		[18.843]			[0.625]			[14.814]
Observations	3,306	3,236		2,488	2,465		928	881
Pseudo R-square	0.04	0.04		0.05	0.05		0.0159	0.0171
Fixed effects	Firm	Firm		Firm	Firm		Firm	Firm
Firms	475	469		370	369		135	130

Standard errors in brackets

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

Question 1: Was the liquidity shock associated with a decline in branch lending? (d) Firm-level data: real effects

Was the liquidity shock associated with a decline corporate investment?

$$Investment/Assets_{it} = \beta_0 + \beta_1 After_t + \beta_2 After_t \times Liquidity\ shock_{it-1}$$
$$+ \beta_3 X_{it} + \eta_i + \varepsilon_{it}$$

- i = firm

- Use quarterly data from Compustat for firms with access to the syndicated loans, excluding the agriculture, mining, financial, and utilities sectors.

- Sample period is 2010:Q3 to 2012:Q2

- $After$ = 1 for interval from 2011:Q3 to 2012:Q2.

- $Liquidity\ shock$ = 1 if the firm had a lending relationship with a branch that had deposit outflows between 2010 and 2011.

Question 1: Was the liquidity shock associated with a decline in branch lending? (d) <u>Firm-level data: real effects</u>

	(1)	(2)	(3)		(4)	(5)	(6)
Dependent variable	Investment/Assets				Cash/Assets		
After	0.129***	0.124***	0.127***		-1.002***	-0.997***	-1.020***
	[0.022]	[0.021]	[0.022]		[0.148]	[0.144]	[0.148]
After x Liquidity shock	-0.073**		-0.068**		0.416*		0.427*
	[0.034]		[0.035]		[0.228]		[0.230]
After x Liquidity shock (fraction)		-0.104*				0.810*	
		[0.062]				[0.423]	
Tobin's Q	0.159***	0.158***	0.150***		1.766***	1.771***	1.655***
	[0.059]	[0.059]	[0.058]		[0.502]	[0.502]	[0.499]
Cash flow			0.011				0.127**
			[0.007]				[0.056]
Observations	10,250	10,250	10,036		10,329	10,329	10,092
R-squared	0.01	0.01	0.01		0.03	0.03	0.03
Firms	1,371	1,371	1,363		1,383	1,383	1,372
Firm fixed effects	Yes	Yes	Yes		Yes	Yes	Yes

Robust standard errors in brackets

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

Conclusions and policy implications

▸ In the summer of 2011, the U.S. branches of European banks suffered a liquidity shock arising from their reduced access to dollar funding from MMFs.

▸ The liquidity shock resulted in reduced lending to U.S. entities, a result which is robust to controlling for demand at the sector and firm level.

▸ Internal capital markets were at play, but not enough to offset the liquidity shock.

▸ The liquidity shock was related to regional factors and—within Europe—to sovereign risk, but not to bank-specific characteristics.

Conclusions and policy implications

▸ Internal liquidity management with multiple currencies may become costly in periods of financial stress.

▸ Basel regulatory framework: a <u>liquidity coverage ratio</u> implemented in 2015 (stock of high-quality liquid assets/net cash outflows over the next 30 calendar days>1).

  ▸ Supervisors and banks should also be aware of the liquidity needs in each significant currency.

  ▸ Banks that rely on unstable sources of foreign currency funding should keep part of their liquidity buffer in that currency.

Thank you!