

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

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Federal Reserve Board*

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European Central Bank

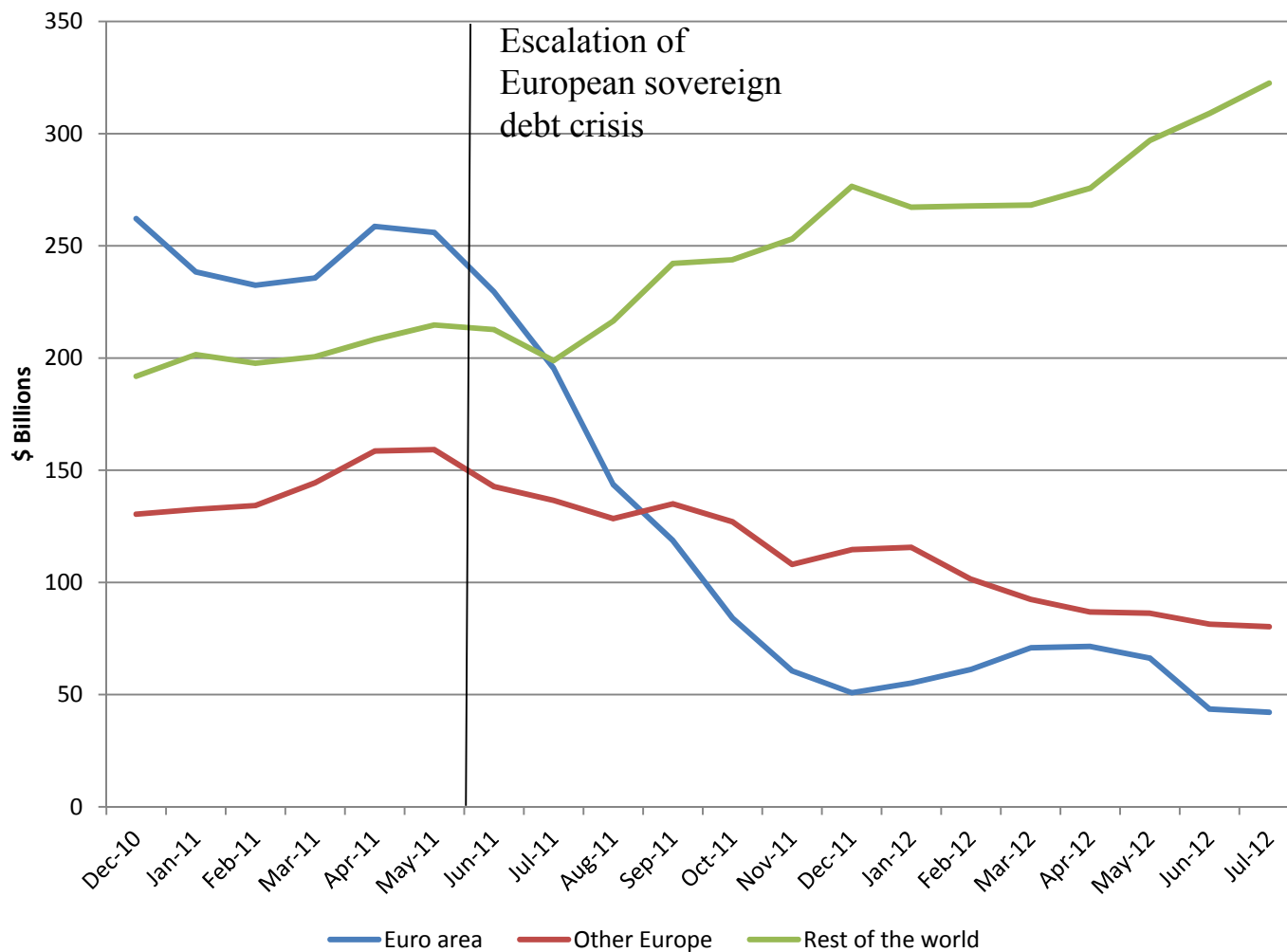
2nd Conference of the Macro-prudential Research Network
of the European System of Central Banks

* The views in this paper are solely the responsibility of the authors and should not be interpreted as reflecting the views of the Board of Governors of the Federal Reserve System or of any other person associated with the Federal Reserve System.

Motivation

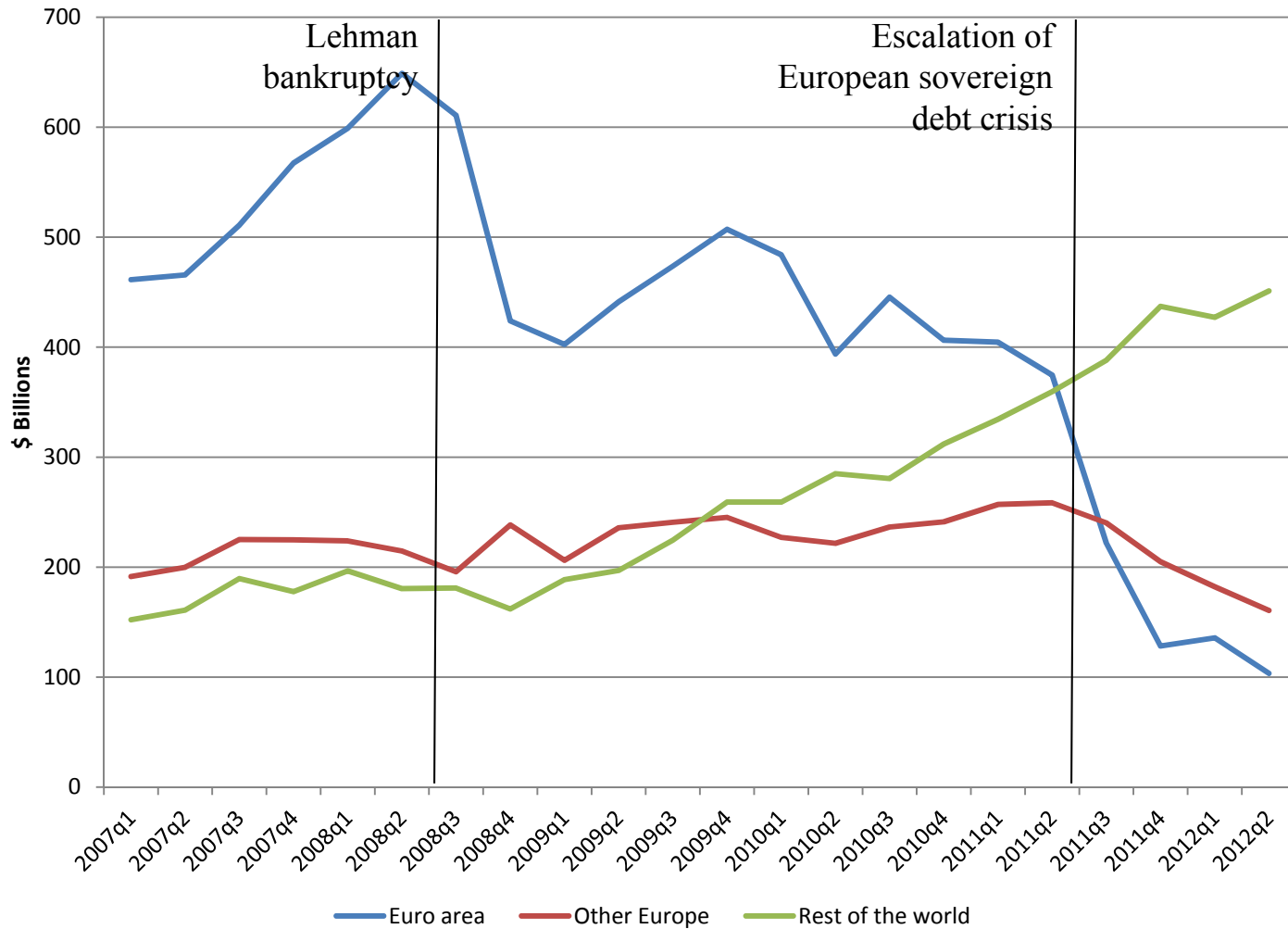
- ▶ As sovereign stresses in Europe increased in the summer of 2011, U.S. branches of euro-area banks suffered a liquidity shock.
- ▶ U.S. money market funds (MMF) cut their holdings of large time deposits issued by these branches.

U.S. MMF exposure to the U.S. branches of foreign banks



Source: Securities and Exchange Commission.

Large Term Deposits outstanding at U.S. branches of foreign banks



Source: FFIEC 002, Federal Reserve Board.

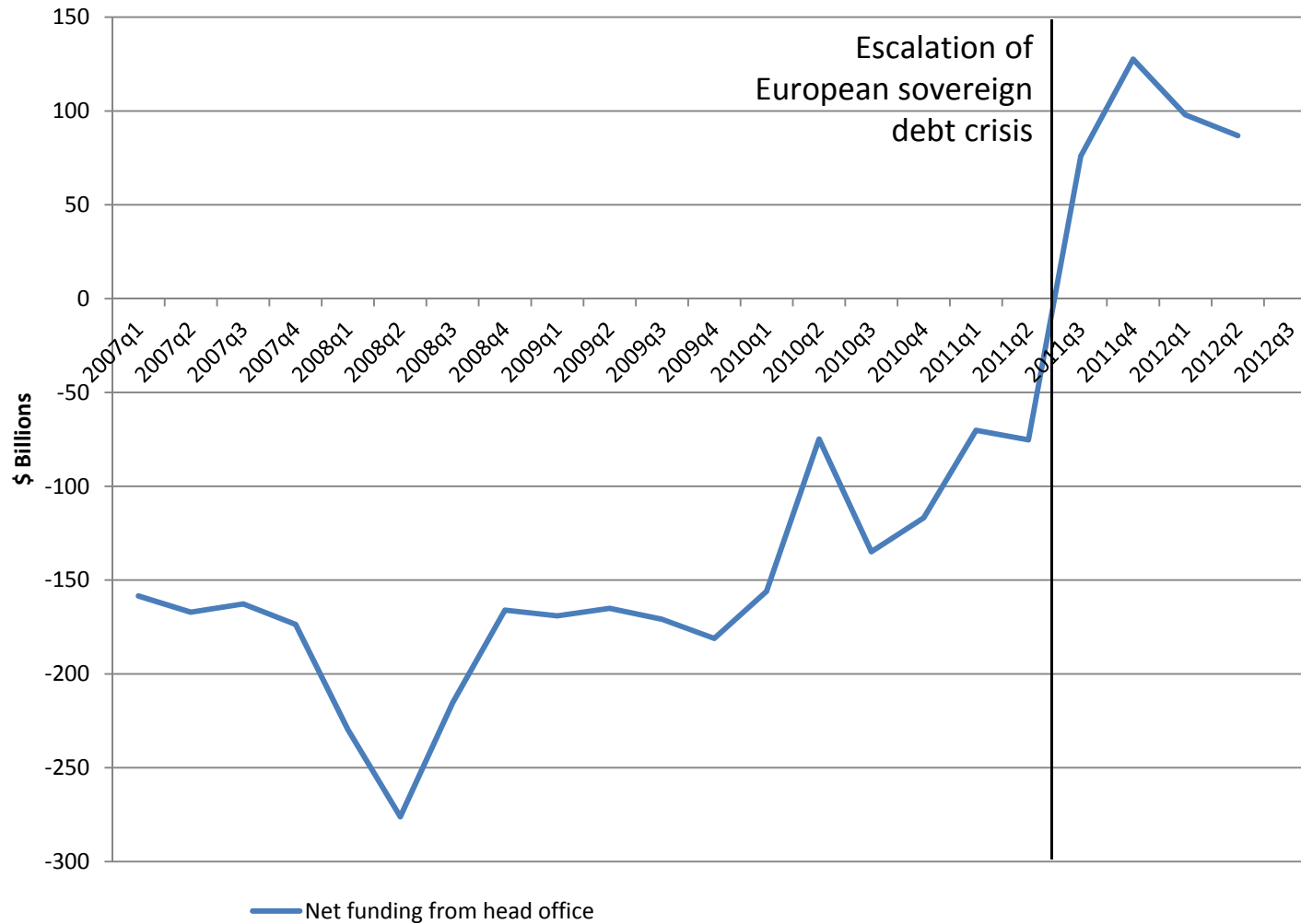
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- ▶ As the U.S. branches of euro area banks lost access to dollar funding, parents had to fund them.

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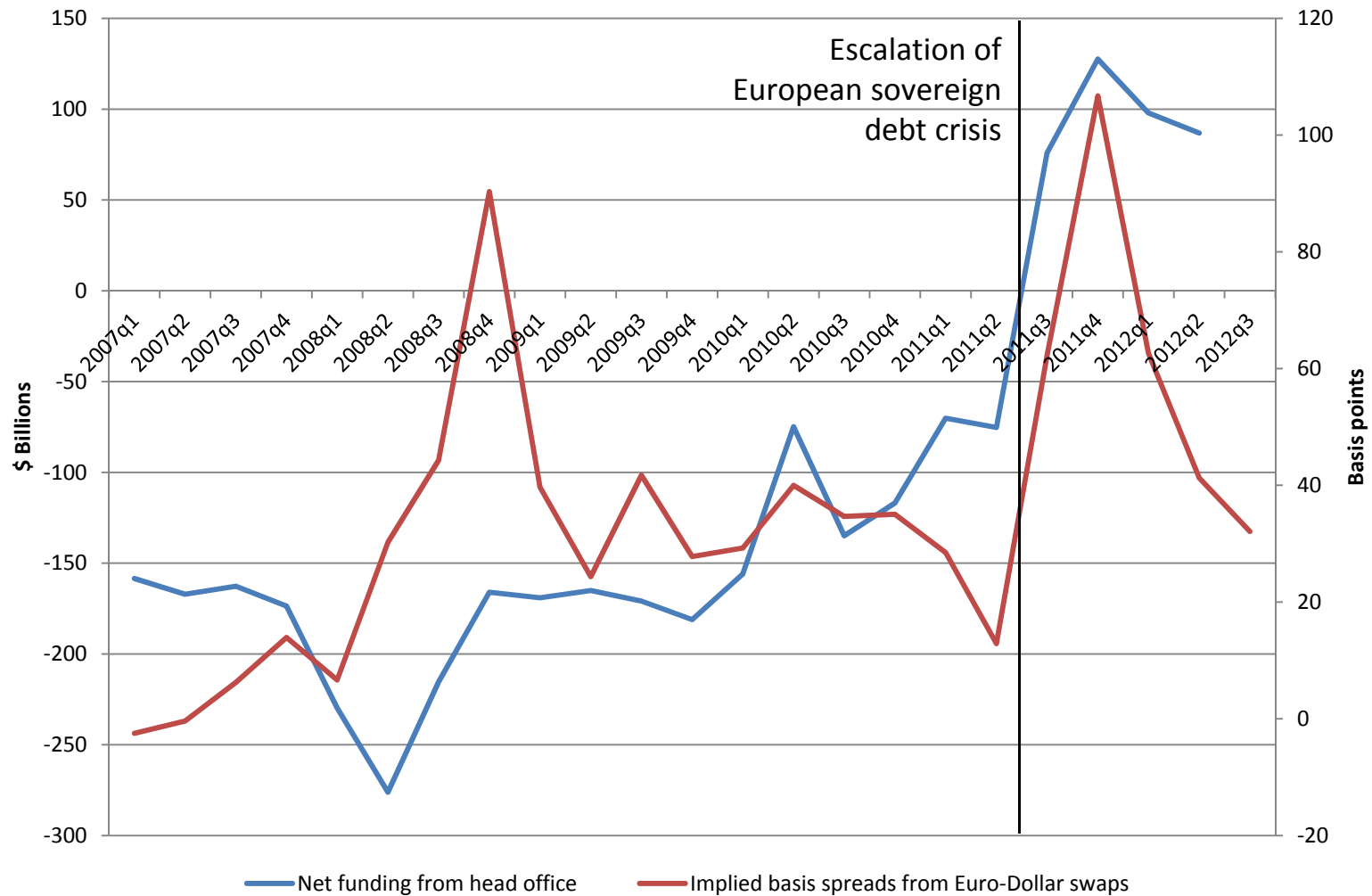
- ▶ As sovereign stresses in Europe increased in the summer of 2011, U.S. branches of euro-area banks suffered a liquidity shock.
- ▶ U.S. money market funds (MMF) cut their holdings of large time deposits issued by these branches.
- ▶ As the U.S. branches of euro area banks lost access to dollar funding, parents had to fund them.
- ▶ But swapping euros into dollars became increasingly expensive.

“Net due to” position of the U.S. branches of European banks and the cost of dollar funding



Source: FFIEC 002, Federal Reserve Board.

“Net due to” position of the U.S. branches of European banks and the cost of dollar funding

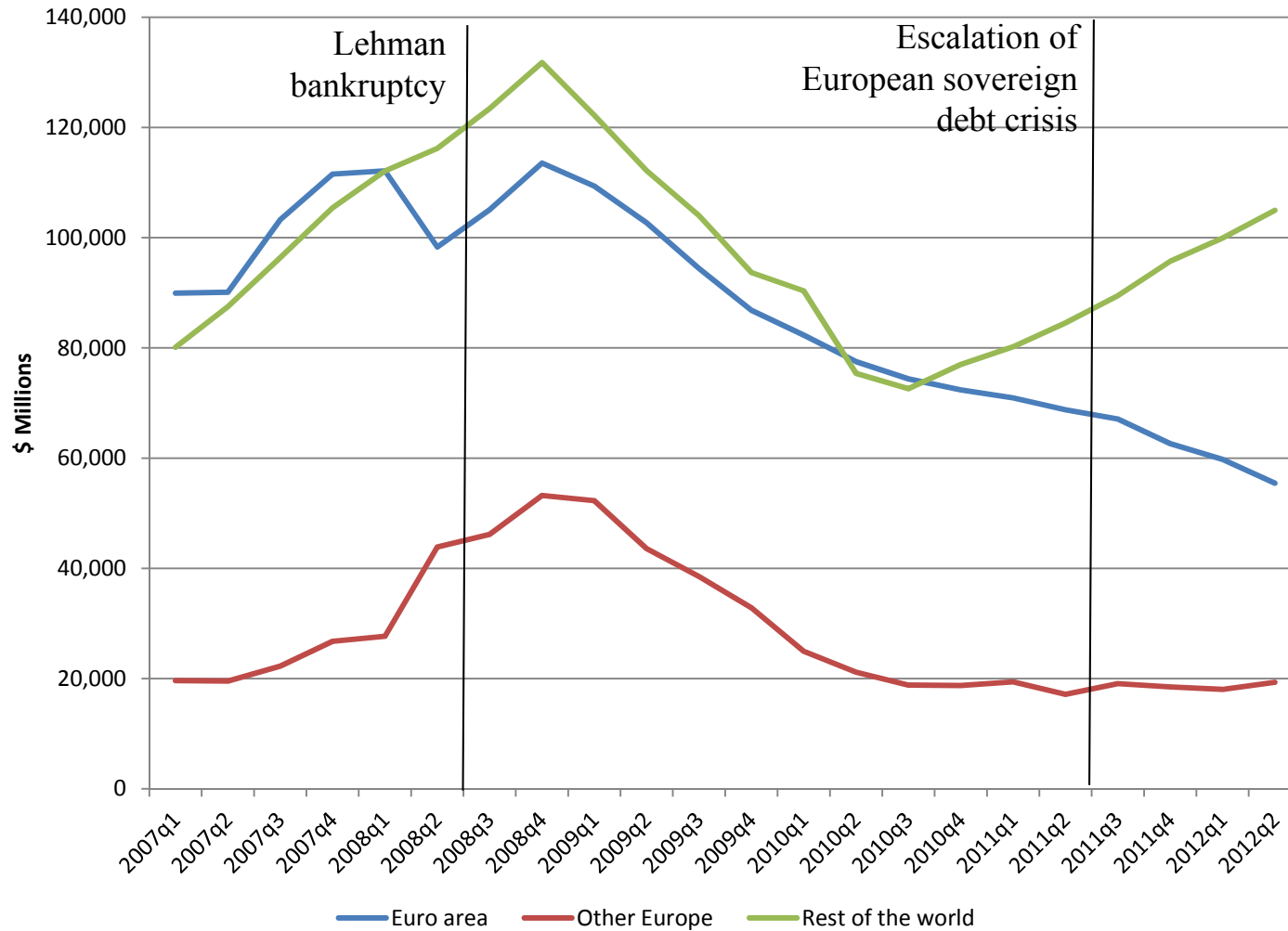


Source: FFIEC 002, Federal Reserve Board.

Motivation

- ▶ Branches were not able to fully substitute external funds with internal financing, providing evidence for a new type of bank lending channel.
- ▶ Lending by euro area banks had been falling since 2008, but the liquidity shock contributed to the decline in 2011.

C&I loans to U.S. addressees outstanding at U.S. branches of foreign banks



Source: FFIEC 002, Federal Reserve Board.

Questions

1. As a result of the liquidity shock, did the euro-area branches reduce their lending in mid-2011?
2. Were the internal capital markets at play to offset this liquidity shock?
3. How was the liquidity shock related to the developments in Europe in mid-2011?

Preview of results

1. The branches of euro-area banks that suffered larger liquidity shocks reduced lending by more.
2. Branches with larger liquidity shocks relied more on funding from parent banks, but such funding did not fully offset the shock.
3. The liquidity shock was related to the increase in sovereign risk of the banks' country of origin.
 - It did not appear related to bank-specific exposure to sovereign debt, reliance on government support, or bank-specific risk.

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)

- ▶ 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 liquid assets	Other funding

JAPANESE PARENT BANK

Assets	Liabilities
Loans	Deposits
Other assets	Other funding
	Capital ↓

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Internal lending	

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

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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.
 - ▶ 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 Moody's ratings.
- ▶ Country and bank CDS premiums: Markit.

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

- ▶ As of end-2011, the U.S. branches of foreign banks accounted for 14 percent of total U.S. banking assets, and for 17 percent of Commercial and Industrial (C&I) loans.

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

Assets	<i>All</i>	<i>European</i>	Liabilities	<i>All</i>	<i>European</i>
Cash	35%	40%	Deposits	50%	48%
			<i>of which: Large time deposits</i>	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%			
<i>of which: C&I loans</i>	12%	10%			
Other Assets	2%	2%			
<i>Total Claims on Non-Related Parties</i>	80%	86%	<i>Total Liabilities to Non-Related Parties</i>	81%	77%
Net Funding to Related Depository Institutions	20%	14%	Net Funding from Related Depository Institutions	19%	23%
<i>Total Assets (\$ billions)</i>	2,081	1,233	<i>Total Liabilities (\$ billions)</i>	2,081	1,233

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Question 1: Liquidity shocks and bank lending (1/2)

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

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

- Dependent and explanatory variables constructed from FFIEC data:
 - i = U.S. branch network of parent bank, j = country of parent bank.
 - $\Delta Loans_{ij} = \{\Delta TotLoans_{ij}, \Delta C\&ILoans_{ij}, \Delta C\&ILoansUS_{ij}\}$ over 2010-11.
 - $\Delta LargeTimeDeposits_{ij}$ over 2010-11 as proxy for the liquidity shock.
 - X_{ij} = branch/parent bank characteristics.

Question 1: Liquidity shocks and bank lending (1/2)

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

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

- Problem of omitted variable bias if $corr(\Delta LargeTimeDeposits_{ij}, \varepsilon_{ij}) \neq 0$.
 - For instance, sovereign stress in country j may be associated with macro problems that harm the exports of U.S. firms to country j , whom in turn reduce demand for loans from country j banks.
- Therefore, add country fixed effects η_j :
 - η_j captures the change in loan demand common to borrowers working with all banks from country j .

Question 1: Liquidity shocks and bank lending (1/2)

	(1)	(2)	(3)
Dependent variable	Δ Total loans	Δ Total C&I Loans	Δ U.S. C&I Loans
Δ Large time deposits	0.141* [0.079]	0.064* [0.036]	0.045* [0.023]
Log branch assets (t-1)	0.438 [0.335]	0.084 [0.082]	0.029 [0.052]
Loans to assets (t-1)	0.129 [0.555]	-0.021 [0.297]	0.026 [0.230]
Deposits to assets (t-1)	0.687 [0.805]	0.431 [0.358]	0.137 [0.166]
Relative size of branch (t-1)	-8.525 [10.595]	-2.358 [2.560]	-1.722 [1.219]
Parent Tier 1 capital ratio (t-1)	0.304 [0.908]	-0.732* [0.367]	-0.003 [0.238]
Observations	129	129	129
R-squared	0.48	0.47	0.43
Countries	42	42	42

Robust standard errors in bracket

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

Question 1: Liquidity shocks and bank lending (2/2)

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

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

- For the dependent variable, use SNC data on syndicated loans by sector:
 - $s = \text{sector, NAICS 3-digit level.}$
 - $\Delta Loans_{ijs} = \{\Delta C\&I Commitments US_{ijs}, \Delta C\&I Loans US_{ijs}\}$ over 2010-11.
- Add sector fixed effects η_s .
- For the explanatory variables, use the same FFIEC data as before.

Question 1: Liquidity shocks and bank lending (2/2)

Dependent variable:	(1) Δ Commitments	(2) Δ Commitments	(3) Δ Utilization	(4) Δ Utilization
Δ Large time deposits	1.700** [0.688]	2.601*** [0.766]	0.562** [0.243]	0.730** [0.305]
Log branch assets (t-1)		27.825*** [6.263]		6.846** [3.004]
Loans to assets (t-1)		83.834*** [24.403]		37.374*** [13.308]
Deposits to assets (t-1)		87.905*** [24.077]		32.260*** [11.930]
Relative size of branch (t-1)		-24.399 [126.580]		20.104 [56.013]
Parent Tier 1 capital ratio (t-1)		-112.494 [171.567]		-26.813 [147.156]
Observations	1,662	1,637	1,662	1,637
R-squared	0.07	0.12	0.07	0.09
Sector fixed effects	NAICS 3 digit	NAICS 3 digit	NAICS 3 digit	NAICS 3 digit
Sectors	78	78	78	78
Countries	34	34	34	34

Robust standard errors in brackets

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

Question 2: Liquidity shocks & internal capital markets

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

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

- $\Delta NetFunding_{ij} = \{All\ related,\ head\ office,\ U.S.\ non\text{-}branch\ offices\}$, 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

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Question 3: Origin of the liquidity shock

- ▶ Regional effect: Yes.
- ▶ Sovereign risk: Yes, only within Europe.
- ▶ Bank-specific exposure to sovereign debt: No.
- ▶ Bank-specific government support: No.
- ▶ Bank-specific risk: No.
- ▶ Bank-specific exposures to GR, IR, PT: No.

Question 3: Origin of the liquidity shock

(a) Foreign sovereign risk

$$\Delta LargeTimeDeposits_{ij} = \beta_0 + \beta_1 \text{Region}_j + X_{ij} + \varepsilon_{ij}$$

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

ΔCDS_j = 2010-2011 change in sovereign CDS premium, common to all banks i from country of origin j .

Question 3: Origin of the liquidity shock

	(1)	(2)	(3)	(4)
Specification	Own-sovereign CDS premiums	Dummy Europe	Dummy core and peripheral Europe	Own-sovereign CDS premiums
Dependent variable	Δ Large time deposits			
Δ Own-sovereign CDS premium	-0.008 [0.005]			-0.082* [0.036]
Dummy Europe		-3.800** [1.516]		
Dummy peripheral Europe			-4.545*** [1.116]	
Dummy core Europe			-6.112 [3.926]	
Observations	129	129	129	31
R-squared	0.08	0.15	0.21	0.55
Bank sample	All	All	All	European
Countries	42	42	42	8

Robust standard errors in brackets

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

Question 3: Origin of the liquidity shock

(b) *Bank-specific* exposure to own sovereign risk

$$\Delta LargeTimeDeposits_{ij} = \beta_0 + \beta_1 \Delta CDS_j + \beta_2 OwnSovDebt_{ij} + \\ + \beta_3 \Delta CDS_j \times OwnSovDebt_{ij} + X_{ij} + \varepsilon_{ij}$$

- $OwnSovDebt_{ij}$ = bank i 's holdings of sovereign debt of country of origin j (as % of the parent bank i 's tier 1 capital, available for 31 European banks that reported sovereign debt exposure in 2011 EBA stress test).

Question 3: Origin of the liquidity shock

	(5)	(6)	(7)	(8)
Specification	Exposure to own- sovereign debt	Reliance on own- government support	Bank CDS premiums	Exposure to Greece, Ireland and Portugal
Dependent variable	Δ Large time deposits			
Δ Own-sovereign CDS premium	-0.106* [0.052]	-0.016* [0.010]	-0.090** [0.037]	
Own sovereign debt/T1 capital (t-1)	-0.133 [0.665]			
Own sovereign debt/T1 capital (t-1) x Δ Own-sovereign CDS premium	0.012 [0.013]			
Government support (t-1)		-0.035 [0.134]		
Government support (t-1) x Δ Own-sovereign CDS premium		0.002 [0.002]		
Δ Idiosyncr. comp. of bank CDS premiums			-0.019 [0.026]	
GIP sovereign debt/T1 capital (t-1)				-24.847 [33.486]
Observations	31	104	28	31
R-squared	0.57	0.11	0.57	0.42
Bank sample Countries	European 8	All 37	European 8	European 8

Robust standard errors in brackets

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Question 3: Origin of the liquidity shock

(c) *Bank-specific* reliance on own sovereign's support

$$\Delta LargeTimeDeposits_{ij} = \beta_0 + \beta_1 \Delta CDS_j + \beta_2 GovSupport_{ij} + \beta_3 \Delta CDS_j \times GovSupport_{ij} + X_{ij} + \varepsilon_{ij}$$

- $GovSupport_{ij}$ = difference in rating notches between:
 1. Moody's bank-specific deposit rating (BDR), which includes government support.
 2. Bank-specific financial strength ratings (BFSR) = measures "a bank's intrinsic safety and soundness on an entity-specific basis."
(see Correa et al., 2012)

Question 3: Origin of the liquidity shock

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Own sovereign debt/T1 capital (t-1) x Δ Own-sovereign CDS premium	0.012 [0.013]			
Government support (t-1)		-0.035 [0.134]		
Government support (t-1) x Δ Own-sovereign CDS premium		0.002 [0.002]		
Δ Idiosyncr. comp. of bank CDS premiums			-0.019 [0.026]	
GIP sovereign debt/T1 capital (t-1)				-24.847 [33.486]
Observations	31	104	28	31
R-squared	0.57	0.11	0.57	0.42
Bank sample Countries	European 8	All 37	European 8	European 8

Robust standard errors in brackets

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

Question 3: Origin of the liquidity shock

(d) *Bank-specific vs. sovereign risk*

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

- $\Delta IdiosyncrBankCDS_{ij}$ is the residual from:

$$\Delta BankCDS_{ij} = \alpha_0 + \alpha_1 \Delta SovCDS_j + \omega_{ij}.$$

Question 3: Origin of the liquidity shock

	(5)	(6)	(7)	(8)
Specification	Exposure to own- sovereign debt	Reliance on own- government support	Bank CDS premiums	Exposure to Greece, Ireland and Portugal
Dependent variable	Δ Large time deposits			
Δ Own-sovereign CDS premium	-0.106* [0.052]	-0.016* [0.010]	-0.090** [0.037]	
Own sovereign debt/T1 capital (t-1)	-0.133 [0.665]			
Own sovereign debt/T1 capital (t-1) x Δ Own-sovereign CDS premium	0.012 [0.013]			
Government support (t-1)		-0.035 [0.134]		
Government support (t-1) x Δ Own-sovereign CDS premium		0.002 [0.002]		
Δ Idiosyncr. comp. of bank CDS premiums			-0.019 [0.026]	
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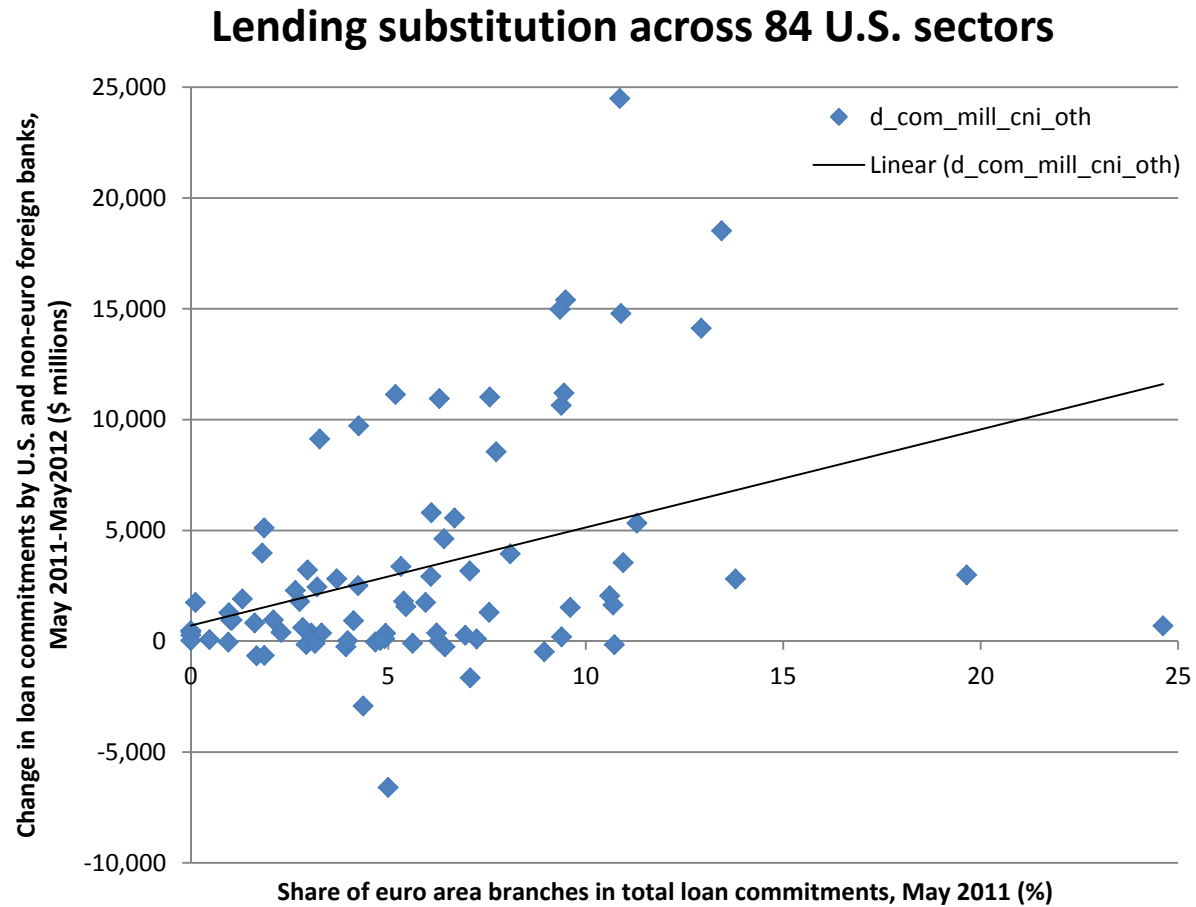
Conclusions and policy implications

- ▶ Internal liquidity management with multiple currencies may become costly in periods of financial stress.
- ▶ Basel regulatory framework: a liquidity coverage ratio to be 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.

Conclusions and to do...

- ▶ Real effects on the U.S. economy?
 - ▶ ROW bank lending actually rose in 2011:H2, but was that enough to offset the reduced lending by euro-area banks?
 - ▶ The liquidity shock may have greater impact in “niche” lending markets in which the euro-area banks specialize.

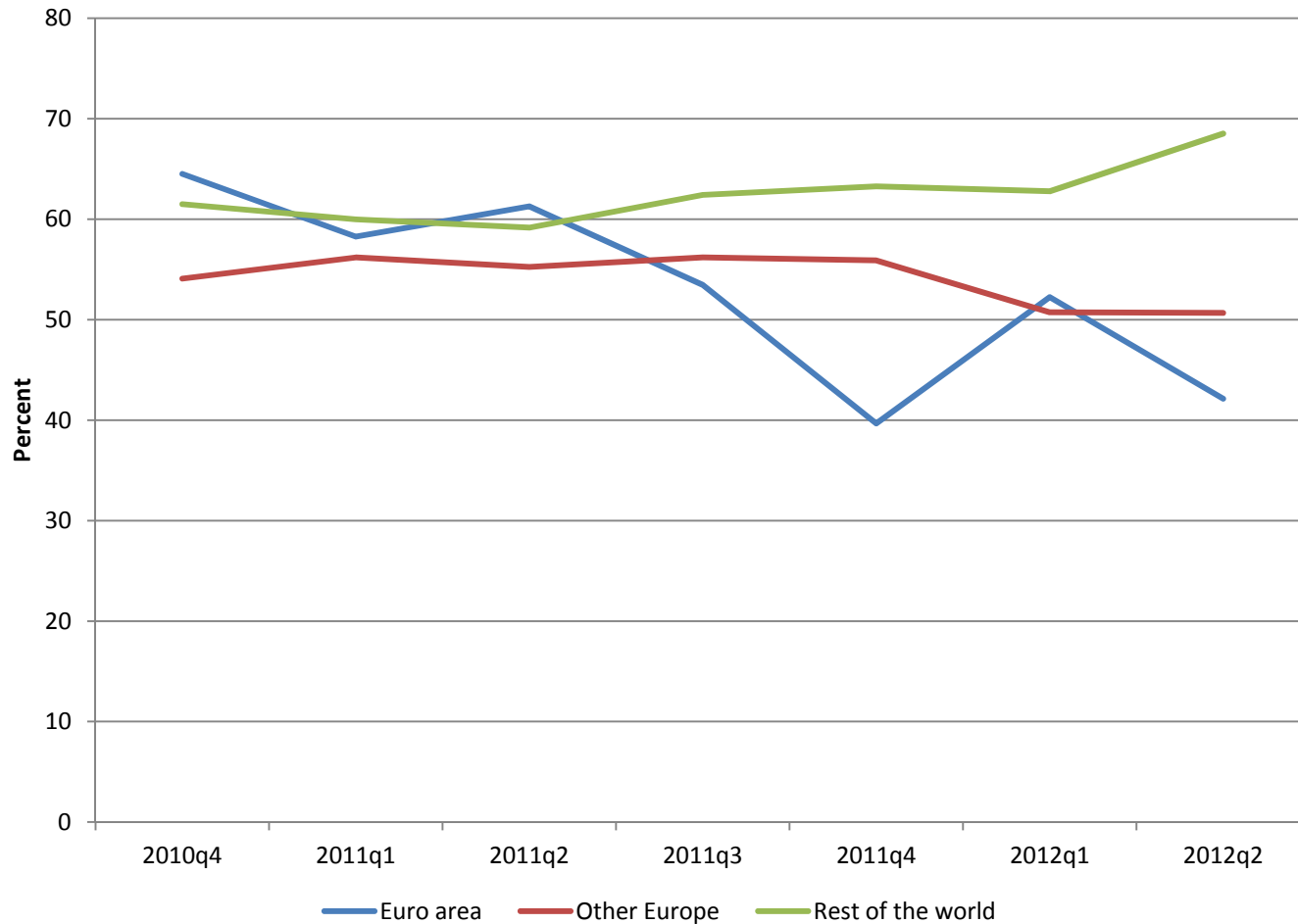
Conclusions and to do...



ADDITIONAL SLIDES



MMF's CD holdings as % of foreign bank branches' large time deposits



Source: Securities and Exchange Commission, FFIEC 002/Federal Reserve Board.

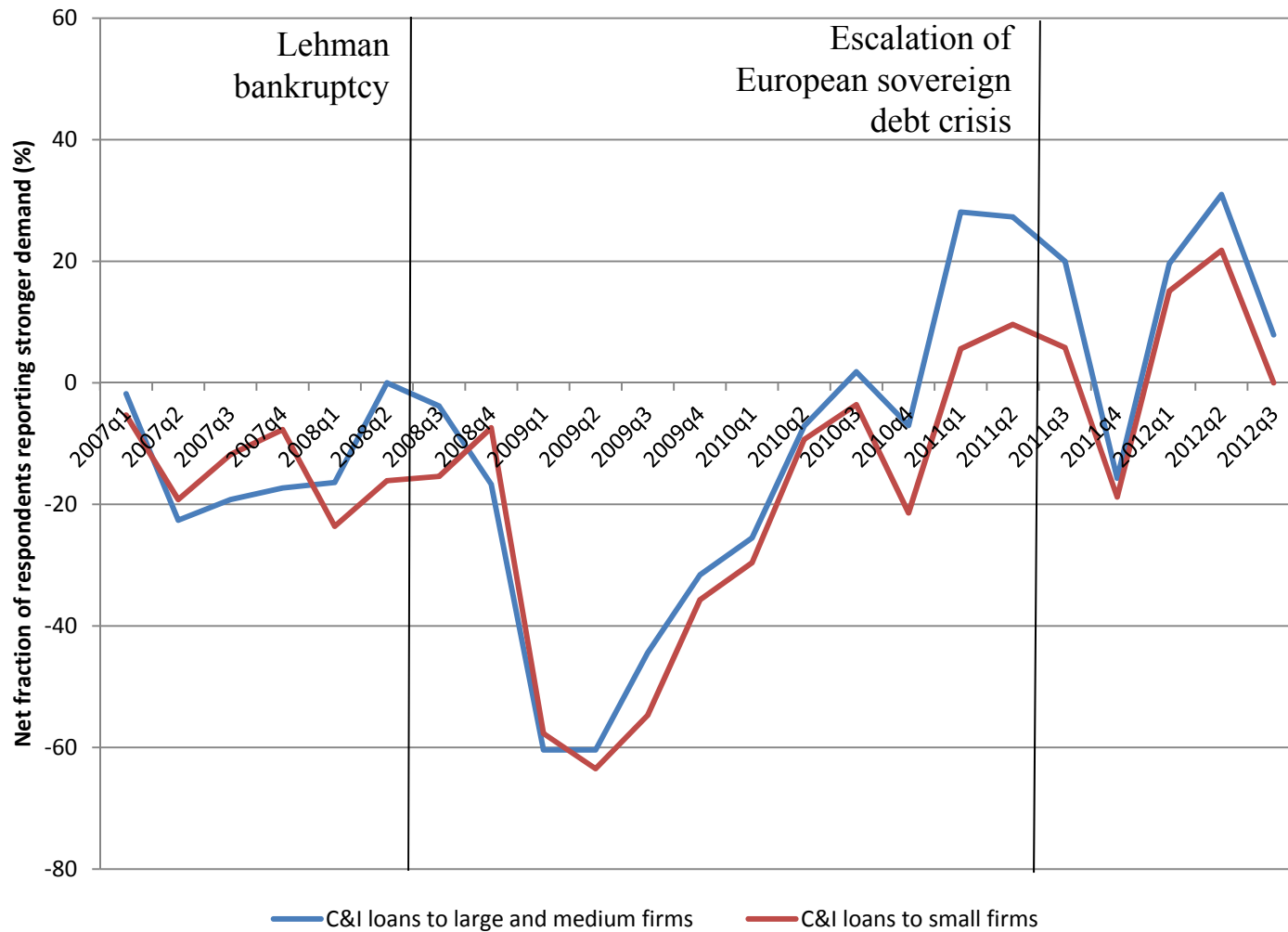
Data: summary statistics

	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

Primer on U.S. branches and agencies of foreign banks

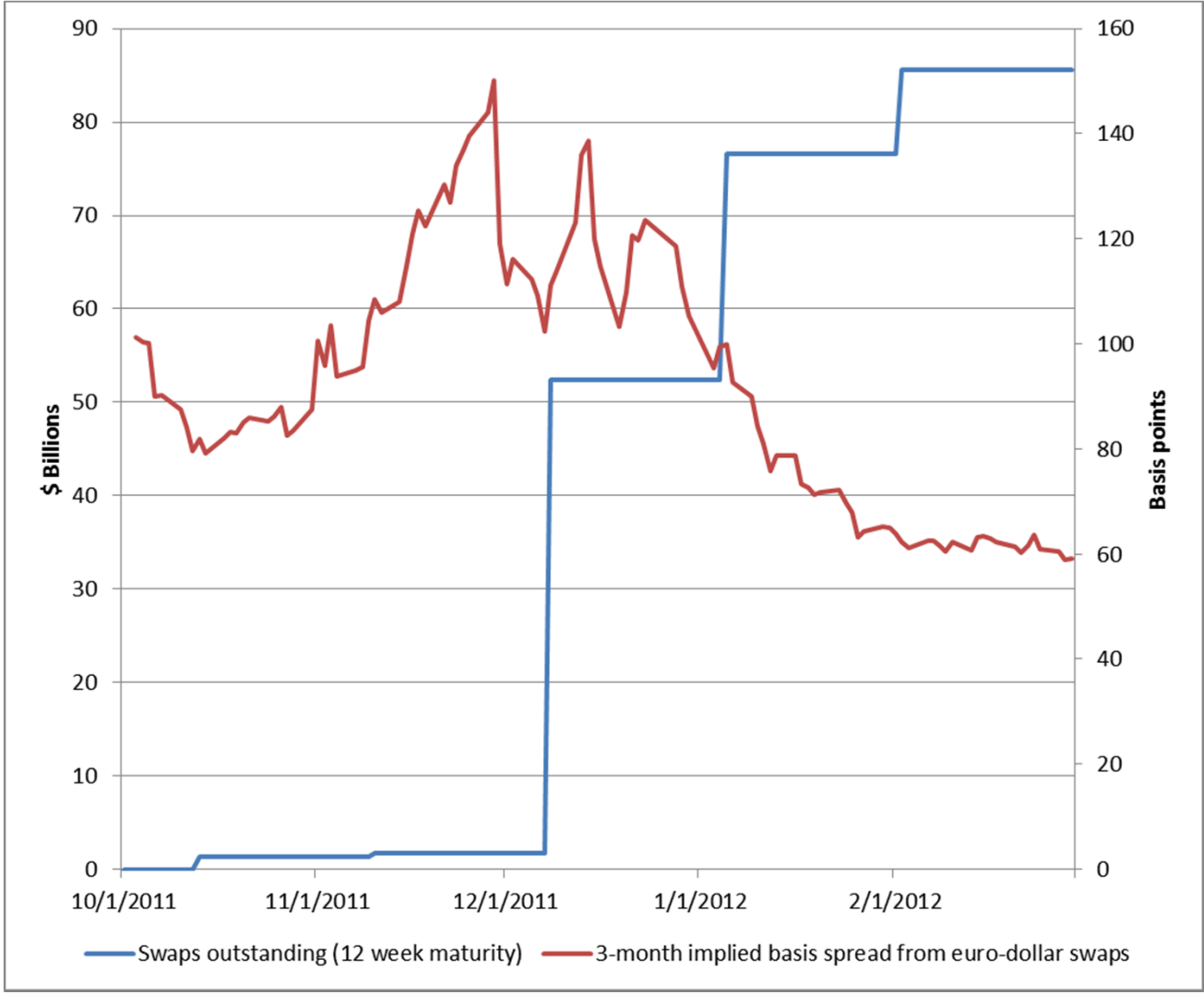
- ▶ In 1978, the International Banking Act adds U.S. branches of foreign banks to the federal regulatory framework, and requires deposit insurance for branches engaged in retail deposit taking.
- ▶ The Foreign Bank Supervision Enhancement Act (FBSEA) of 1991—part of FDICIA—eliminates deposit insurance for branches of foreign banks (some are grandfathered).
- ▶ Branches are not subject to capital requirements on a stand-alone basis.
- ▶ As of end-December 2011, the U.S. branches of foreign banks accounted for 14 percent of total U.S. banking assets and 17 percent of Commercial and Industrial (C&I) loans.

Demand for C&I loans from U.S. domestic banks



- ▶ Source: Senior Loan Officer Opinion Survey on Bank Lending Practices, FRB.

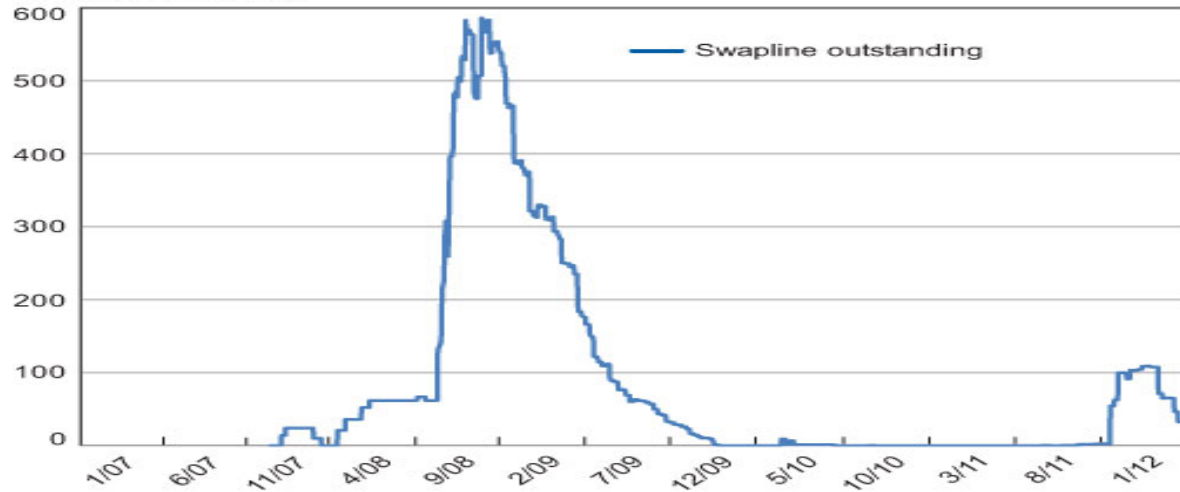
Dollar swaps outstanding with the ECB



Dollar swaps outstanding with the ECB

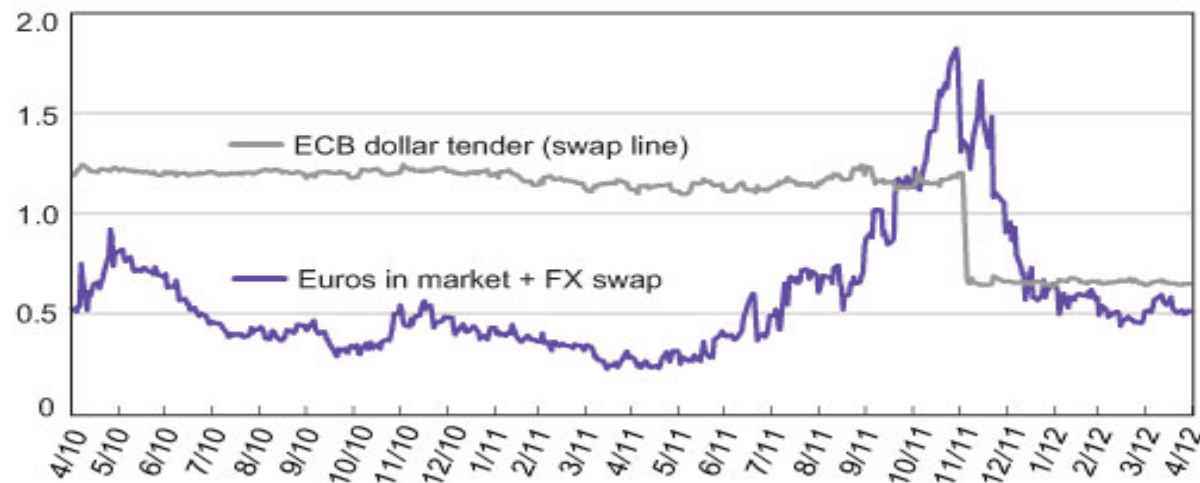
Amount Outstanding at Swap Facility

Billions of U.S. dollars



Cost of Various Options for Three-Month Secured U.S. Dollar Funding

Percent



Source: Miu, Sarkar and Tepper (2010)

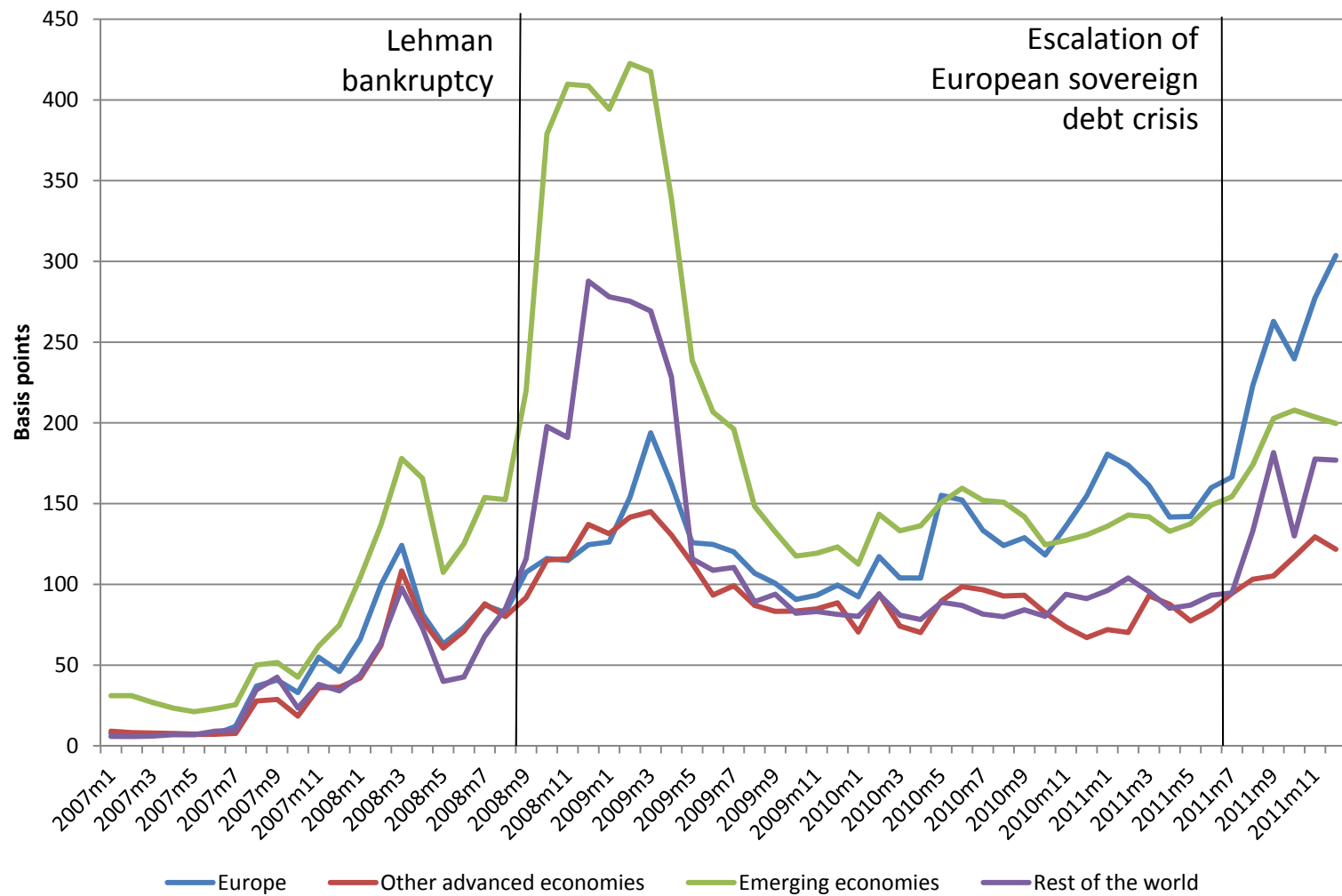
Robustness check 1: bank lending and liquidity shock

Dependent variable	(1) Δ Total loans, 2009-2010	(2) Δ Total C&I Loans, 2009-2010	(3) Δ U.S. C&I Loans, 2009-2010	(4) Δ Large time deposits 2007-2008	(5) Δ Large time deposits 2007-2008	(6) Δ Large time deposits 2007-2008
Δ Large time deposits	0.125 [0.156]	0.025 [0.176]	0.035 [0.165]			
Δ Bank CDS premium				-0.006 [0.006]		
Dummy EME					-0.326 [0.409]	
Dummy core Europe						-1.211 [2.088]
Dummy peripheral Europe						2.812** [1.235]
Observations	116	116	116	82	140	140
R-squared	0.16	0.18	0.19	0.08	0.04	0.09
Countries	41	41	41	27	49	49

Robust standard errors in brackets

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

Robustness check 2: liquidity shock and bank-specific risk during 2007-08



Robustness check 2: liquidity shock and bank-specific risk during 2007-08

Dependent variable	(1) Δ Total loans, 2009-2010	(2) Δ Total C&I Loans, 2009-2010	(3) Δ U.S. C&I Loans, 2009-2010	(4) Δ Large time deposits 2007-2008	(5) Δ Large time deposits 2007-2008	(6) Δ Large time deposits 2007-2008
Δ Large time deposits	0.125 [0.156]	0.025 [0.176]	0.035 [0.165]			
Δ Bank CDS premium				-0.006 [0.006]		
Dummy EME					-0.326 [0.409]	
Dummy core Europe						-1.211 [2.088]
Dummy peripheral Europe						2.812** [1.235]
Observations	116	116	116	82	140	140
R-squared	0.16	0.18	0.19	0.08	0.04	0.09
Countries	41	41	41	27	49	49

Robust standard errors in brackets

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

Policy implication

- ▶ The Basel Committee proposed a new liquidity regulatory framework. A liquidity coverage ratio (stock of high-quality liquid assets/net cash outflows over the next 30 calendar days >1) is scheduled to be implemented in 2015.
- ▶ “...while the standards are expected to be met on a consolidated basis and reported in a common currency, supervisors and banks should also be aware of the liquidity needs in each significant currency. As indicated in the LCR, the currencies of the pool of liquid assets should be similar in composition to the operational needs of the bank. Banks and supervisors cannot assume that currencies will remain transferable and convertible in a stress, even for currencies that in normal times are freely transferable and highly convertible.”

Basel Committee on Banking Supervision, “Basel III: International framework for liquidity measurement, standards and monitoring”, December 2010