

Wholesale Funding Runs, Internal Capital Markets, and the Bank Lending Channel*

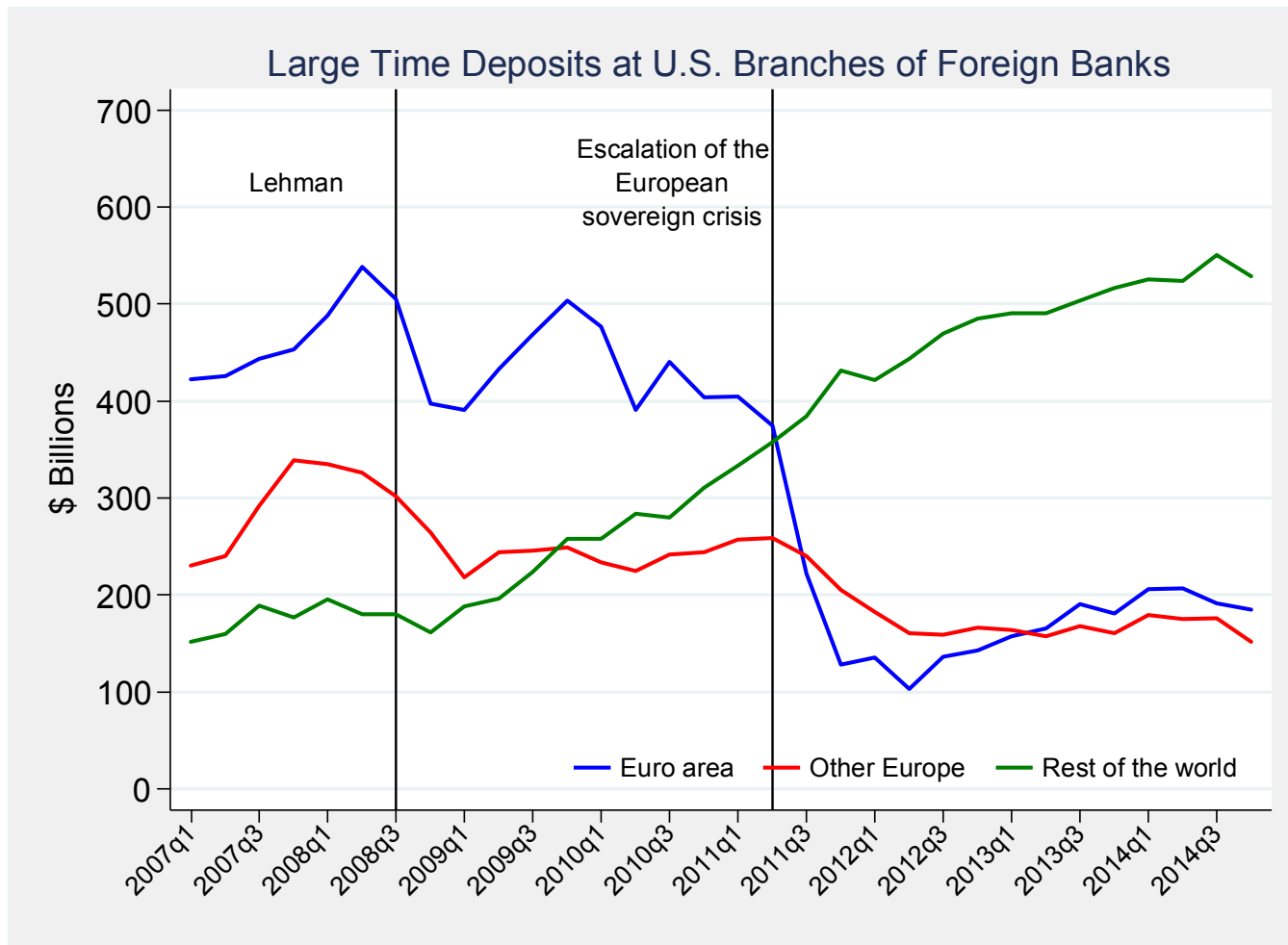
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Motivation (1)

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

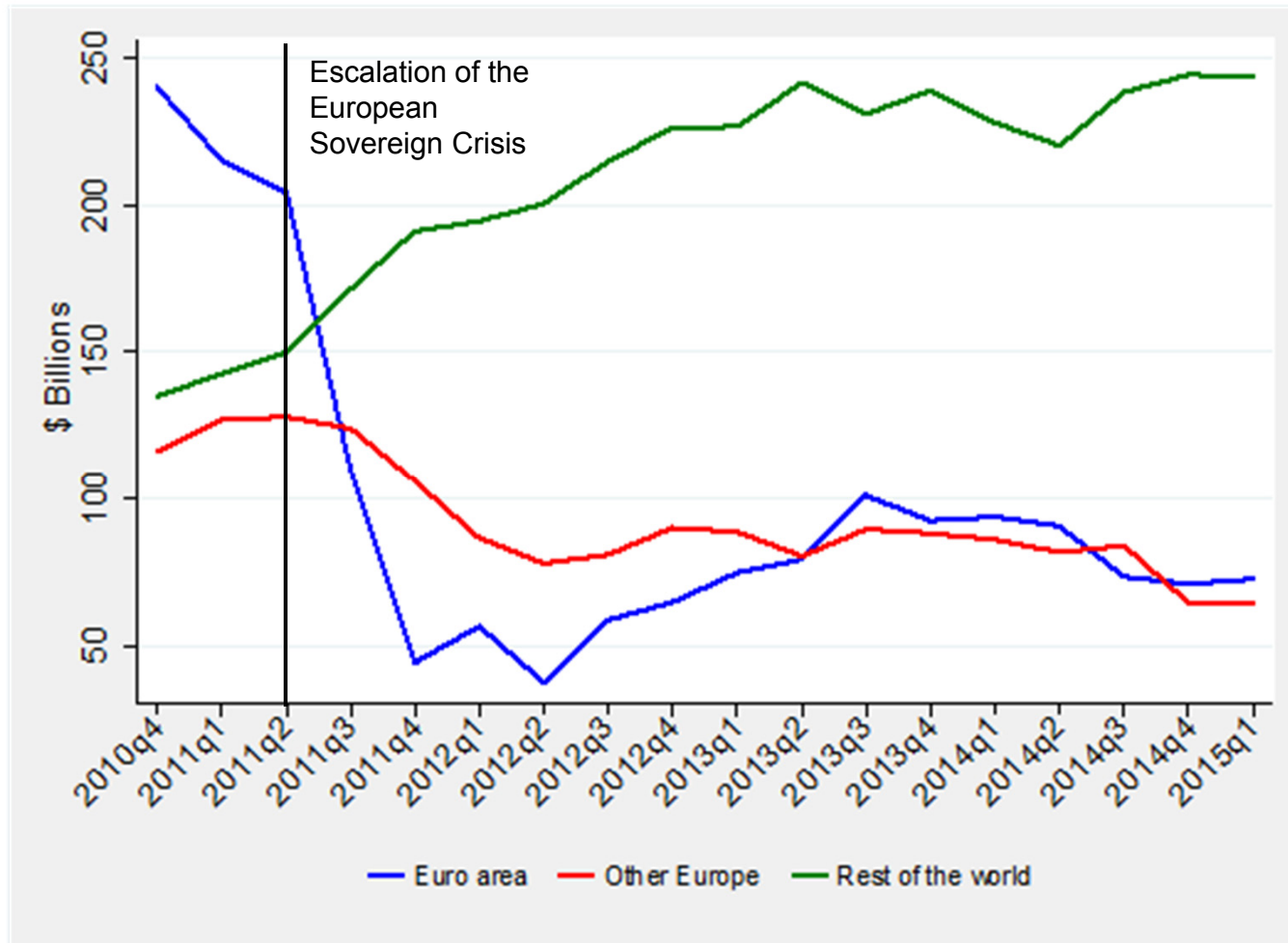


Source: Federal Reserve Board, FFIEC 002.

Motivation (2)

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

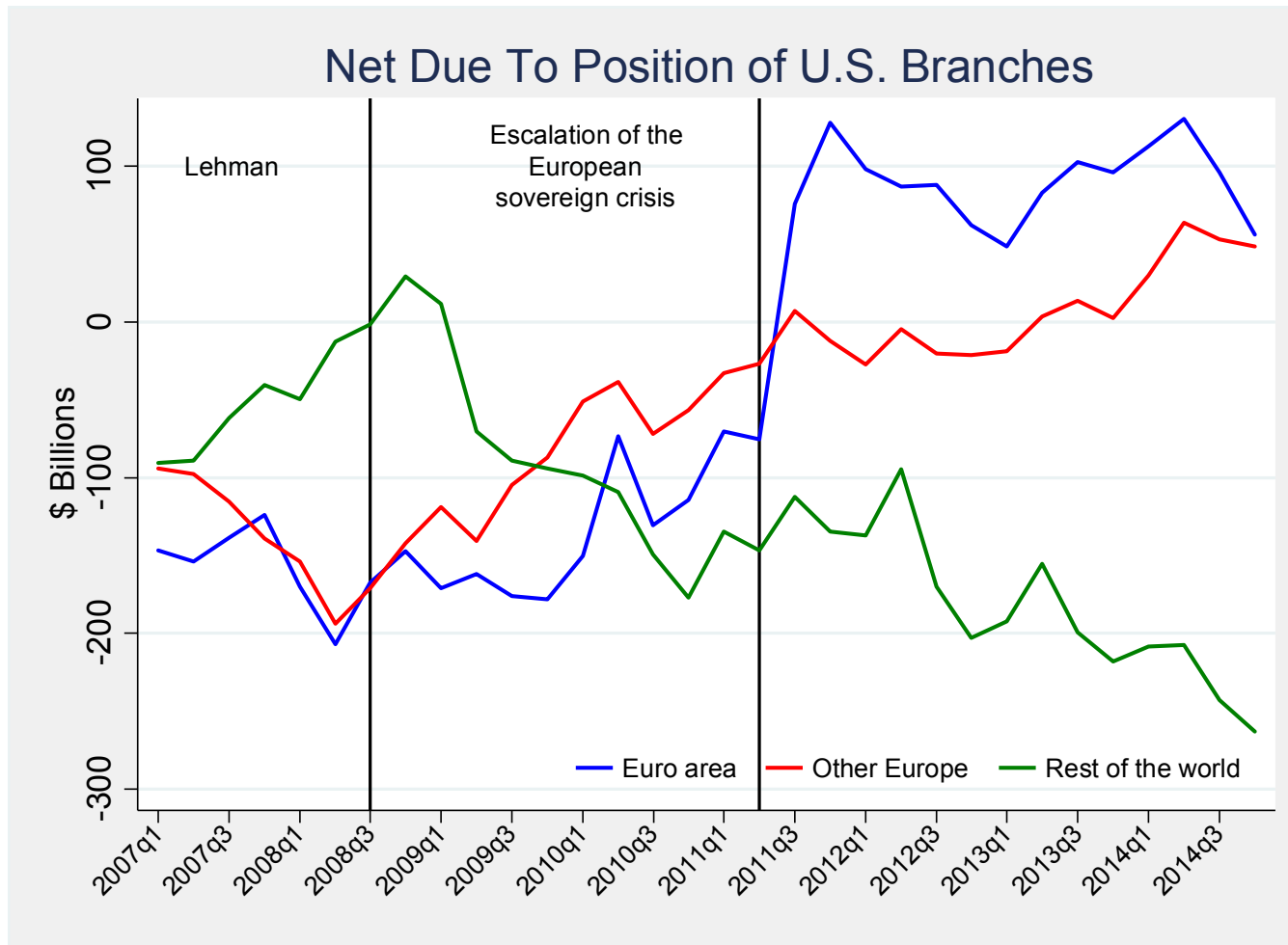
US MMMF exposure to the US branches of foreign banks



Source: Securities and Exchange Commission

Motivation (3)

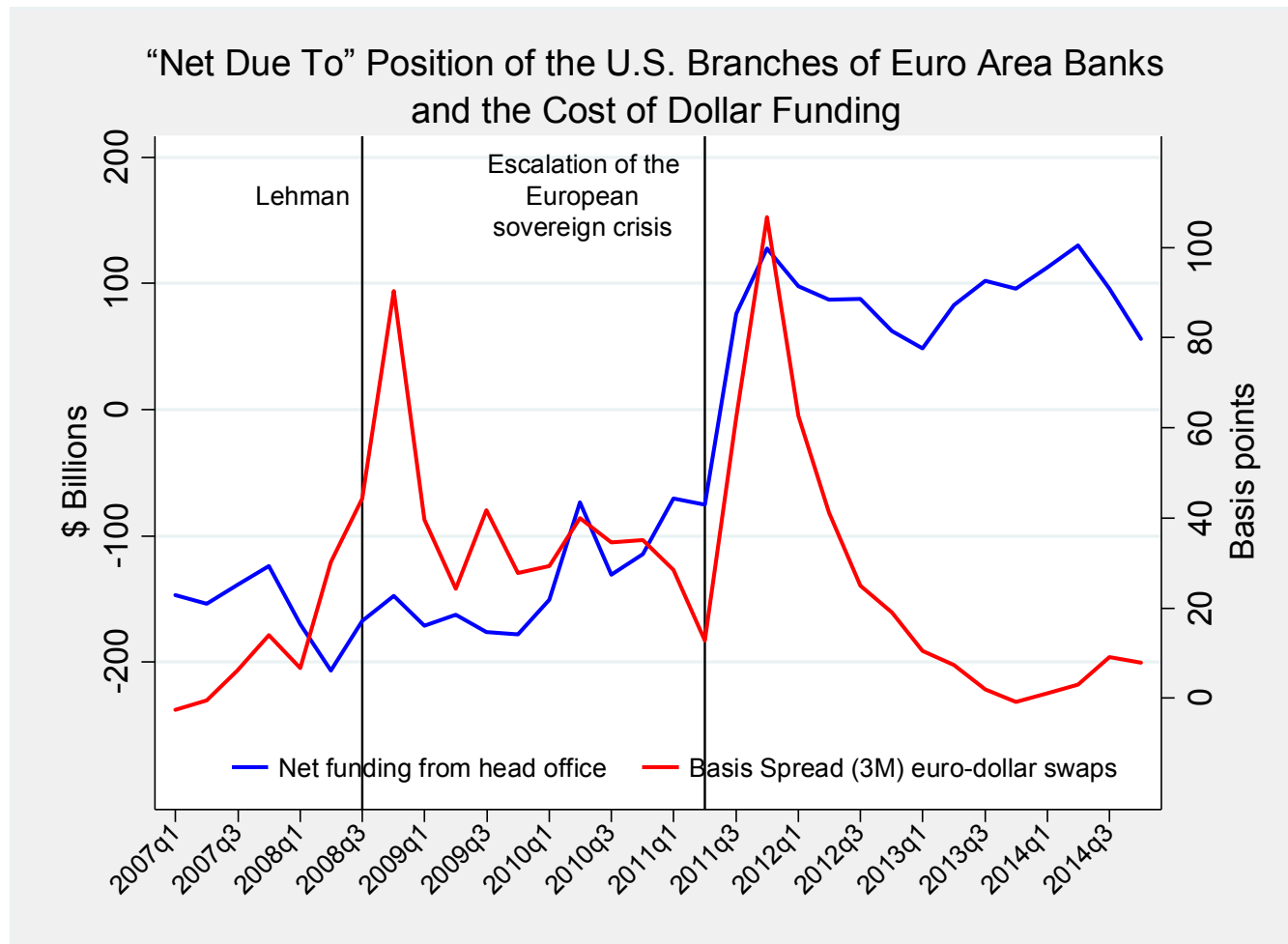
- ▶ As the U.S. branches of euro area banks lost access to dollar funding, parent banks had to fund them.



Source: Federal Reserve Board, FFIEC 002.

Motivation (4)

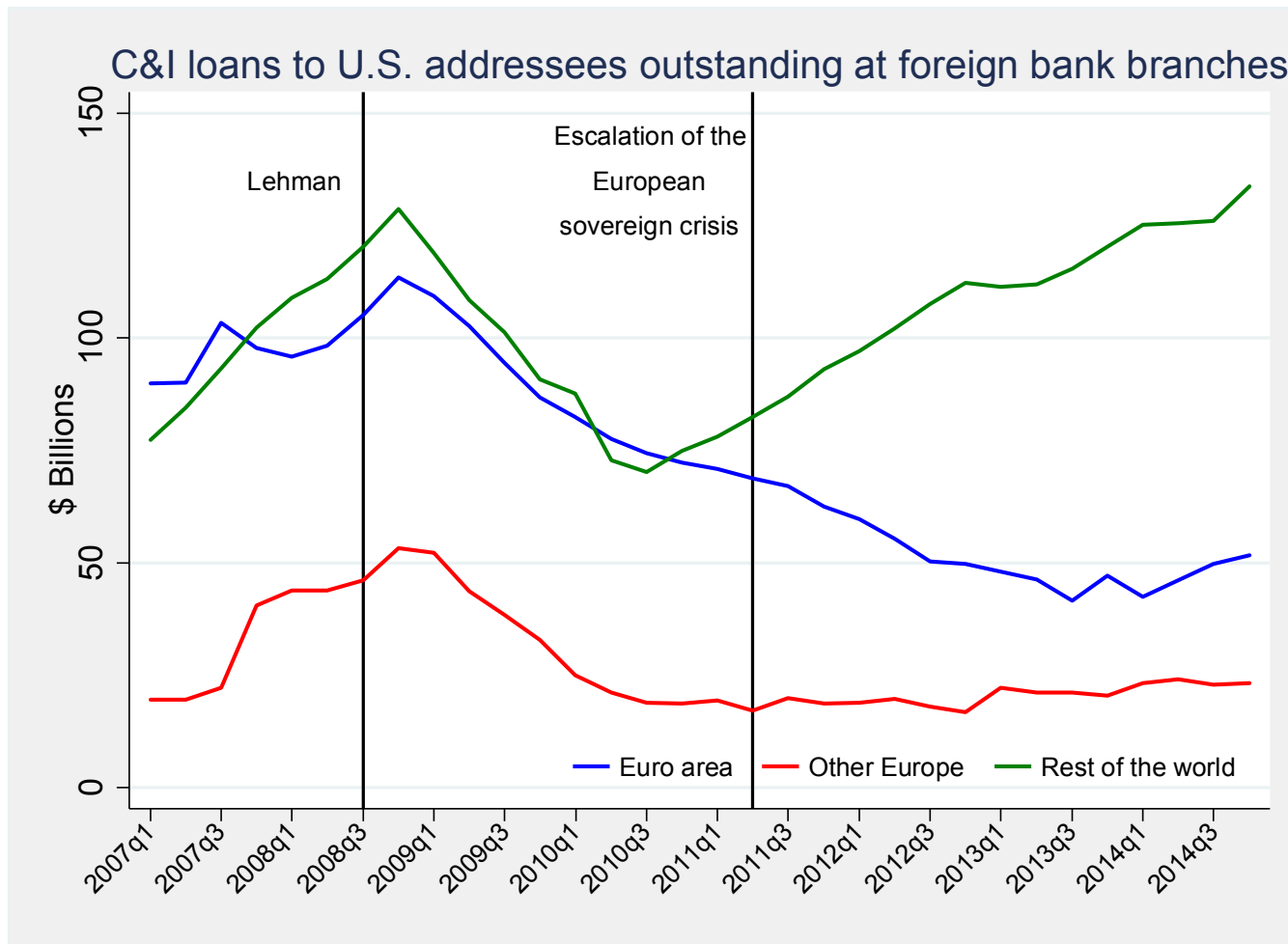
- ▶ As the U.S. branches of euro area banks lost access to dollar funding, parents had to fund them;
- ▶ But swapping EUR into USD became expensive.



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.



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?
4. Was the effect transmitted to the U.S. firms?

Results

1. Liquidity shock was related to broad sentiment against the liabilities of U.S. branches of euro-area banks.
 - The shock was unrelated to bank-specific characteristics, e.g., measures of sovereign debt holdings, government support, risk.
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.
 - Reduction mostly in revolving credit rather than term loans.

Results

4. Publicly-traded U.S. firms linked to affected branches reduced investment and increased cash reserves.

- Affected firms were deprived by liquidity insurance.
- Funding shock accounted for about \$11 billion reduction in credit,
- ... but affected firms invested \$22 billion less than their counterparts.
- Therefore, amplification.

Literature

- ▶ Bank lending channel:
 - Bernanke and Blinder (1998 AER P&P), Kashyap and Stein (2000 AER).
 - Acharya et al. (2013 JF): banks as providers of liquidity insurance to firms.

- ▶ International transmission of shocks through global banks:
 - Peek and Rosengren (1997 AER), Cetorelli and Goldberg (2012 AER P&P), Schnabl (2012 JF), De Haas and Van Horen (2013 RFS).
 - Ivashina, Scharfstein, and Stein (2015 QJE).

- ▶ Banks' internal liquidity management to mitigate shocks:
 - Campello (2002 JF), Cetorelli and Goldberg (2012 JIE, AER P&P).

- ▶ Liquidity shock not related to bank characteristics:
 - Chernenko and Sunderam (2014 RFS): “quiet run” on MMFs with exposure to Eurozone banks in mid-2011.
 - Acharya et al. (2014 JFE): wholesale investors may withdraw funding based on negative public signals rather than bank characteristics.

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	

EUROPEAN PARENT BANK

Assets	Liabilities
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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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U.S. BRANCH

JAPANESE PARENT BANK

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impaired due to dollar funding costs

Contribution to literature

1. A new type of liquidity shock: reduced access of foreign banks to funding from *host* rather than *home* markets.
2. Liquidity shock linked to developments in foreign markets, even without adverse cross-border flows.
3. The liquidity shock reduced branch lending, despite some mitigation from internal capital markets.
4. Internal capital markets were impaired by the cost of swapping funds between currencies, even within the same bank.

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

Country	No. of banks with U.S. branches	Total branch assets (\$ bn)	Country (continued)	No. of banks with U.S. branches	Total branch assets (\$ bn)
Austria	1	2.8	Bahrain	2	1.0
France	5	301.7	China	6	23.7
Germany	10	254.7	Hong Kong	2	1.4
Ireland	2	3.2	Indonesia	2	0.5
Italy	3	26.9	Israel	3	8.0
Netherlands	1	75.0	Japan	9	355.5
Norway	1	23.2	Jordan	1	0.4
Portugal	1	0.4	South Korea	6	4.4
Spain	8	52.7	Malaysia	1	1.0
Sweden	4	93.5	Pakistan	1	0.2
Switzerland	3	158.5	Philippines	2	0.1
Turkey	2	1.4	Qatar	1	0.1
United Kingdom	5	239.1	Saudi Arabia	1	0.1
Canada	7	320.0	Singapore	3	6.2
Argentina	1	0.4	Taiwan	13	14.9
Brazil	4	24.0	Thailand	3	0.5
Chile	2	6.0	UAE	2	1.5
Colombia	2	1.5	Nigeria	1	0.2
Costa Rica	1	0.4	Egypt	1	1.0
Panama	1	0.8	Australia	4	71.4
Uruguay	1	2.3			
Venezuela	2	0.5	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: Origin of the liquidity shock

- **Was the liquidity shock related to region, country, or bank-specific characteristics?**

$$\Delta Large\ Time\ Deposits_{ij} = \beta_0 + \beta_1 D_j + \beta_2 \Delta CDS_j + \beta_3 X_{ij} + \varepsilon_{ij}$$

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$$\Delta Large\ Time\ Deposits_{ij} = \beta_0 + \beta_1 D_j + \beta_2 \Delta CDS_{ij} + \beta_3 GovSup_{ij} \times \Delta CDS_{ij} + \beta_4 GovSup_{ij} + \beta_5 X_{ij} + \varepsilon_{ij}$$

- i = parent bank, j = country of origin.
- D_j = euro-area dummy variable.
- $\Delta LargeTimeDeposits_{ij}$ over 2010-11 as proxy for the liquidity shock.
- ΔCDS_j and ΔCDS_{ij} reflect changes in country and bank-specific risk.
- $GovSup_{ij}$ = measure of government support.
- X_{ij} includes branch and parent characteristics.

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** [2.218]	-5.814** [2.646]	-5.225* [2.964]	-8.981** [3.383]	-7.622** [3.166]
Δ Own-sovereign CDS premium		0.006 [0.006]			0.000 [0.007]
Δ Idiosyncratic component of bank CDS			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]
Log branch assets _(t-1)	-0.159 [0.570]	-0.133 [0.568]	-1.166 [0.924]	-1.117 [1.014]	-0.087 [0.566]
Loans to assets _(t-1)	1.327 [1.401]	1.678 [1.444]	-1.741 [2.415]	0.925 [4.760]	-0.003 [1.306]
Deposits to assets _(t-1)	-0.227 [1.495]	-0.097 [1.608]	-0.660 [3.177]	2.795 [3.719]	-1.012 [1.836]
Relative size of branch _(t-1)	24.544 [19.728]	25.494 [19.528]	59.533** [24.979]	51.203* [26.603]	27.016 [20.888]
Parent Tier 1 capital ratio _(t-1)	6.193 [9.566]	8.539 [9.903]	6.253 [27.612]	37.826 [49.292]	7.356 [16.857]
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

Question 1: Origin of the liquidity shock, euro-area sample

Specification	(1) Own- sovereign CDS prem.	(2) Bank CDS prem.	(3) SRISK	(4) Exposure to own- sovereign	(5) Gov. support	(6) Exposure to Greece, Ireland and Portugal
Dependent variable	Δ Large time deposits					
Δ Own-sovereign CDS prem.	-0.081 [0.060]			-0.105 [0.071]	-0.038 [0.116]	
Δ Idiosyncratic component of bank CDS prem.		-0.021 [0.021]				
SRISK			-0.345 [0.566]			
Own sovereign debt/T1 capital _(t-1)				-0.111 [0.360]		
Own sovereign debt/T1 capital _(t-1) x Δ Own-sovereign CDS prem.				0.012 [0.012]		
Government support _(t-1)					-0.208 [2.211]	
Government support _(t-1) x Δ Own- sovereign CDS prem.					-0.021 [0.036]	
GIP sovereign debt/T1 capital _(t-1)						-24.510 [57.178]
Observations	31	28	24	31	27	31
R-squared	0.55	0.38	0.36	0.56	0.61	0.42
Countries	8	8	8	8	8	8

Question 1: Origin of the liquidity shock

Findings:

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

Question 2: Liquidity shocks & internal capital markets

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

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

- i = parent bank, j = country of origin.
- $\Delta NDTP_{ij} = \{All\ related; \ Head\ office; \ U.S.\ non\ branch\ offices\}$, positive values show increased 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
Δ Large time deposits	-0.868*** [0.130]	-0.624*** [0.086]	-0.006** [0.003]
Log branch assets _(t-1)	1.379*** [0.264]	0.406** [0.171]	0.012 [0.007]
Loans to assets _(t-1)	-1.641 [1.284]	-1.184* [0.640]	0.025 [0.016]
Deposits to assets _(t-1)	-1.159 [1.196]	-1.363 [0.841]	-0.060 [0.039]
Relative size of branch _(t-1)	23.563* [11.842]	25.822 [15.835]	0.544 [0.354]
Parent Tier 1 capital ratio _(t-1)	-10.490 [13.130]	-11.482 [7.355]	-0.008 [0.228]
Observations	129	129	129
R-squared	0.56	0.49	0.11
Countries	42	42	42

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

- **Specification:**

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

- 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.
 - X_{ij} = branch/parent bank characteristics.
- $\Delta LargeTimeDeposits_{ij}$ over 2010-11 as proxy for the liquidity shock:
 - Enters either by itself.
 - or instrumented with the share of large time deposits provided by MMMFs as of end-2010 and a euro-area dummy variable.
 - or replaced by *Residual funding*, i.e., the residual from regressing ΔLTD on $\Delta NDTP$ and X over 2000-07.

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	(4) Δ Total loans	(5) Δ Total C&I Loans	(6) Δ U.S. C&I Loans	(7) Δ Total loans	(8) Δ Total C&I Loans	(9) Δ U.S. C&I Loans
Δ Large time deposits	0.146*	0.061**	0.043**	0.368**	0.150**	0.075**			
	[0.078]	[0.028]	[0.019]	[0.187]	[0.066]	[0.033]			
Residual funding _(t)							0.113	0.044**	0.034***
							[0.088]	[0.016]	[0.012]
Log branch assets _(t-1)	0.420	0.113*	0.030	0.536**	0.132**	0.012	0.309	0.068	-0.003
	[0.293]	[0.058]	[0.033]	[0.233]	[0.066]	[0.029]	[0.290]	[0.071]	[0.035]
Loans to assets _(t-1)	-0.006	-0.020	-0.034	-1.274	-0.608	-0.180	0.378	0.142	0.080
	[0.406]	[0.279]	[0.221]	[0.891]	[0.378]	[0.221]	[0.454]	[0.277]	[0.190]
Deposits to assets _(t-1)	0.565	0.324	0.072	0.139	0.192	0.189	0.737	0.394	0.122
	[0.780]	[0.336]	[0.118]	[0.898]	[0.307]	[0.134]	[0.779]	[0.336]	[0.116]
Relative size of branch _(t-1)	-8.653	-3.074	-1.818**	-23.799*	-7.465*	-1.117	-8.291	-2.813	-1.706
	[9.446]	[2.041]	[0.866]	[12.352]	[3.915]	[1.870]	[10.496]	[2.972]	[1.522]
Parent Tier 1 capital ratio _(t-1)	-5.194*	-5.751**	-2.483	-12.272**	-7.299**	-3.451*	-4.153**	-5.352**	-2.176
	[2.752]	[2.343]	[1.842]	[6.110]	[3.359]	[2.032]	[1.706]	[1.932]	[1.523]
Observations	114	114	114	111	111	111	114	114	114
R-squared	0.48	0.51	0.46				0.44	0.47	0.41
Estimation	FE	FE	FE	IV	IV	IV	RES	RES	RES
Fixed effects	Country	Country	Country	None	None	None	Country	Country	Country
Countries	27	27	27	27	27	27	27	27	27
Hansen J statistic (p-value)				0.25	0.30	0.99			
Kleiberg-Paap Wald F stat.				4.78	4.78	4.78			
Weak id. test - AR (p-value)				0.21	0.11	0.10			
Weak id. test - CLR (p-value)				0.32	0.16	0.08			
Weak id. test - KJ (p-value)				0.27	0.15	0.09			

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

- 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 SNC data on syndicated loans by sector:
 - i = parent bank; j = country; s = sector 3-digit NAICS.
 - $\Delta Loans_{ijs} = \{\Delta C\&I Commitments US_{ijs}, \Delta C\&I Loans US_{ijs}\}$ over 2010-11.
- Add sector fixed effects η_s .
- For explanatory variables, same FFIEC data as before.

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

Dependent variable	(1) Δ Commitments	(2)	(3) Δ Utilization	(4)
Δ Large time deposits	2.600* [1.433]		0.730** [0.301]	
Residual funding _(t)		4.066** [1.575]		0.754 [0.527]
Log branch assets _(t-1)	27.874*** [7.452]	20.138*** [6.264]	6.843*** [2.270]	4.936** [2.068]
Loans to assets _(t-1)	83.165** [33.910]	66.864** [30.754]	37.301*** [11.028]	35.372*** [11.127]
Deposits to assets _(t-1)	87.117* [49.566]	101.564** [50.738]	32.255** [12.848]	34.742** [13.583]
Relative size of branch _(t-1)	-25.243 [146.158]	-50.622 [124.842]	20.404 [44.115]	33.416 [46.827]
Parent Tier 1 capital ratio _(t-1)	-110.003 [293.851]	6.369 [302.907]	-26.518 [162.746]	15.478 [161.903]
Observations	1,652	1,652	1,652	1,652
R-squared	0.12	0.13	0.09	0.09
Estimation	FE	RES	FE	RES
Fixed effects	NAICS 3 digit	NAICS 3 digit	NAICS 3 digit	NAICS 3 digit
Banks	101	101	101	101

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

- 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 SNC data on syndicated loans by firm:
 - $i =$ parent bank; $j =$ country; $f =$ firm.
 - $\Delta Loans_{ijf} = \{\Delta C\&I Commitments US_{ijf}, \Delta C\&I Loans US_{ijf}\}$ over 2010-11.
- Add firm fixed effects η_f .
- For explanatory variables, same FFIEC data as before.

Question 3: Was the liquidity shock associated with a decline in branch lending? (c) Loan-level data: the intensive mg.

- Commitments = term loans + used and unused portions of revolving credit.
- Utilization = term loans + used portion of revolving credit.

Dependent variable	(1) ΔCommitments	(2)	(3) ΔUtilization	(4)
Δ Large time deposits	0.066 [0.068]		0.012 [0.025]	
Residual funding _(t)		0.072 [0.075]		-0.024 [0.025]
Log branch assets _(t-1)	1.178*** [0.228]	0.942*** [0.292]	-0.015 [0.190]	0.005 [0.145]
Loans to assets _(t-1)	0.859 [2.149]	0.791 [1.819]	1.399 [0.913]	2.047** [0.958]
Deposits to assets _(t-1)	1.906 [3.200]	2.321 [3.330]	0.912 [0.856]	0.777 [0.933]
Relative size of branch _(t-1)	-21.900*** [6.955]	-20.333*** [5.517]	-1.909 [2.494]	0.796 [2.069]
Parent Tier 1 capital ratio _(t-1)	32.146 [21.957]	38.113* [22.716]	23.329** [10.920]	24.779** [9.757]
Observations	4,280	4,280	4,280	4,280
R-squared	0.45	0.45	0.68	0.68
Estimation	FE	RES	FE	RES
Fixed effects	Firm	Firm	Firm	Firm
Banks	99	99	99	99

Question 3: Was the liquidity shock associated with a decline in branch lending? (c) Loan-level data: the extensive mg.

- Logistic regression, $D_{ijf}=1$ if lending relation existed in 2010 but not 2011, = 0 if it continued; “odds ratios” reported, <1 implies negative relation.

	(1)	(2)	(3)	(4)	(5)	(6)
	All loans		Revolving credit		Term loans	
Δ Large time deposits	0.982*** [0.004]		0.979*** [0.005]		0.985 [0.010]	
Residual funding _(t)		0.975*** [0.005]		0.966*** [0.006]		0.984* [0.009]
Log branch assets _(t-1)	0.737*** [0.028]	0.790*** [0.029]	0.716*** [0.032]	0.778*** [0.033]	0.885 [0.073]	0.948 [0.075]
Loans to assets _(t-1)	0.510** [0.146]	0.596* [0.173]	0.616 [0.208]	0.799 [0.274]	0.285** [0.145]	0.311** [0.160]
Deposits to assets _(t-1)	0.368*** [0.086]	0.330*** [0.077]	0.280*** [0.075]	0.248*** [0.067]	0.695 [0.292]	0.643 [0.274]
Relative size of branch _(t-1)	3.211 [3.357]	3.278 [3.293]	6.473* [7.314]	8.843** [9.643]	8.140 [19.998]	5.123 [11.982]
Parent Tier 1 capital ratio _(t-1)	10.688 [19.479]	2.724 [4.834]	0.292 [0.627]	0.080 [0.168]	4.847 [14.658]	1.202 [3.640]
Observations	3,249	3,249	2471	2471	887	887
Pseudo R-squared	0.04	0.04	0.05	0.06	0.02	0.02
Estimation	FE	RES	FE	RES	FE	RES
Fixed effects	Firm	Firm	Firm	Firm	Firm	Firm
Firms	469	469	369	369	130	130
Loans	All	All	RC	RC	TL	TL

Question 4: Transmission to firms:

(a) Firm-level SNC data, intensive vs. extensive margins

Were firms able to substitute the lost loans from euro-area branches?

Intensive and extensive margin specifications:

$$\Delta Loans_{i,2010-12} = \beta_0 + \beta_1 Euro\text{-area link}_i + \beta_2 Firm\ size_i + \beta_3 Loan\ quality_{it} + \varepsilon_{it}$$

$$D_{i,2010-12} = \beta_0 + \beta_1 Euro\text{-area link}_i + \beta_2 Firm\ size_i + \beta_3 Loan\ quality_{it} + \varepsilon_{it}$$

- i = firm
- $\Delta Loans_i = \{\Delta All\ loans_i, \Delta Revolving\ credit_i\}$ over 2010-12, using SNC dataset, take firm-level aggregates of outstanding loans.
- $D_i=1$ if firm had a syndicated loan in SNC in 2010 but not 2012, = 0 if it continued.
- $Firm\ size_i = 2010$ commitments as a scale variable.
- $Quality_i =$ dummy variable is a firm had at least one loan with quality issues as of 2010.

Question 4: Transmission to firms:

(a) Firm-level SNC data, intensive margin

- In alternative specifications, $Euro\text{-}area\ loan\ share_{(2010)}$ = share of each firm's loan commitments funded by U.S. branches of euro-area banks as of 2010; $Euro\text{-}area\ dummy_{(2010)}$ = indicator variable equaling one if the firm had an outstanding commitment with a U.S. branch of a euro-area bank in 2010; $Liquidity\ shock_{(2010)}$ = indicator variable equaling one if the firm had a relationship with a U.S. branch of a foreign bank facing large time deposit outflows between 2010 and 2011.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All loans	Revolving credit	Revolving credit	All loans	Revolving credit	Revolving credit	All loans	Revolving credit	Revolving credit
Euro-area loan share ₍₂₀₁₀₎	26.018	-96.567	-119.231***						
	[71.054]	[75.187]	[45.024]						
Euro-area dummy ₍₂₀₁₀₎				40.964*	5.258	-33.891			
				[24.217]	[18.838]	[24.519]			
Liquidity shock ₍₂₀₁₀₎							140.518	53.902	-99.485**
							[85.853]	[78.562]	[48.427]
Log commitments ₍₂₀₁₀₎	-5.046	37.904***	-4.729	-13.008	35.196***	-2.163	-6.742	34.837***	-4.609
	[19.810]	[12.162]	[15.552]	[20.611]	[11.324]	[13.705]	[19.511]	[12.146]	[15.705]
Indicator for problem loan ₍₂₀₁₀₎	-179.626***	-96.941***	-41.926*	-184.397***	-98.606***	-40.997*	-181.129***	-99.086***	-42.010*
	[40.981]	[26.141]	[22.507]	[41.055]	[26.037]	[23.878]	[41.335]	[26.025]	[22.246]
Observations	2,837	2,532	1,343	2,837	2,532	1,343	2,837	2,532	1,343
R-squared	0.05	0.07	0.07	0.05	0.07	0.07	0.05	0.07	0.07
Fixed effects	Industry, State	Industry, State	Industry, State	Industry, State	Industry, State	Industry, State	Industry, State	Industry, State	Industry, State
Sample	All firms	All firms	Private firms	All firms	All firms	Private firms	All firms	All firms	Private firms
Loans	All	RC	RC	All	RC	RC	All	RC	RC

Standard errors in brackets

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

Question 4: Transmission to firms:

(a) Firm-level SNC data, extensive margin

- Logistic regression, $D_{ijf}=1$ if a SNC syndicated loan existed in 2010 but not 2012, = 0 if it continued; “odds ratios” reported, >1 implies positive relation.

	(1) All loans	(2) Revolving credit	(3) All loans	(4) Revolving credit	(5) All loans	(6) Revolving credit
Euro-area loan share ₍₂₀₁₀₎	2.085** [0.617]	10.278*** [4.010]				
Euro-area dummy ₍₂₀₁₀₎			1.411*** [0.139]	1.466*** [0.160]		
Liquidity shock ₍₂₀₁₀₎					1.617* [0.454]	6.302*** [2.266]
Log commitments ₍₂₀₁₀₎	0.564*** [0.021]	0.546*** [0.022]	0.534*** [0.022]	0.533*** [0.024]	0.565*** [0.021]	0.544*** [0.023]
Indicator for problem loan ₍₂₀₁₀₎	2.811*** [0.310]	3.785*** [0.488]	2.750*** [0.304]	3.781*** [0.488]	2.806*** [0.309]	3.787*** [0.488]
Observations	3,997	3,373	3,997	3,373	3,997	3,373
Pseudo R-squared	0.09	0.11	0.09	0.10	0.09	0.11
Fixed effects	Industry	Industry	Industry	Industry	Industry	Industry
Loans	All	RC	All	RC	All	RC

Standard errors in brackets

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

Question 4: Transmission to firms:

(b) Firm-level Compustat data on investment, cash holdings

Was the liquidity shock associated with a decline in investment?

$$Investment/Assets_{it} = \beta_0 + \beta_1 After_t + \beta_2 After_t \times Euro\text{-}area\ link_{it-1} + \beta_3 X_{it} + \eta_i + \varepsilon_{it}$$

- 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.
- $Euro\text{-}area\ link$ = in alternative specifications, $Euro\text{-}area\ loan\ share_{(2010)}$; $Euro\text{-}area\ dummy_{(2010)}$; $Liquidity\ shock_{(2010)}$.

Question 4: Transmission to firms:

(b) Firm-level Compustat data on investment, cash holdings

Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)
	Investment/Assets			Cash/Assets		
After	0.161*** [0.021]	0.172*** [0.021]	0.174*** [0.022]	-1.245*** [0.173]	-1.382*** [0.180]	-1.396*** [0.184]
After x Euro-area loan share	-0.435* [0.249]			1.670 [2.016]		
After x Euro-area dummy		-0.110*** [0.036]			0.832*** [0.263]	
After x Liquidity shock			-0.109*** [0.035]			0.819*** [0.263]
Tobin's Q	0.197*** [0.058]	0.194*** [0.061]	0.194*** [0.061]	2.550*** [0.450]	2.561*** [0.445]	2.561*** [0.445]
Observations	15,533	15,533	15,533	15,533	15,533	15,533
R-squared	0.02	0.02	0.02	0.03	0.04	0.04
Firms	1,416	1,416	1,416	1,416	1,416	1,416
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

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 was related to regional factors, but not to sovereign risk or bank-specific characteristics.
- ▶ Internal capital markets were at play, but not enough to offset the liquidity shock.
- ▶ The liquidity shock resulted in reduced lending to U.S. firms, robust to controlling for demand at the sector and firm level.
- ▶ U.S. firms could not entirely substitute lost funding, hence decreased investment and increased cash holdings.

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 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!

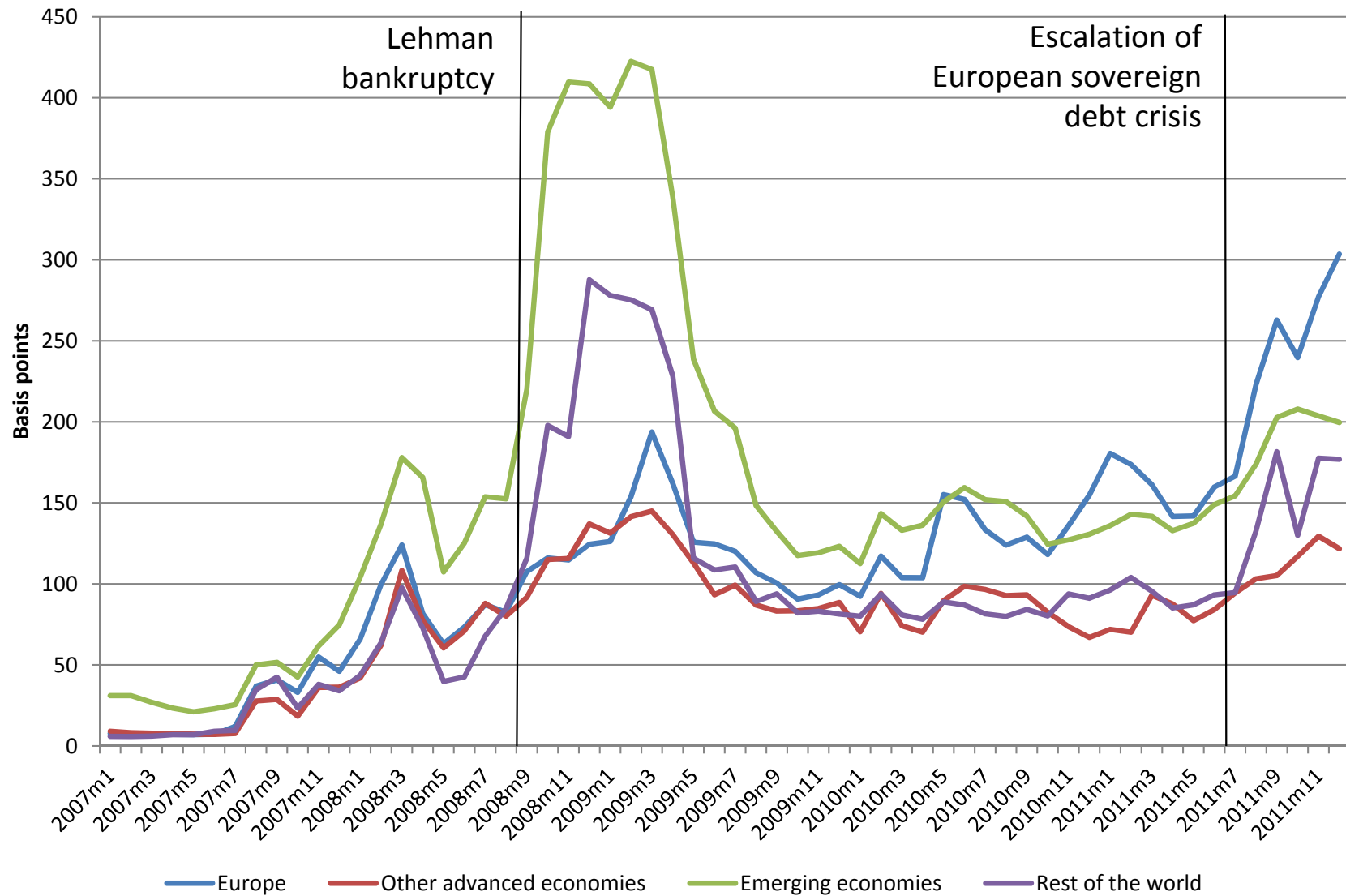
Additional slides:
Robustness checks

Robustness check 1:

U.S. subsidiaries of foreign banks

Dependent variable	(1) Δ Total deposits	(2) Δ Large time deposits	(3) Δ Total deposits	(4) Δ Large time deposits	(5) Δ Total loans	(6) Δ Total C&I Loans	(7) Δ Total loans	(8) Δ Total C&I Loans
Dummy euro area	0.609 [1.228]	0.241 [0.332]			-0.572 [0.562]	0.134 [0.234]		
Branch liquidity shock indicator			1.026 [1.470]	0.104 [0.294]			-0.527 [0.647]	0.391* [0.220]
Log subsidiary assets _(t-1)	0.526* [0.298]	0.022 [0.058]	0.604 [0.427]	0.045 [0.079]	0.348 [0.204]	0.117 [0.078]	0.432 [0.278]	0.110 [0.097]
Subsidiary total capital ratio _(t-1)	0.589** [0.226]	-0.009 [0.013]	1.080*** [0.197]	0.007 [0.020]	-0.172 [0.320]	0.087 [0.068]	0.635*** [0.099]	0.219*** [0.032]
Subsidiary loans to assets _(t-1)	-0.786 [2.126]	0.474 [0.651]	-3.838 [2.770]	0.362 [0.439]	-2.006 [1.459]	0.733 [0.454]	-2.662 [2.121]	0.144 [0.470]
Subsidiary deposits to assets _(t-1)	-1.216 [1.523]	0.218 [0.311]	-2.581 [2.205]	0.170 [0.305]	-1.010 [1.051]	0.449 [0.387]	-2.351 [1.400]	0.297 [0.469]
Relative size of subsidiary _(t-1)	24.099 [22.361]	-0.819 [0.838]	27.524 [25.909]	-1.246 [1.244]	15.548 [16.913]	3.294 [3.078]	18.174 [16.865]	4.094 [3.136]
Observations	38	38	28	28	38	38	28	28
R-squared	0.57	0.10	0.64	0.07	0.18	0.52	0.67	0.72
Related branch	No	No	Yes	Yes	No	No	Yes	Yes
Countries	22	22	16	16	22	22	16	16

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



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

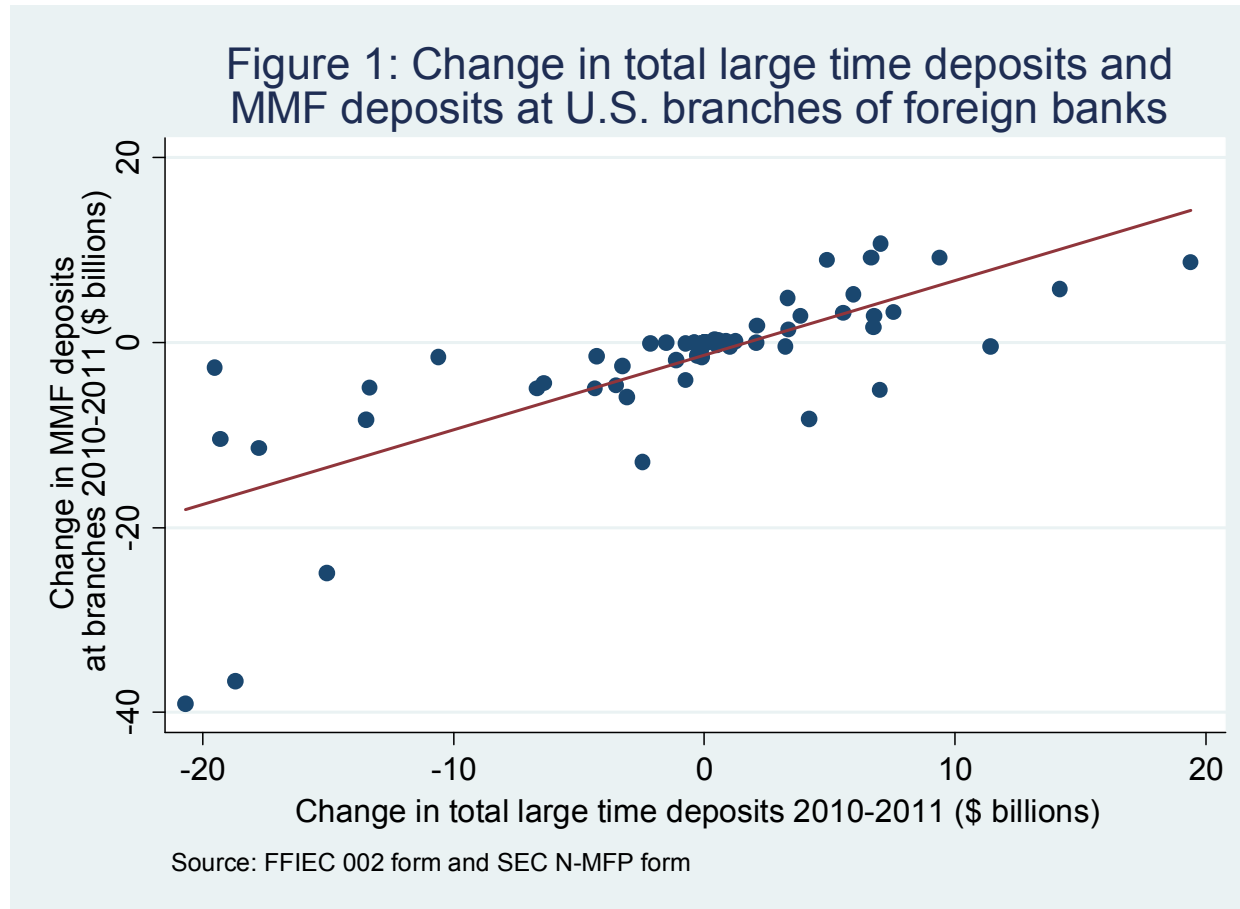
Dependent variable	(1) Δ Total loans, 2009-2010	(2) Δ Total C&I Loans, 2009-2010	(3) Δ U.S. C&I Loans, 2009-2010	(4) Δ Large time deposits 2007-2008	(5) Δ Large time deposits 2007-2008	(6) Δ Large time deposits 2007-2008
Δ Large time deposits	0.125 [0.156]	0.025 [0.176]	0.035 [0.165]			
Δ Bank CDS premium				-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

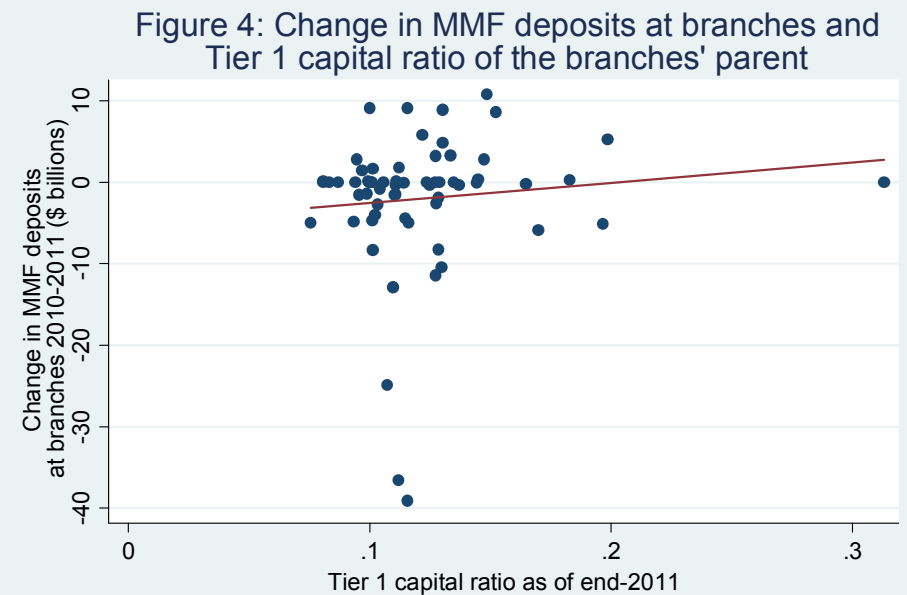
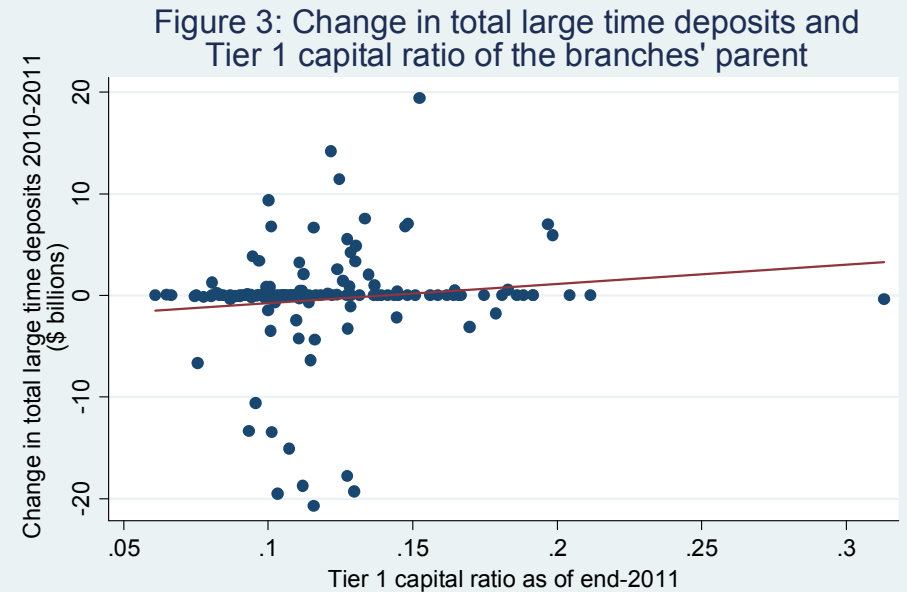
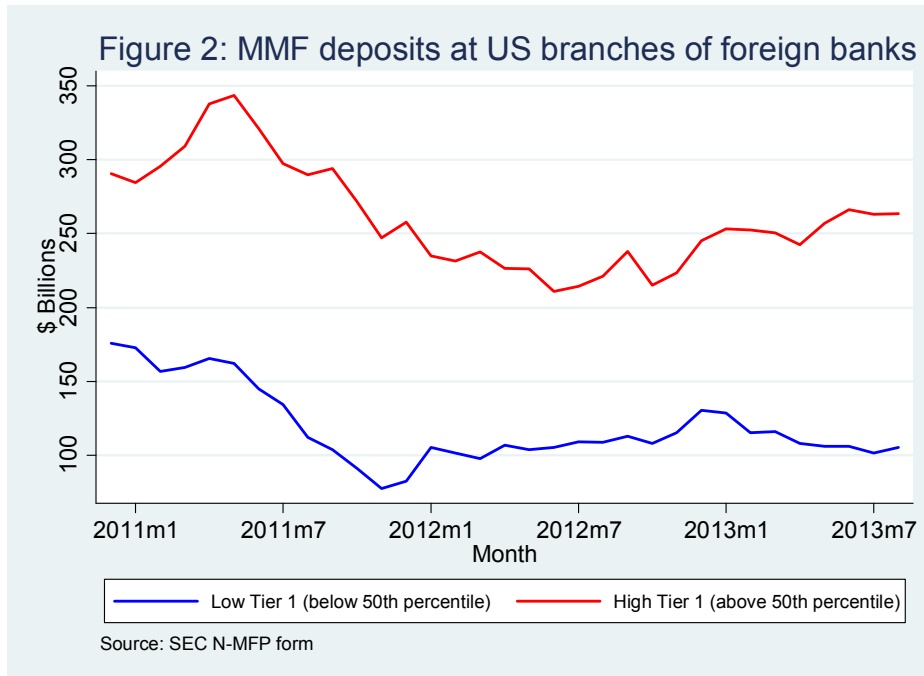
*** p<0.01, ** p<0.05, * p<0.1

Robustness check 3:

Large time deposits vs. MMF deposits

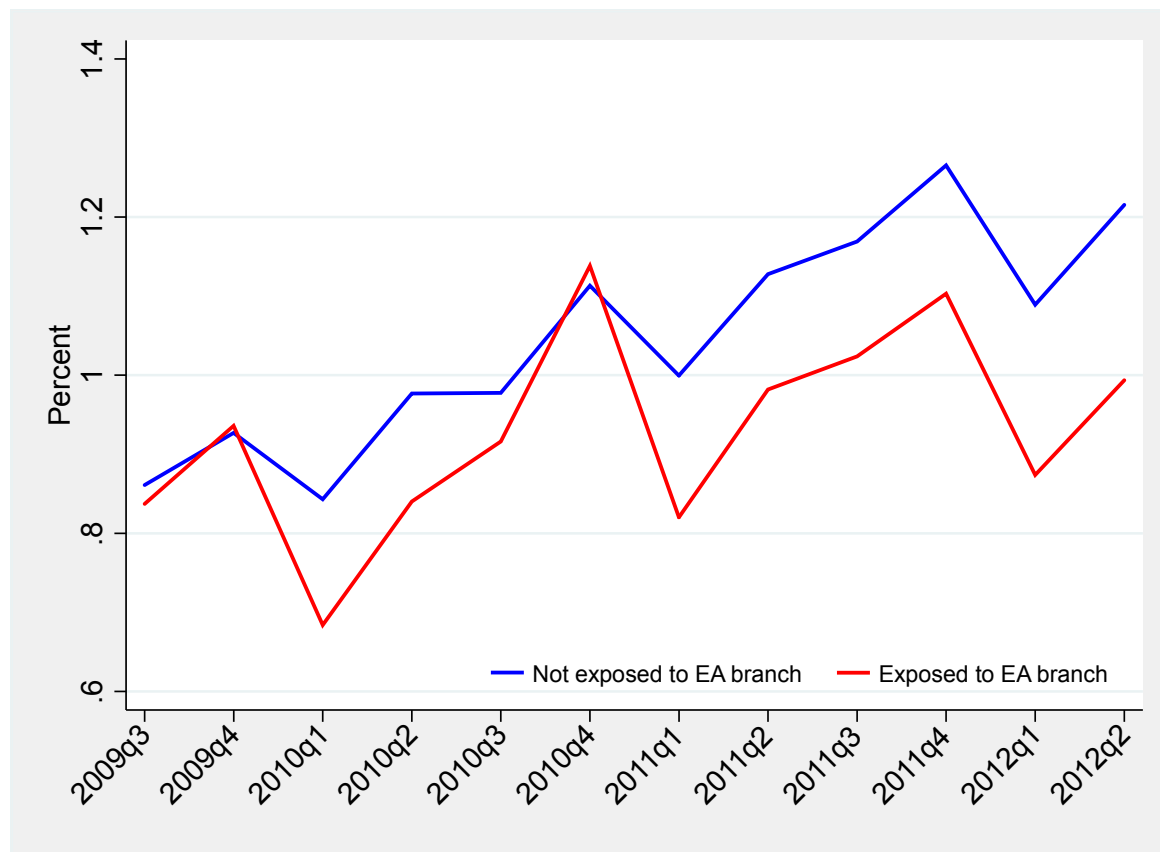


Robustness check 4: Liquidity shock vs. bank characteristics



Robustness check 5:

Firms' investment/assets and link to euro area banks



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.

Data: FFIEC and SNC 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: Compustat summary statistics, U.S. publicly-traded firms

Panel A: Full sample

	Obs.	Mean	Median	Std. Dev.
Investment/Assets(%)	15,533	1.02	0.70	1.11
Cash/Assets(%)	15,533	11.56	8.00	11.36
Tobin's Q	15,533	1.50	1.33	0.66
Cash flow/Assets(%)	15,237	3.50	3.33	2.34

Panel B: Information as of end-2010

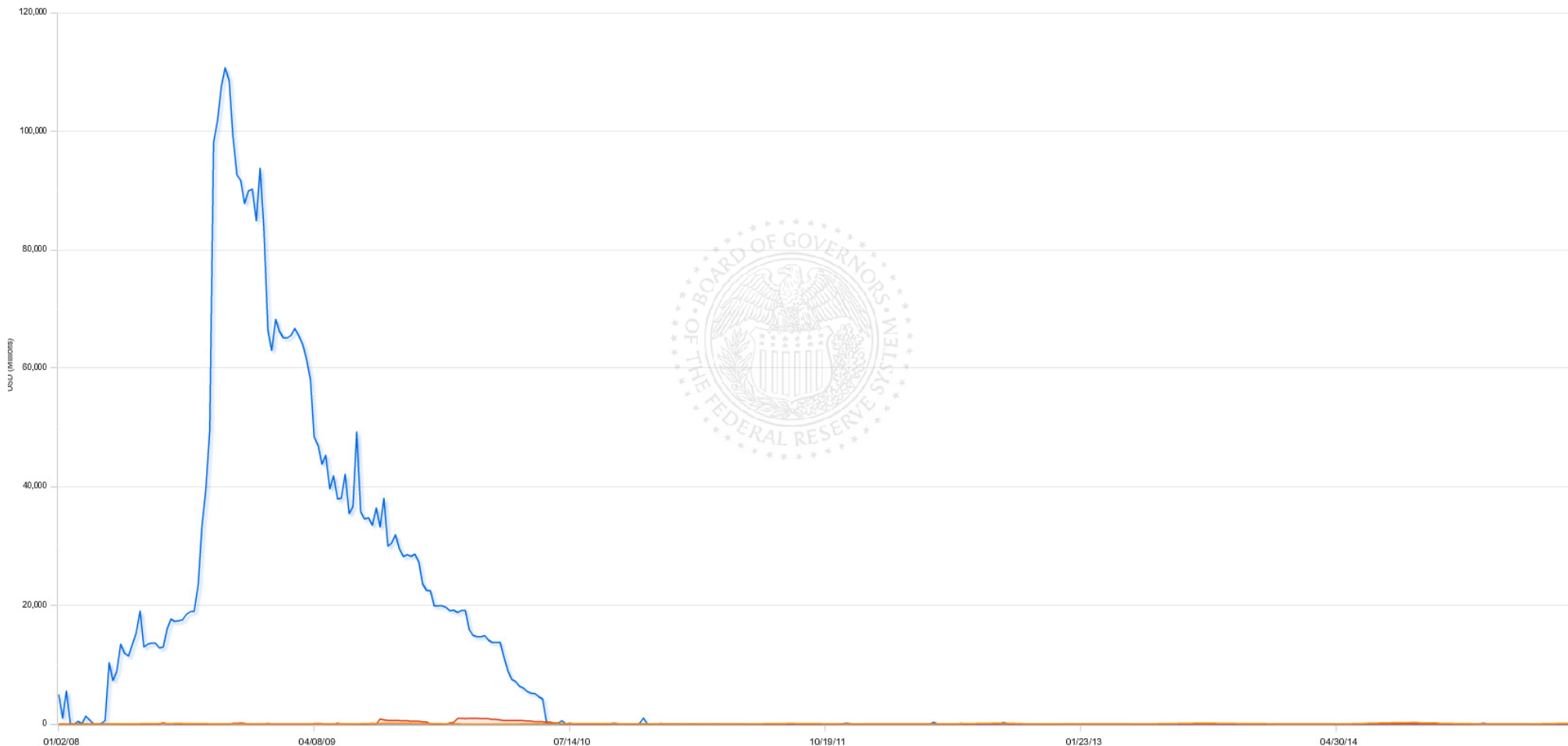
	Obs.	Mean	Median	Std. Dev.
<i>Not exposed to EA branch</i>				
Assets (\$ mill.)	1,019	4,907	1,237	20,246
Investment/Assets(%)	1,019	1.11	0.78	1.16
Cash/Assets(%)	1,019	12.75	8.98	11.96
<i>Exposed to EA branch</i>				
Assets (\$ mill.)	286	17,757	6,519	33,124
Investment/Assets(%)	286	1.14	0.91	1.05
Cash/Assets(%)	286	10.16	8.02	9.17
<i>Total</i>				
Assets (\$ mill.)	1,305	7,723	1,726	24,250
Investment/Assets(%)	1,305	1.12	0.81	1.14
Cash/Assets(%)	1,305	12.18	8.74	11.46

Additional slides:

Fed liquidity facilities (incl. FX swaps)

Federal Reserve discount window lending: primary, secondary, and seasonal lending

Assets: Liquidity and Credit Facilities: Loans: Primary credit: Wednesday level
Assets: Liquidity and Credit Facilities: Loans: Secondary credit: Wednesday level
Assets: Liquidity and Credit Facilities: Loans: Seasonal credit: Wednesday level



Legend: **BLUE=primary**; **RED=secondary**; **ORANGE=seasonal**.

Sources: <http://www.federalreserve.gov/monetarypolicy/discountrate.htm> and
<http://www.federalreserve.gov/releases/h41/>

Credit extended through Federal Reserve liquidity facilities

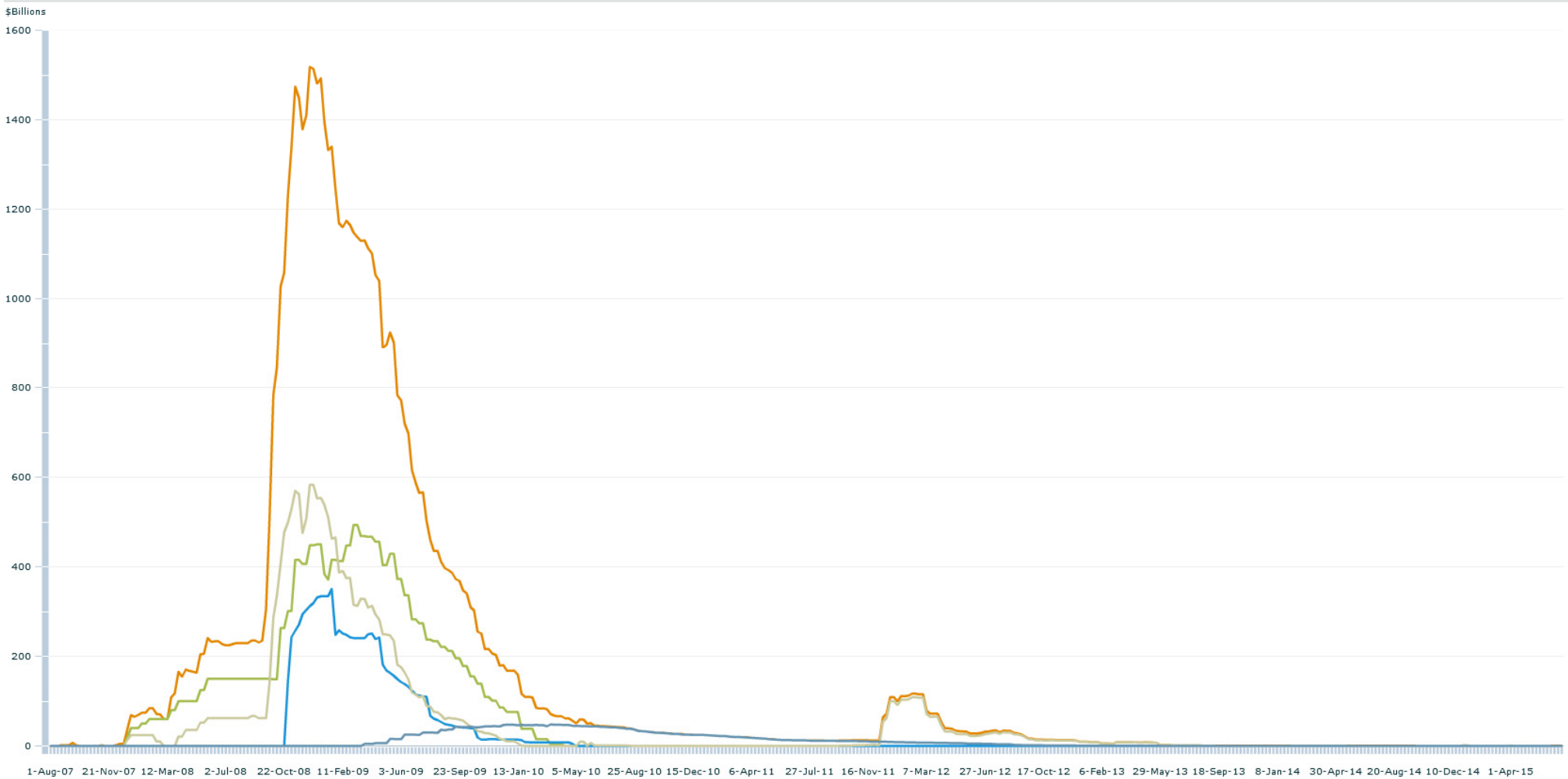
Choose one of the 5 charts.

Credit Extended through Federal Reserve Liquidity Facilities

Legend: All Liquidity Facilities* (Orange), Term Auction Credit (Green), Commercial Paper Funding Facility (Blue), Central Bank Liquidity Swaps (Grey), Term Asset-Backed Securities Loan Facility (Dark Grey)

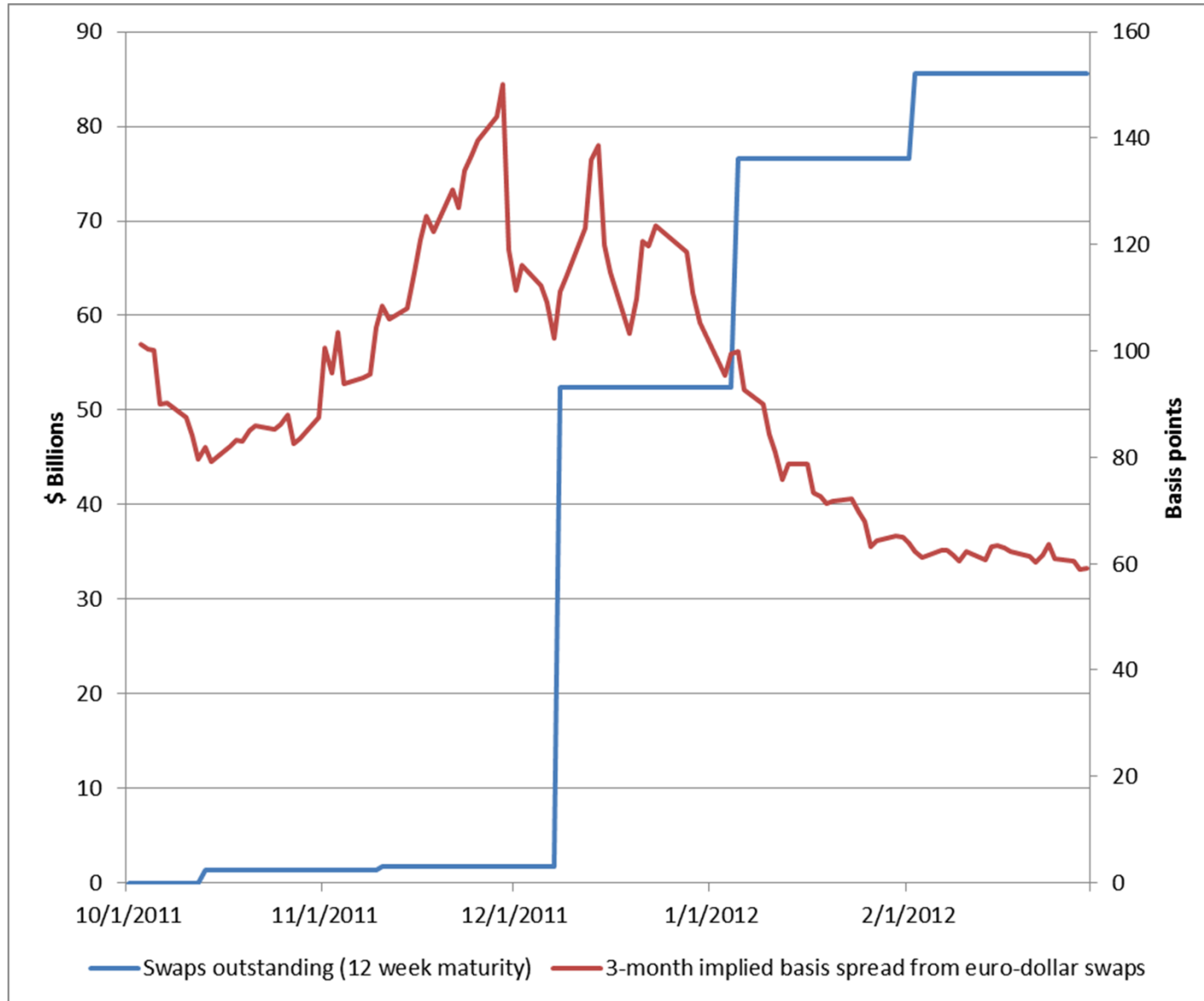
View as table, Fullscreen

Among the liquidity facilities, the Term Auction Facility, the Commercial Paper Funding Facility, and the central bank liquidity swap lines had provided the most reserve balances. Most of the liquidity facilities wound down significantly over the course of 2009.



Legend: **ORANGE** = All Liquidity Facilities; **GREEN**= Term Auction Credit; **BLUE**=Commercial Paper Funding Facility; **GREY**=Central Bank Liquidity Swaps; **DARK GREY**=Term Asset-Backed Securities Loan Facility.

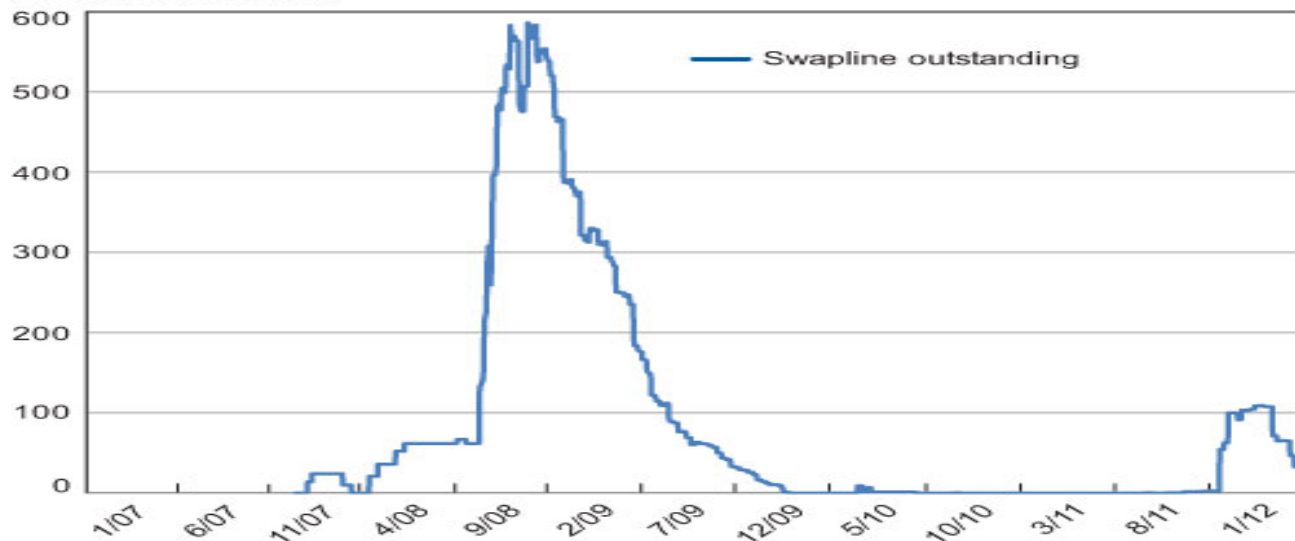
Dollar swaps outstanding with the ECB



Dollar swaps outstanding with the ECB

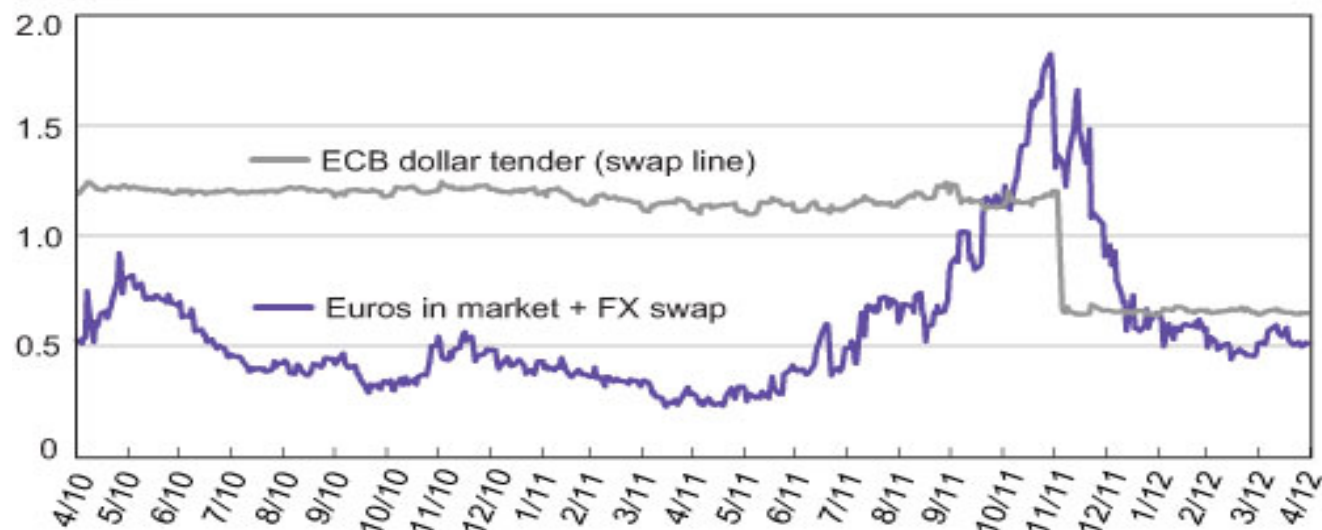
Amount Outstanding at Swap Facility

Billions of U.S. dollars



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

Percent



Source: Miu, Sarkar and Tepper (2010)

Euro-dollar exchange rate, 2011-2012

