Dollar Funding and the Lending Behavior of Global Banks

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(with David Scharfstein and Jeremy Stein)

Facts

- US dollar assets of foreign banks are very large
  - Foreign banks play a major role around the world and in the U.S. market

- To raise US dollar financing, foreign banks rely heavily on wholesale funding

- Foreign banks cannot take on FX risk:

  - their dollar assets are matched most of the time by dollar liabilities

  - they actively use swap market to hedge the FX risk

Syndicated Lending Around the World (2005-2007)

Paper: Table II

	Lending in the region	% of Total lending	Lending in Euro (billion USD)	Lending in USD (billion USD)	Lending in Euro (%)	Lending in USD (%)
Eurozone banks:						
Eurozone	1,036.15	45.5%	941.64	89.11	90.9%	8.6%
Rest of Europe	420.64	18.5%	124.04	127.12	29.5%	30.2%
U.S.	495.52	21.8%	4.30	490.53	0.9%	99.0%
Rest of North America	17.89	0.8%	0.00	14.47	0.0%	80.9%
Asia	139.44	6.1%	10.06	102.92	7.2%	73.8%
Latin America	81.09	3.6%	2.27	78.81	2.8%	97.2%
Middle East	63.25	2.8%	3.40	59.78	5.4%	94.5%
Africa	21.27	0.9%	1.74	17.65	8.2%	83.0%
Total:	2,275.25		1,087.46	980.39	47.8%	43.1%
U.S. banks:						
Eurozone	313.96	7.8%	252.06	60.53	80.3%	19.3%
Rest of Europe	234.74	5.8%	41.48	75.46	17.7%	32.1%
U.S.	3,269.47	80.8%	7.82	3,255.99	0.2%	99.6%
Rest of North America	56.83	1.4%	0.12	47.79	0.2%	84.1%
Asia	89.91	2.2%	5.56	60.11	6.2%	66.9%
Latin America	56.79	1.4%	0.41	56.38	0.7%	99.3%
Middle East	15.54	0.4%	0.16	15.38	1.0%	99.0%
Africa	10.24	0.3%	0.32	8.69	3.1%	84.9%
Total:	4,047.48		307.93	3,580.33	7.6%	88.5%

- Foreign banks play a major role around the world and in the U.S. market

U.S. Prime Money Market Funds as a Dollar Funding Source

Bank	Country	MMF reliance as of April 2011
Eurozone:		
Deutsche Bank	Germany	7.65
Rabobank	Netherlands	7.63
Societe Generale	France	6.25
ING Bank	Netherlands	5.14
Natixis	France	5.06
Credit Agricole	France	4.28
BNP Paribas	France	4.25
Commerzbank	Germany	1.90
Banco Bilbao Vizcaya Argentaria	Spain	1.25
UniCredit	Italy	0.99
Banco Santander	Spain	0.78
Rest of Europe:		
Credit Suisse	Switzerland	4.92
Barclays Bank	UK	4.37
Lloyds TSB Bank	UK	3.97
UBS	Switzerland	3.32
RBS	UK	2.29
HSBC	UK	1.49

MMF Reliance=MMF Holdings$_{April\ 2011}$/(Deposits + Short Term Debt)$_{2010}$

MMFs Reduce their Exposure to Eurozone Banks

European Debt Crisis
May 2011- June 2012
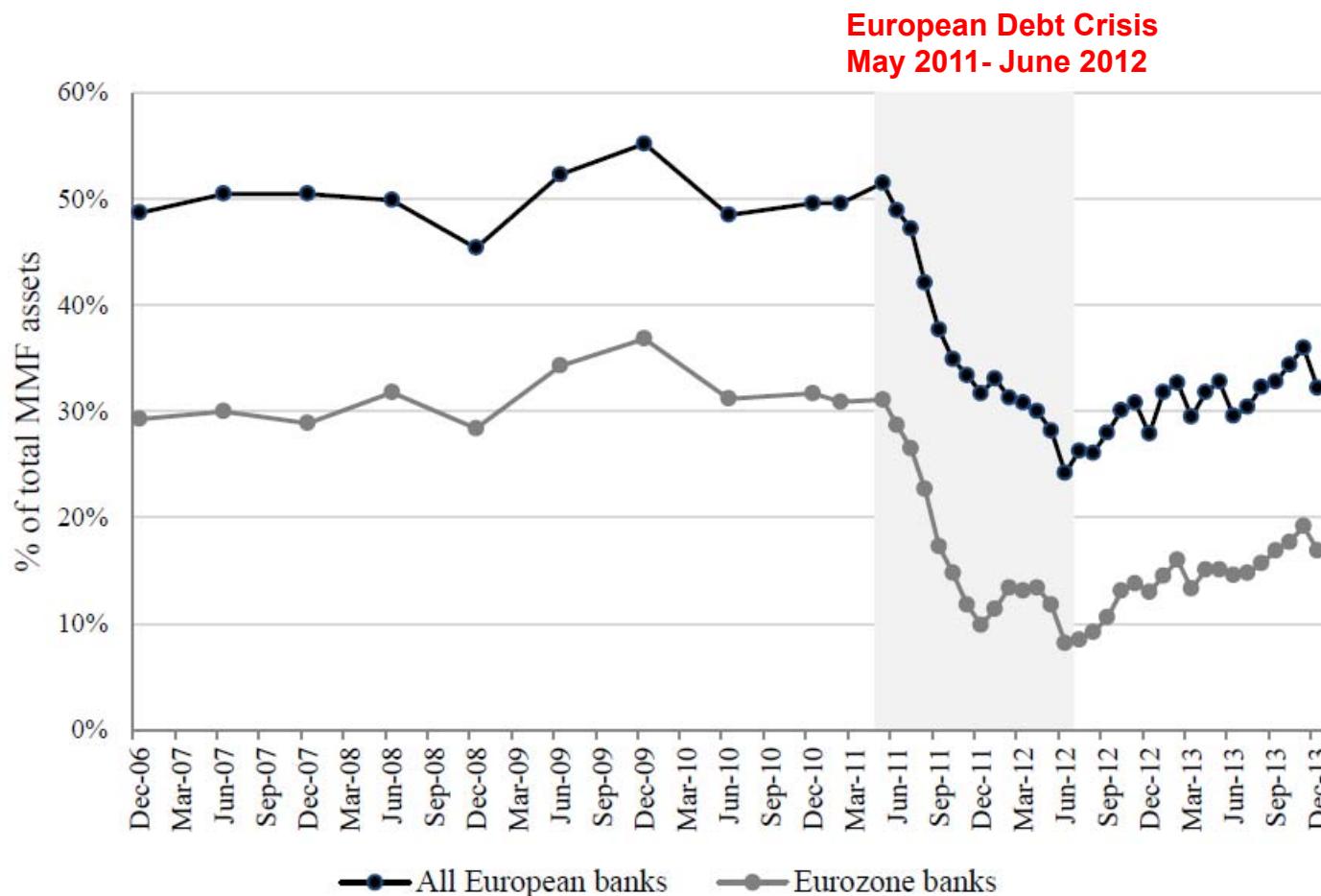
FIGURE II
Money-Market-Fund Exposure to European Banks

Deviations from Covered Interest Parity (CIP)
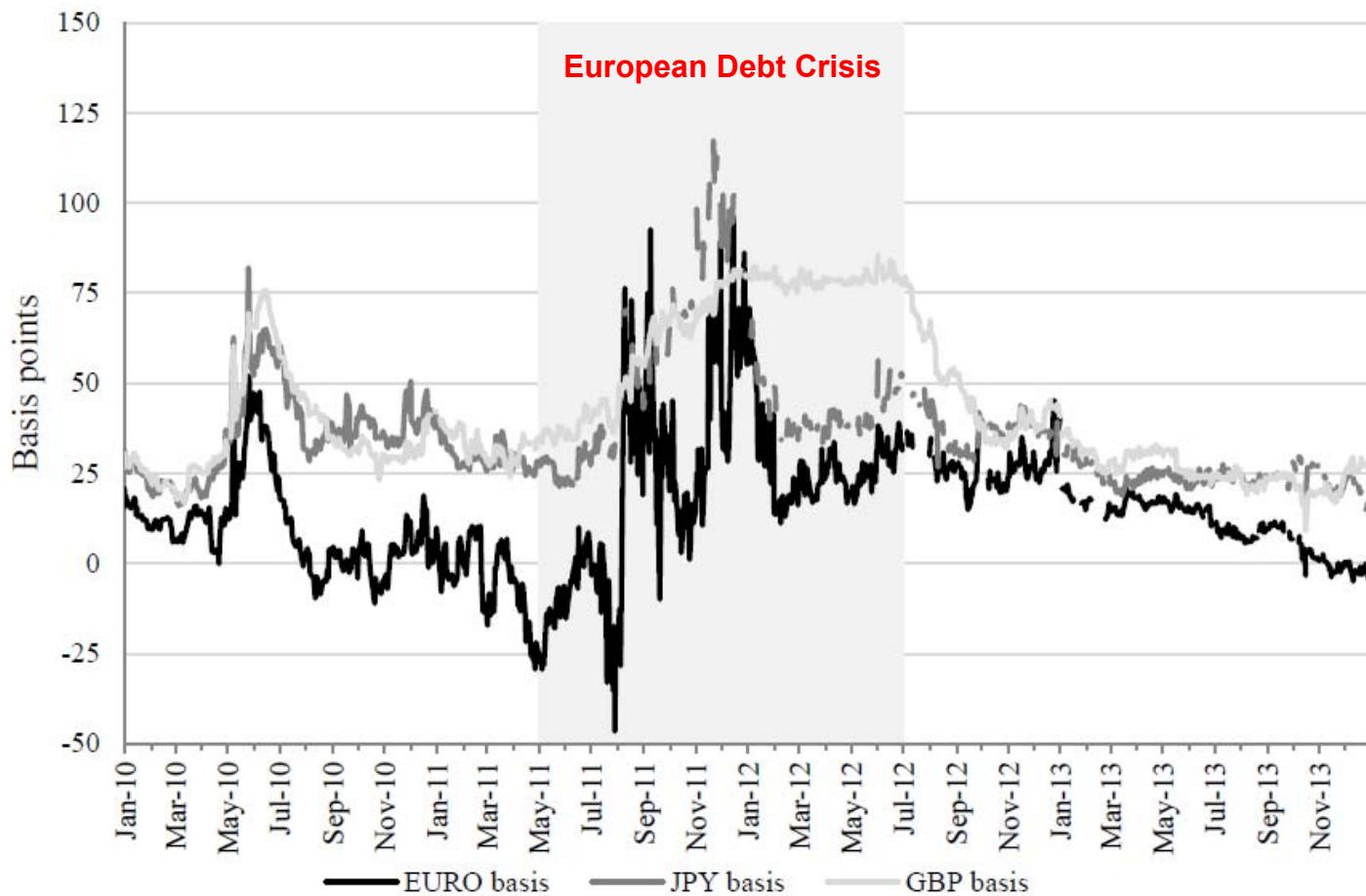
Elements of the Model
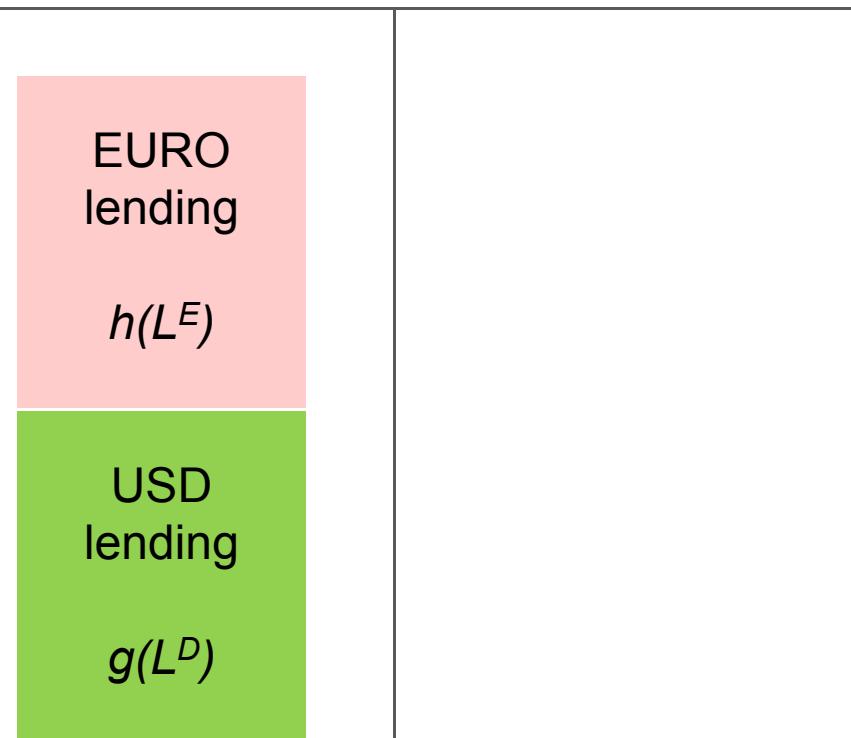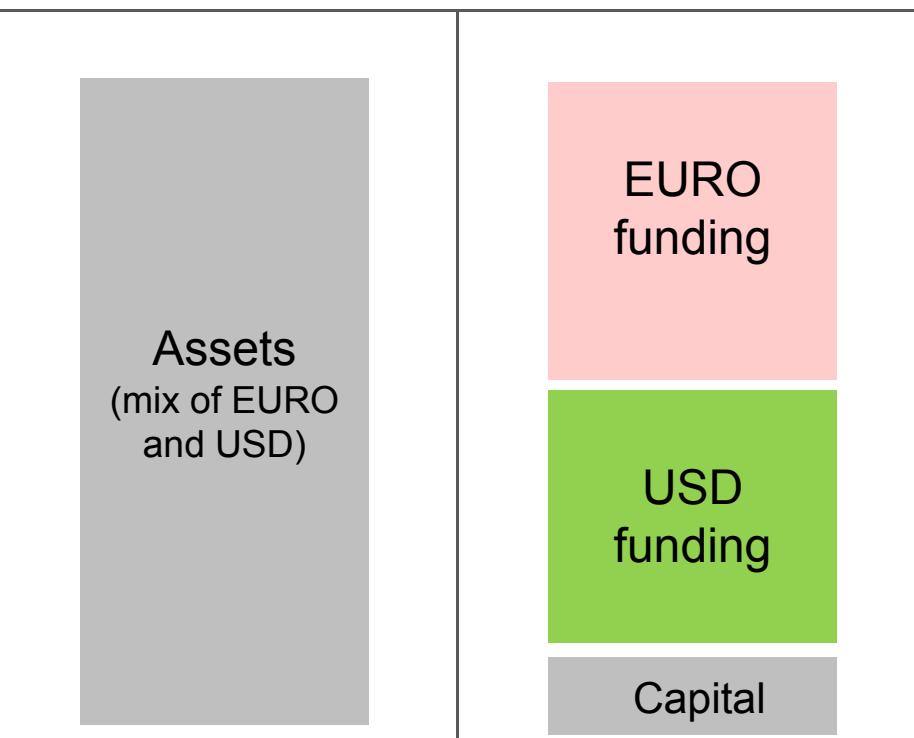
Eurozone bank:

EURO
lending

$h(L^E)$

USD
lending

$g(L^D)$

$L^E + L^D \leq K$

Elements of the Model

Eurozone bank:

Assets (mix of EURO and USD)

EURO funding

USD funding

Capital

- Capital constrained banks can lend in dollars and euros but they must hedge FX risk or borrow in the currency in which they lend

Elements of the Model

Eurozone bank:

$$L^E = B^E - S$$

FX swap market

$$L^D = B^D + S$$

- Capital constrained banks can lend in dollars and euros but they must hedge FX risk or borrow in the currency in which they lend

Elements of the Model

Eurozone bank:

EURO funding — Insured

USD funding — Wholesale

Capital

p: probability of default
α: fraction of wholesale/uninsured funding

Assets
(mix of EURO and USD)

?

Elements of the Model

Eurozone bank:

Negative shock to bank's creditworthiness:

Assets
(mix of EURO
and USD)

?

EURO
funding

Insured

USD
funding

Wholesale

Capital

EURO
funding

↓   ↓

USD
funding
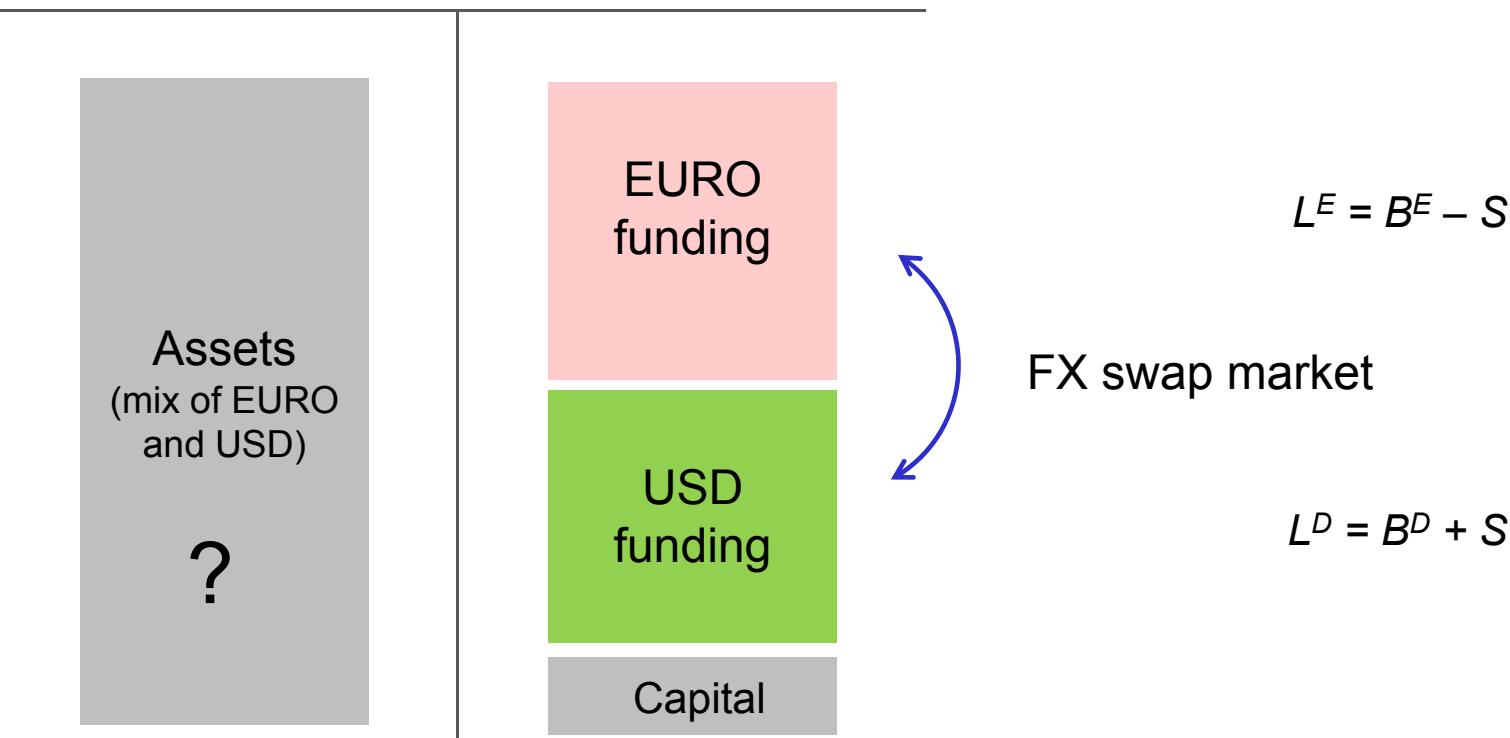
Capital
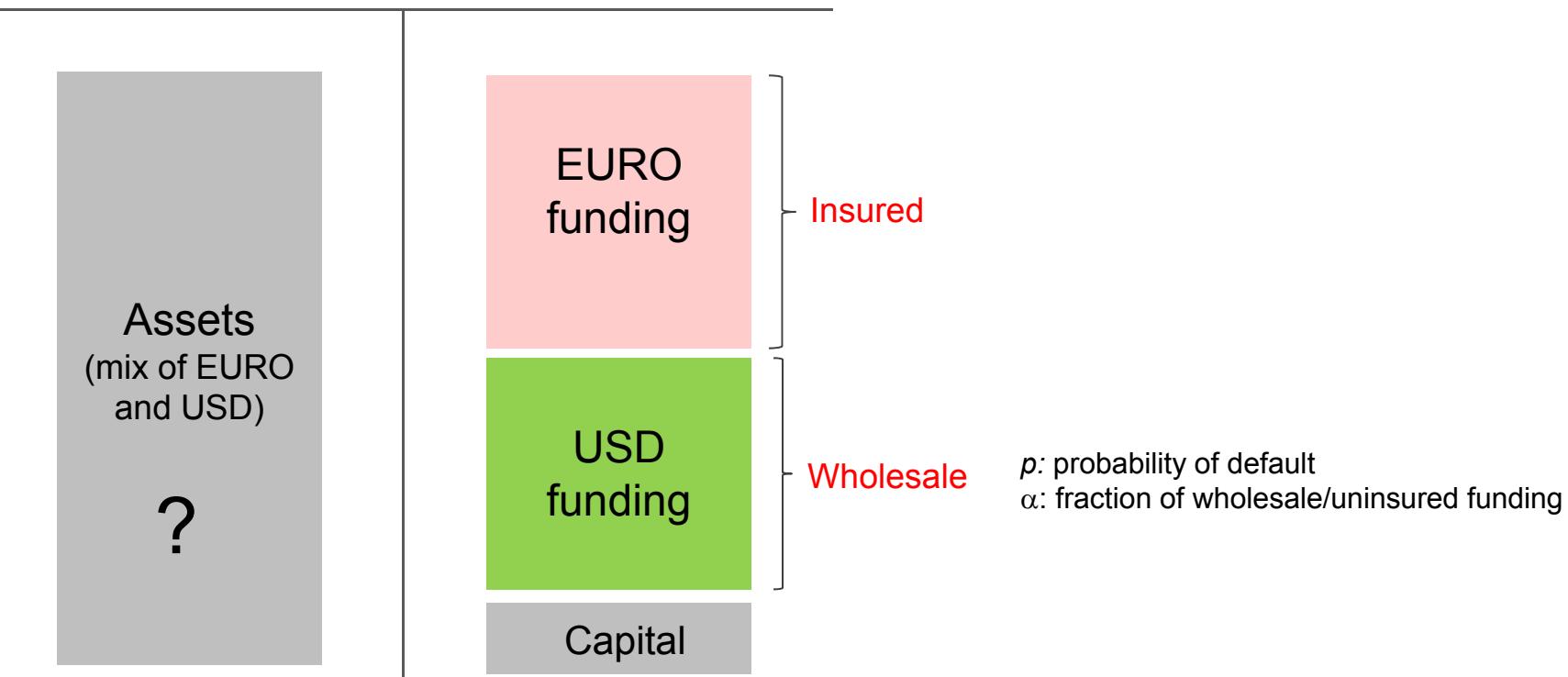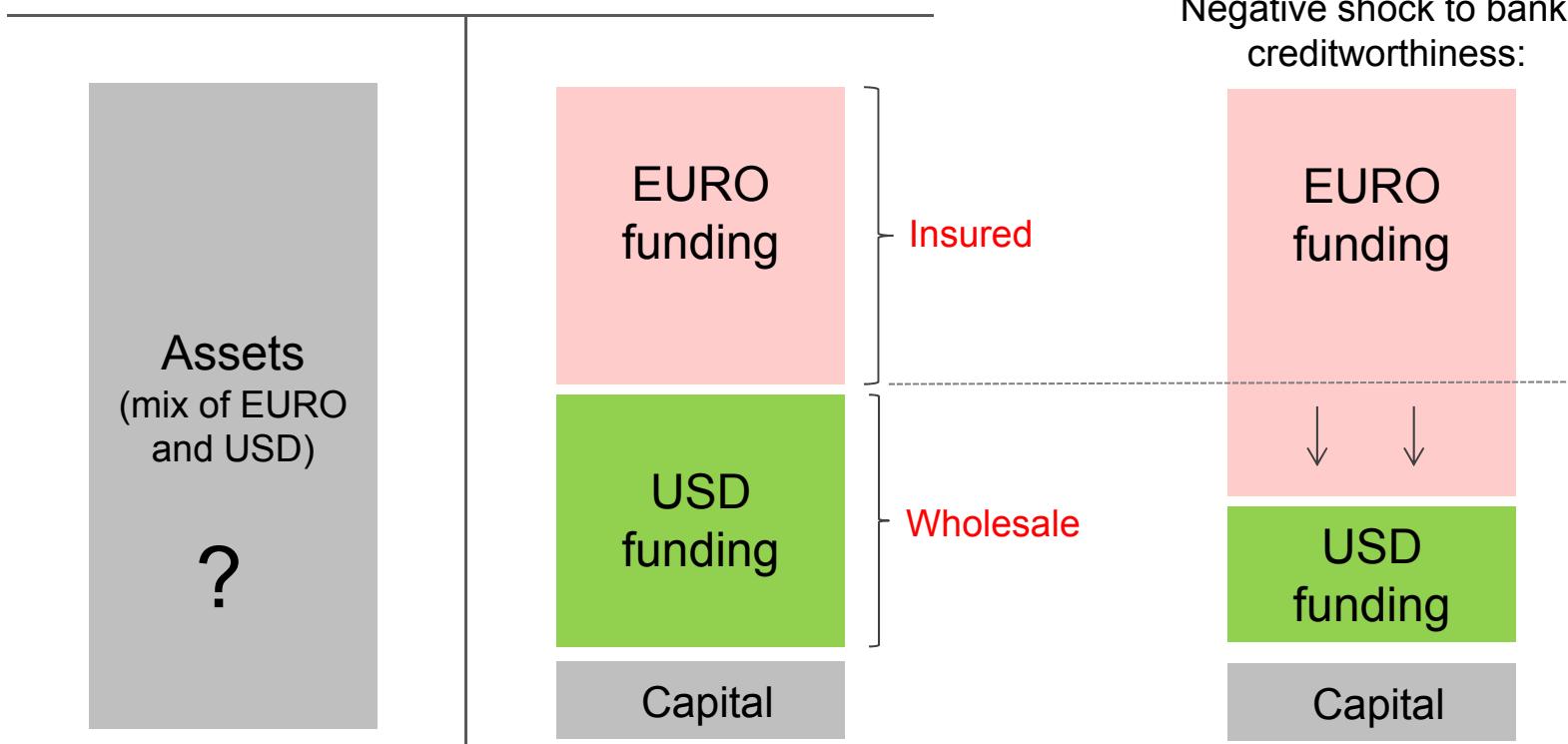
- Borrowing in the home (euro) country is cheaper because of a too-big-to-fail subsidy
- Increase in concerns about bank solvency increases the costs of dollar relative to euro funding

Elements of the Model

Eurozone bank:

Negative shock to bank's creditworthiness:

Assets
(mix of EURO
and USD)

?

EURO
funding — Insured

USD
funding — Wholesale

Capital

EURO
funding

↓ ↓

USD
funding

Capital

FX swap market
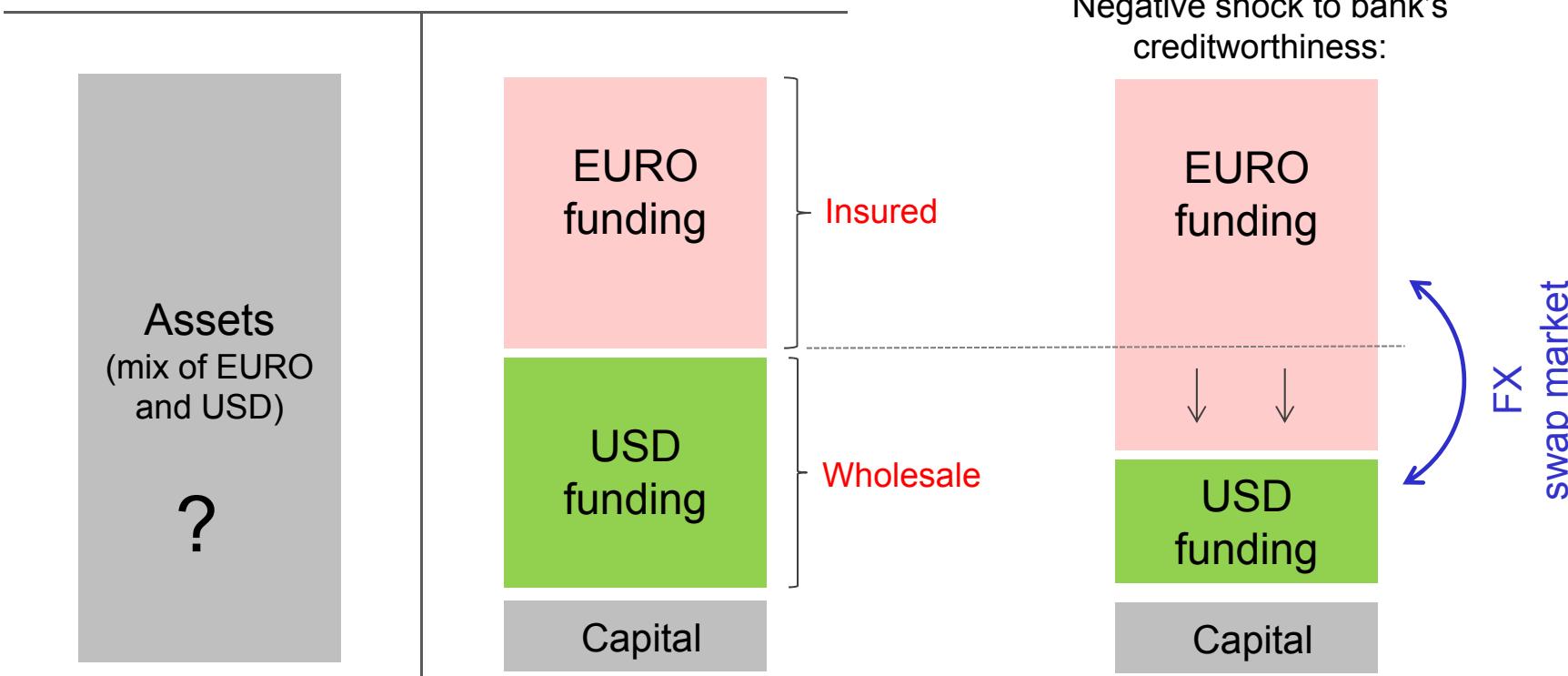
- In absence of a breakdown in FX market, shock to USD funding affect the currency blend of the funding, but not of the assets

Elements of the Model

Eurozone bank:
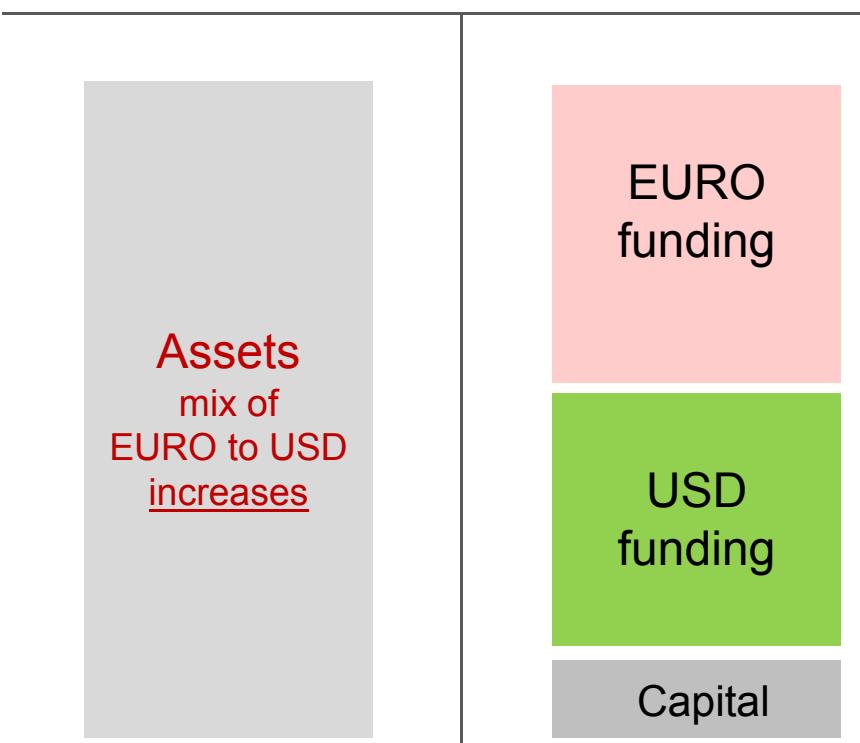
Negative shock to bank's creditworthiness:
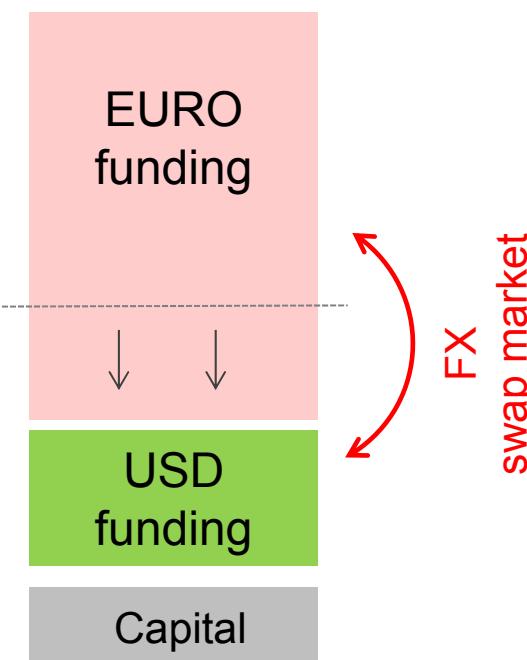
- Increase in bank solvency risk
    - → increase in the costs of USD funding relative to euro funding
    - → increase in demand for borrowing in euros and swapping into dollars
    - → capital-constrained arbitrageurs need to earn higher returns on the swap
- → Increase in bank solvency risk makes it more expensive to make dollar loans

Elements of the Model

Model:

	Assets	Liabilities
	Euro assets $h(L^E)$	Euro deposits: r
	Dollar assets $g(L^D)$	Dollar wholesale: $r + \alpha p$
		Synthetic dollar: $r + \Delta$

$$L^E + L^D = K$$

Shock to default risk

Net cost of FX swaps

Characteristics of the Equilibrium

1. <u>Swap Supply:</u> Arbitrageurs equate the expected swap return, Δ, to the expected return on alternative investment opportunity
   - $\Delta > 0$ implies violation of Covered Interest Parity (CIP)

2. <u>Swap Demand:</u> Bank swaps euro borrowing into dollars such that the expected endogenous cost of the swap, Δ, equals the relative subsidy to euro borrowing, αp
   - The subsidy is increasing in the probability of default, p, and the extent to which the bank depends on wholesale funding in USD, α

3. <u>Dollar and Euro Lending:</u> Banks equate the marginal value of euro lending, h', to the marginal value of dollar lending, g', net of the cost of swaps, Δ:

$$h'(L^E) = g'(L^D) - \Delta$$
$$= g'(L^D) - \alpha p$$

Euro lending relative to dollar lending is increasing in the subsidy to euro borrowing (high α and high p)

Key Empirical Implications

- An increase in perceived riskiness (p) of Eurozone banks, as in the recent MMF crisis, leads to:
    - i.   decreased lending in dollars;
    - ii.   increased lending in euros;
    - iii. increased swap activity;
    - iv.   larger deviations of CIP basis.

- Given that the MMF funding shock was also associated with concerns about Eurozone bank capital (K) we would expect to see a decrease in dollar and euro lending but a decrease in the share of loans that are made in dollars
    - As noted before, a capital shock alone (a decrease in K) would not generally predict an decrease in the dollar loan share

- Main empirical prediction is that Eurozone banks will decrease their dollar loan share, while there should be no effect for banks with limited European sovereign debt exposure

- The model also predicts that there should be a bigger impact of increase in p on the lending behavior of banks that receive more dollar wholesale funding (as proxied by dependence on U.S. MMFs)
    - More MMF dependent banks should experience bigger drop in dollar loan share

Data

- Empirical analysis uses loan data in U.S. and Eurozone from Thomson Reuters *DealScan* database
  - Loan issuance at origination

- *DealScan* primarily covers syndicated loans
  - Syndicated loan is typically originated by one bank but funded by a group of lenders (syndicate participants)

- Syndicated lending is an important part of the overall lending volume
  - In 2011, global syndicated loan issuance was $3.75 trillion USD
    - $1.9 trillion in the U.S. market (46% investment grade)
    - $1 trillion in the European market

- Loan size in 2011, U.S. borrowers: 1st pct. -- $10 million, median -- $215 million

- Overall:
  - Downside of using *DealScan* is that It misses small loans
  - Upside is access to loan issuance data (vs. loans outstanding on bank balance sheets)

	Market:	Share of Eurozone lending		Market share U.S.	
		Lead	All lenders	Lead	All lenders
Europe, "GIIPS":					
UniCredit	Italy	3.02	3.21	0.05	0.31
Banco Bilbao Vizcaya Argentaria	Spain	2.33	2.23	0.06	0.43
Intesa Sanpaolo	Italy	1.91	2.14	0.04	0.26
Banco Santander	Spain	2.37	2.32	0.10	0.44
Mediobanca	Italy	0.99	1.07	--	--
Banco Financiero y de Ahorros	Spain	0.90	1.00	0.01	0.04
La Caja de Barcelona	Spain	0.78	0.77	--	--
Banco de Sabadell	Spain	0.32	0.35	--	--
Bank of Ireland Group	Ireland	0.30	0.45	0.05	0.24
ICO [Instituto de Credito Oficial]	Spain	0.23	0.26	--	--
France:					
BNP Paribas	France	6.70	5.07	2.31	2.36
Credit Agricole	France	4.91	4.29	1.03	1.25
Societe Generale	France	4.57	3.64	0.48	1.02
Natixis SA	France	3.01	3.22	0.09	0.47
CM-CIC	France	1.32	1.72	0.00	0.06
BeNeLux:					
ING Group	Netherlands	2.72	2.47	0.33	0.81
Fortis Bank	Belgium	1.71	1.89	0.38	0.66
Rabobank	Netherlands	0.78	0.96	0.30	0.41
KBC Group	Belgium	0.47	0.74	0.02	0.28
Dexia Bank	Belgium	0.46	0.65	0.02	0.06
Rest of Eurozone:					
Commerzbank	Germany	4.92	4.74	0.50	0.90
Deutsche Bank	Germany	4.74	3.50	4.47	3.25
WestLB	Germany	1.32	1.41	0.14	0.29
BayernLB	Germany	1.13	1.22	0.07	0.23
Landesbank Baden-Wurttemberg	Germany	0.98	1.14	0.01	0.04
Landesbank Hessen-Thuringen [Helaba]	Germany	0.42	0.62	0.04	0.08
DZ Bank	Germany	0.42	0.56	0.01	0.10
KfW Bankengruppe	Germany	0.41	0.68	0.00	0.01
HSH Nordbank	Germany	0.38	0.38	0.06	0.09
NordLB Group	Germany	0.24	0.31	0.03	0.08
Total Eurozone:		54.77	53.00	10.61	14.15

Dollar Loan Share of Eurozone Banks Falls after Shock

- The dependent variable is the fraction of loans originated by bank's *i* in month *t* that is denominated in U.S. dollars (S_{it}); denominator is euro- and U.S. dollars- denominated loans. Sample period: 2005-2011

$$S_{it} = D_i + \beta \ SHOCK + FX_t.$$

Dollar Loan Share of Eurozone Banks Falls after Shock

- The dependent variable is the fraction of loans originated by bank's *i* in month *t* that is denominated in U.S. dollars (S_{it}); denominator is euro- and U.S. dollars- denominated loans. Sample period: 2005-2013.

$$S_{it} = D_i + \beta\ SHOCK + FX_t.$$

Banks:	Eurozone banks			
Market:	Europe and U.S		Europe	
	Loan volume	Number of loans	Loan volume	Number of loans
	(1)	(2)	(3)	(4)
SHOCK (05/2011-06/2012)	-0.0348*	-0.0328**	-0.0365*	-0.0342***
	[0.020]	[0.013]	[0.020]	[0.013]
EUROBANK*SHOCK	--	--	--	--
USD/Euro spot exchange rate	0.1182	0.1535***	0.1282*	0.1577***
	[0.073]	[0.050]	[0.075]	[0.050]
Fixed effects:				
Bank (D_i)	Yes	Yes	Yes	Yes
Month (D_t)	--	--	--	--
Obs.	1,188	1,188	1,188	1,188
Clusters (D_t)	108	108	108	108
Adj. *R*-squared	0.09	0.14	0.09	0.14

vs. mean 17.7% (to the right of the SHOCK row)

Dollar Loan Share of Eurozone Banks Falls after Shock

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$$S_{it} = D_i + D_t + \beta\, EUROBANK_i * SHOCK + FX_t.$$

Dollar Loan Share of Eurozone Banks Falls after Shock

- The dependent variable is the fraction of loans originated by bank's i in month t that is denominated in U.S. dollars (S_{it}); denominator is euro- and U.S. dollars- denominated loans. Sample period: 2005-2013

$$S_{it} = D_i + D_t + \beta\ EUROBANK_i \text{*} SHOCK + FX_t.$$

Banks:	Eurozone and U.S. banks			
Market:	Europe and U.S.			
	Loan volume		Number of loans	
	(5)	(6)	(7)	(8)
SHOCK (05/2011-06/2012)	0.0053 [0.014]	--	-0.0007 [0.002]	--
EUROBANK*SHOCK	-0.0398* [0.020]	-0.0398* [0.021]	-0.0313** [0.013]	-0.0313** [0.014]
USD/Euro spot exchange rate	0.0916* [0.054]	--	0.0996*** [0.032]	--
Fixed effects:				
Bank (D_i)	Yes	Yes	Yes	Yes
Month (D_t)	--	Yes	--	Yes
Obs.	1,836	1,836	1,836	1,836
Clusters (D_t)	108	108	108	108
Adj. R-squared	0.83	0.86	0.91	0.91

Are Results Driven by Differential Loan Demand?

- Borrowers from Eurozone banks in U.S. syndicated loan market are U.S. firms, not U.S. subsidiaries of European firms

- U.S. borrowers from Eurozone banks tend to be larger than U.S. borrowers from U.S. banks
  - If anything, suggests that demand for loans from Eurozone banks in U.S. should fall by less than loan demand from U.S. banks
  - Eurozone borrowers from Eurozone banks are also smaller, suggesting that loan demand in Eurozone should fall by more
  - Makes it more difficult to observe the patters we document

- Econometric evidence from firm fixed-effects regressions

Choice of Lender for Dollar-Denominated Loans

- Each observation is a separate loan.
- The dependent variable is the <u>fraction of lead banks</u> on the loan headquartered in the Eurozone.

USD loans:

$$EUROBANK\ SHARE_{jt} = D_j + \beta\ SHOCK + X_j,$$

USD and Euro loans:

$$EUROBANK\ SHARE_{jt} = D_j + D_t + DOLLAR\ LOAN_{jt} + \beta\ DOLLAR\ LOAN_{jt}{}^*SHOCK + X_j,$$

Choice of Lender for Dollar-Denominated Loans

- Each observation is a separate loan.
- The dependent variable is the <u>fraction of lead banks</u> on the loan headquartered in the Eurozone.

Market:	Europe and U.S.				
Loan currency:	U.S. dollar		U.S. dollar and euro		
	(1)	(2)	(3)	(4)	(5)
SHOCK	-0.0105**	-0.0119**	0.0662***	--	--
	[0.005]	[0.005]	[0.019]		
DOLLAR LOAN*SHOCK	--	--	-0.0763***	-0.0758***	-0.0762***
			[0.019]	[0.019]	[0.023]
DOLLAR LOAN	--	--	-0.0673***	-0.0664***	-0.5431***
			[0.0219]	[0.022]	[0.007]
Ln(Loan amount)	--	0.0041**	-0.0017	-0.0021	-0.0011
		[0.002]	[0.002]	[0.002]	[0.001]
Fixed effects:					
Borrower(D_j)	Yes	Yes	Yes	Yes	--
Month (D_t)	--	--	--	Yes	Yes
Industry (D_{SIC})	--	--	--	--	Yes
Obs.	32,309	32,303	37,236	37,236	36,340
Clusters (D_t)	168	168	168	168	168
Adj. R-squared	0.73	0.73	0.83	0.83	0.42

Likelihood of Obtaining Dollar-Denominated Loans

- Sample of firms that received a dollar-denominated loan before the shock period.

TABLE VI
LIKELIHOOD OF OBTAINING A DOLLAR-DENOMINATED LOAN

Market:	Europe and U.S.			
Loan currency:	U.S. dollar			
	(1)	(2)	(3)	(4)
PAST EUROBANK SHARE (last loan)	-0.0542***	-0.0418***	-0.0487***	--
	[0.011]	[0.012]	[0.012]	
PAST EUROBANK SHARE (5-yr avg)	--	--	--	-0.0635***
				[0.012]
All-in-drawn spread	--	--	-0.0002***	-0.0002***
			[0.000]	[0.000]
No spread information	--	--	-0.0601***	-0.0592***
			[0.011]	[0.011]
Ln(Loan amount)	--	--	0.0295***	0.0297***
			[0.003]	[0.003]
Maturity	--	--	0.0038**	0.0038**
			[0.002]	[0.002]
Revolving line	--	--	0.0310***	0.0303***
			[0.008]	[0.008]
Fixed effects:				
Industry (D_{SIC})	--	Yes	Yes	Yes
Year of last loan origination	--	Yes	Yes	Yes
Observations	10,190	9,444	9,441	9,441
R-squared	0.00	0.21	0.23	0.23

Loan Spreads

- Dependent variable: change in spread charged over LIBOR for USD loans.

TABLE VII
THE EFFECT OF LENDER TYPE ON LOAN SPREADS

Market:	Europe and U.S.		
Loan currency:	U.S. dollar		
	(1)	(2)	(3)
PAST EUROBANK SHARE	34.577*	45.09***	39.073**
	[18.085]	[16.059]	[15.704]
All-in-drawn spread	--	--	-0.439***
			[0.048]
Ln(Loan amount)	--	--	-18.219***
			[3.169]
Maturity	--	--	13.851***
			[2.531]
Loan type	--	--	-74.047***
			[9.104]
Fixed effects:			
Industry (D_{SIC})	Yes	Yes	Yes
Year of last loan origination	--	Yes	Yes
Observations	3,816	3,816	3,816
Clusters (D_j)	1,413	1,413	1,413
R-squared	0.08	0.33	0.45

Regressions: Dollar Loan Share and MMF Dependence

Market:	Europe and U.S.	
	Most MMF exposed banks	Least MMF exposed banks
	(1)	(2)
SHOCK	-0.0095**	-0.0024
	[0.004]	[0.002]
Ln(Loan amount)	0.0032**	0.0009
	[0.001]	[0.001]
Fixed effects:		
Borrower(D_i)	Yes	Yes
Obs.	32,303	32,303
Clusters (D_t)	168	168
Adj. R-squared	0.71	0.68

H_0: β_{SHOCK}, most MMF exposed banks $= \beta_{SHOCK}$, least MMF exposed banks
F-statistic $= 6.20**$

Conclusion

- Eurozone banks are a key source of funding for U.S. firms and households

- We present a model that helps to explain this phenomenon
    - Greater government subsidies on euro borrowing relative to wholesale dollar funding
    - Creates incentives for banks to increase euro borrowing and swap into dollars to fund dollar loans
    - But limited arbitrage capital in FX swap market induces violations of Covered Interest Parity and reduces incentive of banks to swap euros into dollars
    - Banks cut dollar lending relative to euro lending

- One of the consequences of the European debt crisis was that Eurozone banks contracted their dollar lending relative to euro lending despite the fact that European economies were more threatened by the debt crisis
    - Banks that were more dependent on wholesale dollar funding (MMFs) cut their dollar loan share by more