

The “Greatest” Carry Trade Ever? Understanding Eurozone Bank Risks

Viral V. Acharya (NYU, CEPR and NBER)
and
Sascha Steffen (ESMT)

FDIC

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Motivation

- Sovereign debt crisis has cast doubt on the solvency of European banks due to massive impairments and mark-to-market losses on sovereign bond holdings
 - Greece, Ireland, Portugal, Spain and Italy (GIPSI)
- Widening bond yield spreads between GIPSI countries and, for example, German bunds

Figure 1.A. Pairwise Comparison of Government Bond Yield Spreads: Italy versus Germany

This graphic shows the time series of 10-year government bond yields comparing Italian and German 10-year government bond yields since January 2005 (Source: Bloomberg).

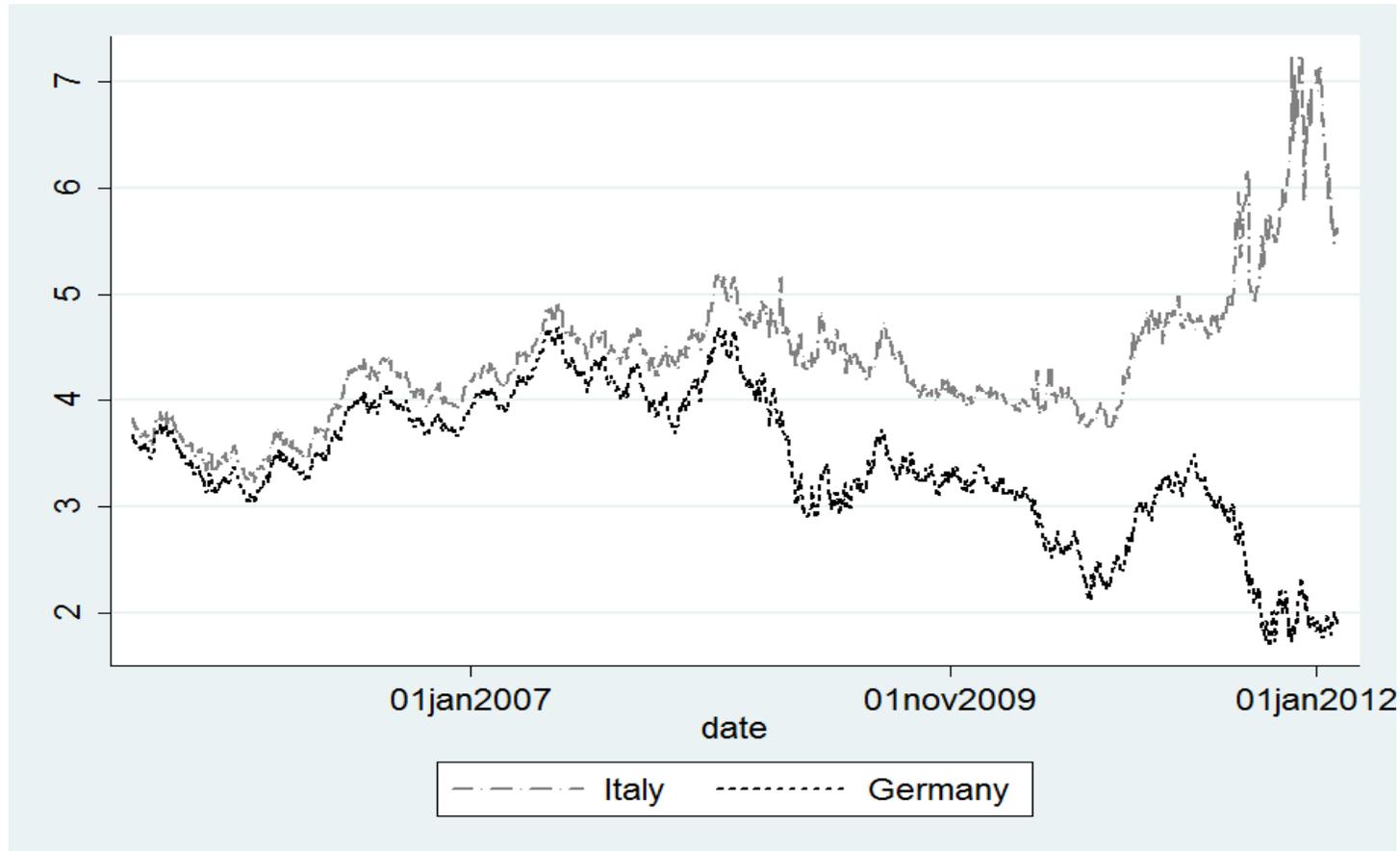
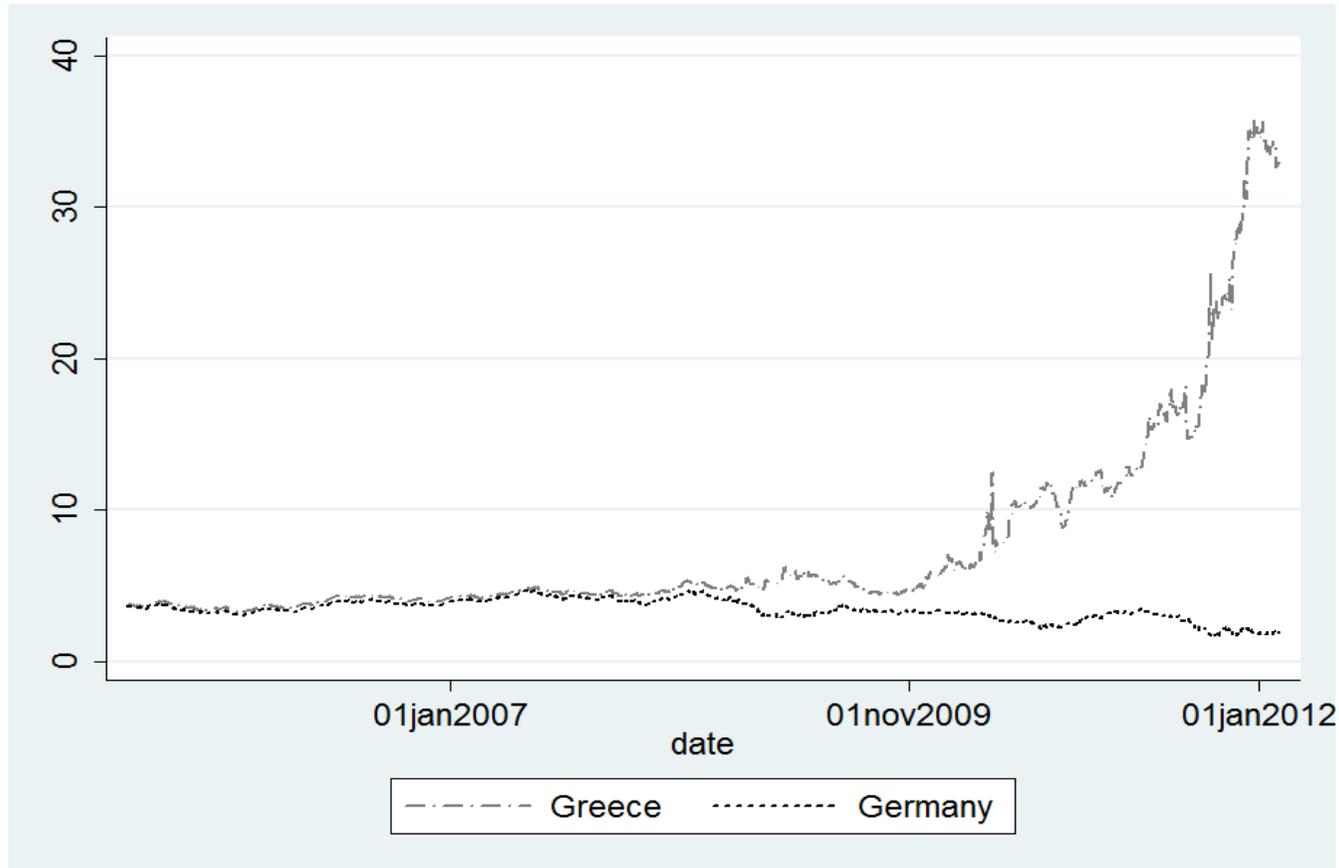


Figure 1.B. Pairwise Comparison of Government Bond Yield Spreads: Greece versus Germany

This graphic shows the time series of 10-year government bond yields comparing Greek and German 10-year government bond yields since January 2005 (Source: Bloomberg).



Motivation

- Sovereign debt crisis has cast doubt on the solvency of European banks due to massive impairments and mark-to-market losses on sovereign bond holdings
 - Greece, Ireland, Portugal, Spain and Italy (GIPSI)
- Widening bond yield spreads between GIPSI countries and, for example, German bunds
- Banks have lost about 70% of market value since 2010 and shed billions of Euros of assets
- Sovereign debt crisis has even challenged the survival of the Eurozone

“Carry Trades“ in Peripheral Sovereign Bonds

- (Our results suggest that) Bank risk in this period can be understood as reflecting a “carry trade“ behavior
 - Financing leg: short-term wholesale market
 - Investment leg: long-term GIPSI government bonds
- Carry trade reflects a bet on the economic convergence of the Eurozone and a convergence of the spread between the two legs
- Banks gain on the upside when yields of GIPSI countries decrease (and market prices increase), i.e. banks can pocket the “carry”
- Bank lose on the downside when spreads between both legs diverge further
 - Leading to losses of banks on sovereign bond portfolio
 - Questioning solvency and/or liquidity of banks in funding markets
- Current regulatory capital requirement in fact incentivizes such behavior by treating most sovereign bonds as safe and ignoring short-term funding

Dexia S.A. – A Carry Trade Gone Bad

*"And of course, the deterioration of the Euro zone situation and particularly the sovereign crisis in the peripheral economies hit very badly the group. And that's of course not a surprise for a group that still had very important short-term funding needs that was mainly present in strong exposures in peripheral countries. [...] Before 2008, it was the group's high rating granting easy access to wholesale funding that led to the situation of October 2008 with **short-term funding need of €260 billion outstanding in October 2008, i.e. 43% of total balance sheet.** [...] with very significant acceleration and buildup of the **bond portfolio was amounting at €203 billion** at the end of 2008. **Mostly carry-trades** with marginal improvement of customer access [...] that led to a very significant gearing ratio because the portfolio size was, at that time, 25 times the group equity."*

(Pierre Mariani, Chairman-Management Board & CEO, Dexia SA, Earnings Call, February 23rd, 2012)

Dexia S.A. – A Period of Leverage and Growth

- Dexia is organized as parent holding company under Belgium law with three main banking subsidiaries, Dexia Crédit Local (DCL, France), Dexia Bank Belgium (DBB, Belgium) and Dexia Banque Internationale à Luxembourg (DBL, Luxembourg).
- Dexia is focussed on four major segments (EC (2010)):
 - Public and wholesale banking (PWB), Retail and commercial banking (RCB), Treasury, Funding and Markets (TFM), Asset Management & Services (AMS).
- Most of its profitability until summer 2008 was coming from maturity transformation and non-core investment activities.
 - As of October 2008, Dexia was funded with EUR 260 billion short term (mostly unsecured) debt (40% of its balance sheet) and had EUR 203 billion bond portfolio
 - Average maturity of assets > 11yrs, funded in inter-bank and money markets
 - Also strongly exposed to the US property and municipal debt markets
 - October 3rd, 2008: 1st bailout and recapitalization by governments

Table I. Dexia S.A. Liquidity and Sovereign Debt Holdings

Panel A. Dexia's liquidity profile (million Euros, except for ratios)

Item	2007	2008	2009	2010	2011
Central bank funds/ liabilities due to central banks	12,414	120,559	54,502	25,520	27,315
Repurchase agreements due to banks	35,755	35,331	31,512	34,873	17,423
Repurchase agreements due to customers	2,994	9,314	20,180	19,161	38
Central bank dependence	0.24	0.73	0.51	0.32	0.61
Deposits due to Banks	178,681	213,192	123,724	98,490	106,384
Deposits due to customers	120,493	102,340	97,739	105,001	16,870
Total Loans	243,635	368,961	354,079	352,606	173,566
Total Loans (% Deposits due to Customers)	2.02	3.61	3.62	3.36	10.29

Panel B. Dexia's bond portfolio holdings

As of	Greece	Ireland	Italy	Portugal	Spain	Total (GIPSI)
31.03.2010	3,747	147	17,553	2,817	1,823	26,087
31.12.2010	3,462	0	15,009	1,927	1,443	21,842
30.09.2011	4,034	0	14,343	1,926	1,399	21,703
31.12.2011	747	0	9,779	1,575	481	12,582

The Sovereign Debt Crisis

- June 2011:
 - Short-term funding reduced to EUR 96 billion (-63%)
 - Contingent liquidity risk through SBPA reduced by EUR 44 billion since Oct 2008.
 - The balance sheet reduced by 20% to EUR 518 billion, EUR 70.3 billion through disposal of assets.
 - Costs cut by 15% via efficiency gains and refocus on core franchises since 2008.
 - Its Tier 1 ratio increased by 280bps to 13.4% by end of March 2011
- Dexia's liquidity under pressure since March 2011, when both Moody's and S&P placed Dexia's ratings under review for possible downgrade
 - Dexia lost about EUR 80 billion short-term funding and deposits between March and October 2011
 - Plus had to post about EUR 15 billion in cash collateral as margin for hedges -> Dexia was long fixed interest rates hedged with interest rate swaps
 - Total return swap position that was short the German bunds

Figure 2.A. Dexia Return Correlations

This graphic shows the time-series of 30-day rolling correlations of Dexia's stock returns with 10-year Italian and 10-year German government bond returns since January 2011. The vertical red lines indicate the two 3-year Long-Term-Refinancing-Operations (LTRO) of the European Central Bank (ECB) in December 2011 and February 2012.

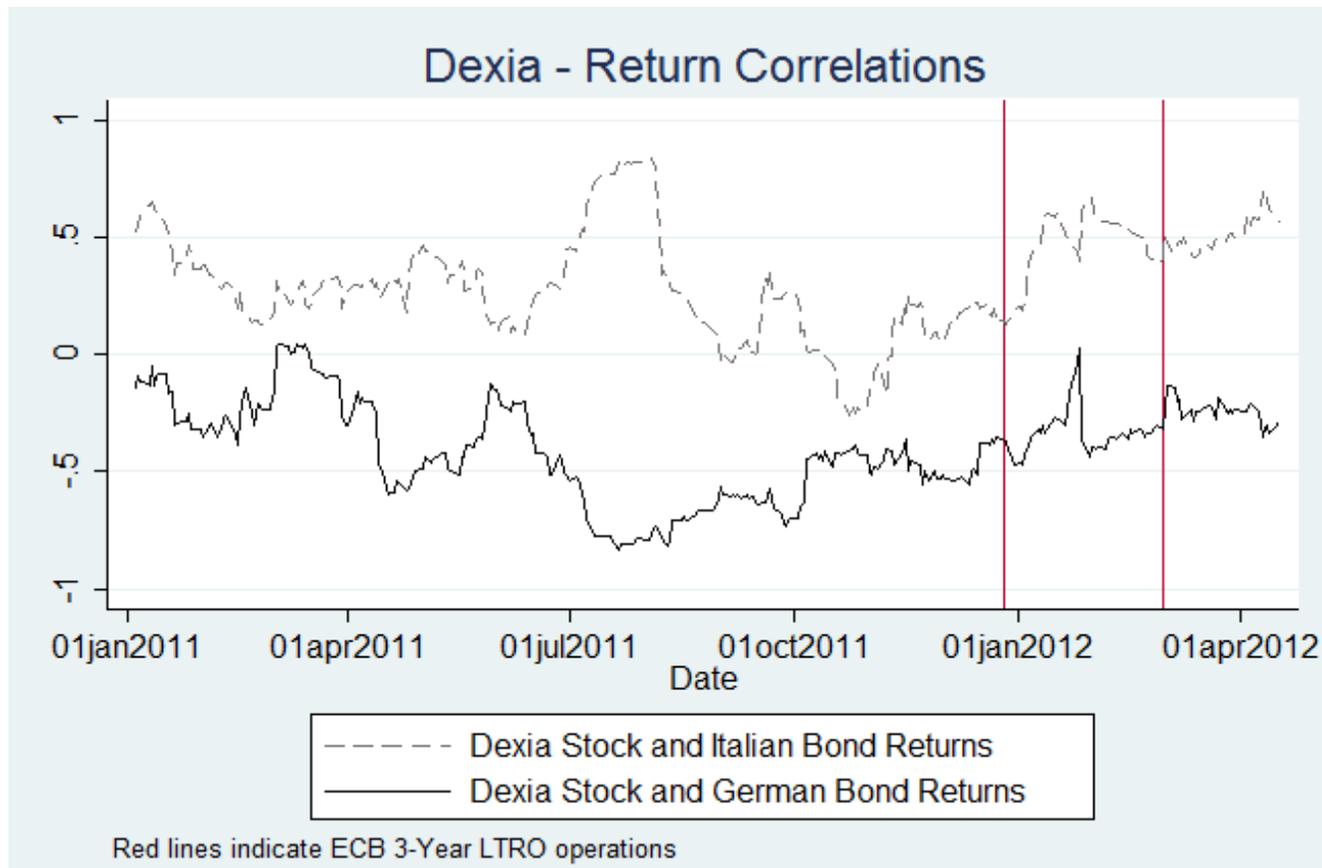
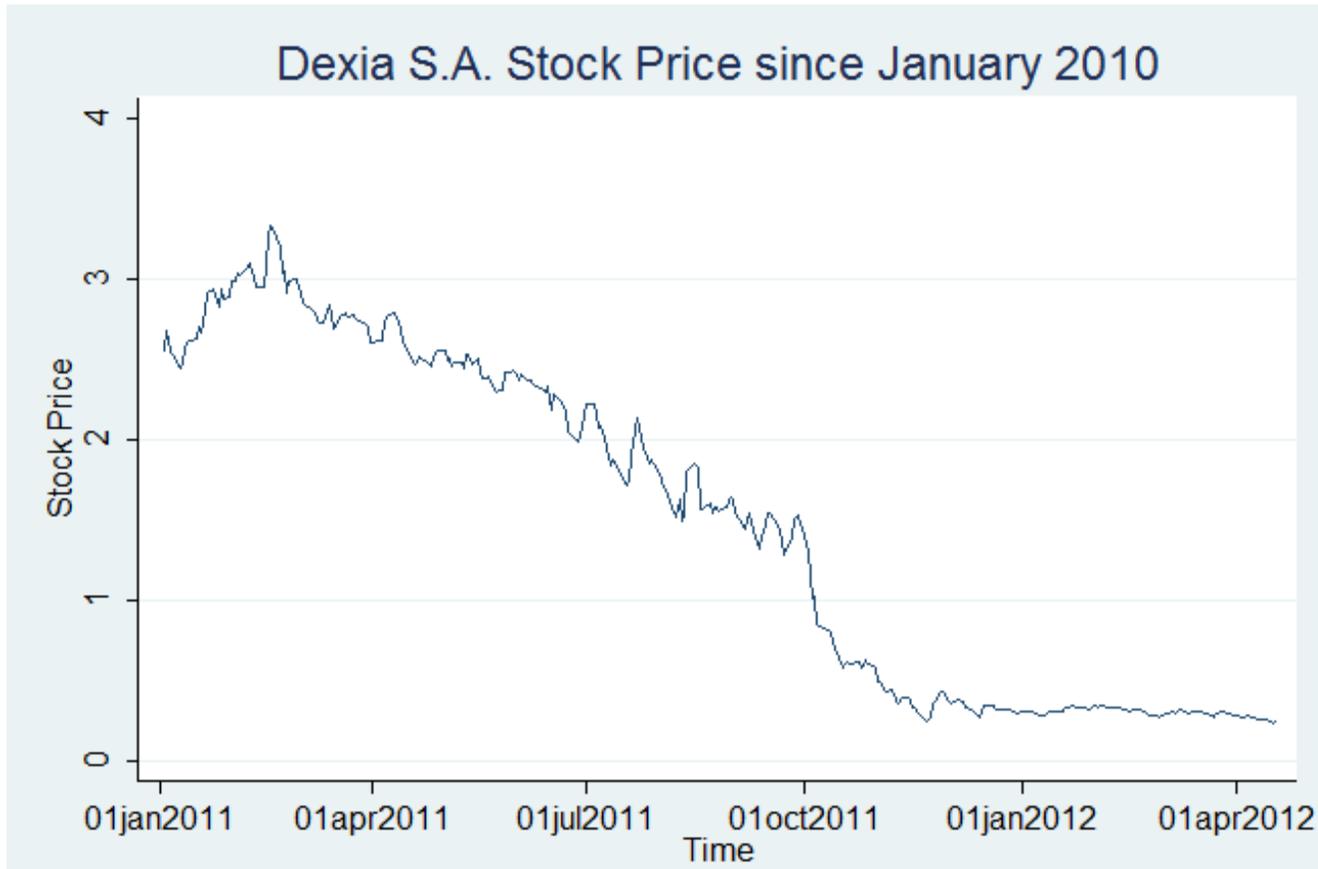


Figure 2.C. Dexia Stock Price Decline since January 2011

This graphic shows Dexia's stock price performance since January 2011.



In this Paper

- We show that Dexia-style behavior was pervasive among European banks
 - Long peripheral sovereign bonds financed in short-term wholesale markets
- We analyze various motives for banks to participate in carry trades
 - Implicit bailout guarantees
 - Risk-shifting by under-capitalized banks
 - Regulatory capital arbitrage
 - Cheap central-bank financing
- We analyze bank behavior around the stress tests and ask whether banks engaged in window dressing (not part of this presentation)
- We analyze whether banks' carry trade behavior is predictive of future capital raisings and ECB dependence

Data

- We collect market information from Bloomberg
 - Stock prices, 10-year sovereign bond yields, bank and sovereign CDS spreads
- The European Banking Authority (EBA) disclosed information about banks' bond portfolio after the 3 stress tests
 - July 2010, July 2011 and December 2011 (capital exercise)
 - Information about banks' Tier 1 ratios in “stressed scenarios”
- Financial information of banks from SNL Financial
- Annual and quarterly reports from banks
 - ECB funding, repo transactions
- S&P Credit Portal, European Central Bank (ECB) and Bank for International Settlement (BIS)
 - Credit reports, (aggregate) lending information

Sample of Banks

Bank	SNL ID	Ticker	Ticker-Exchange	Country	Total Assets (EUR 000) (30.6.2011)
Deutsche Bank AG	113830	DBK	DBK-ETR	Germany	2,164,103,000
HSBC Holdings Plc	113876	HSBA	HSBA-LON	United Kingdom	1,967,795,830
BNP Paribas SA	3001689	BNP	BNP-PAR	France	1,965,283,000
Barclays Plc	114508	BARC	BARC-LON	United Kingdom	1,871,468,662
Royal Bank of Scotland Group Plc	3001937	RBS	RBS-LON	United Kingdom	1,803,649,293
Crédit Agricole SA	4085960	ACA	ACA-PAR	France	1,723,608,000
Banco Santander SA	113983	SAN	SAN-MAD	Spain	1,251,524,817
ING Groep N.V.	113837	INGA	INGA-AMS	Netherlands	1,242,739,000
Société Générale SA	113818	GLE	GLE-PAR	France	1,181,372,000
Lloyds Banking Group Plc	4041848	LLOY	LLOY-LON	United Kingdom	1,161,698,150

- We start with all publicly listed banks that participated in the EBA stress tests
 - Exclude some due to data availability (e.g. HRE, Bankia, Irish Life and Permanent)
- Overall, 51 banks included in our analysis (top 10 shown above)

Table II. Descriptive Statistics on Return Correlations

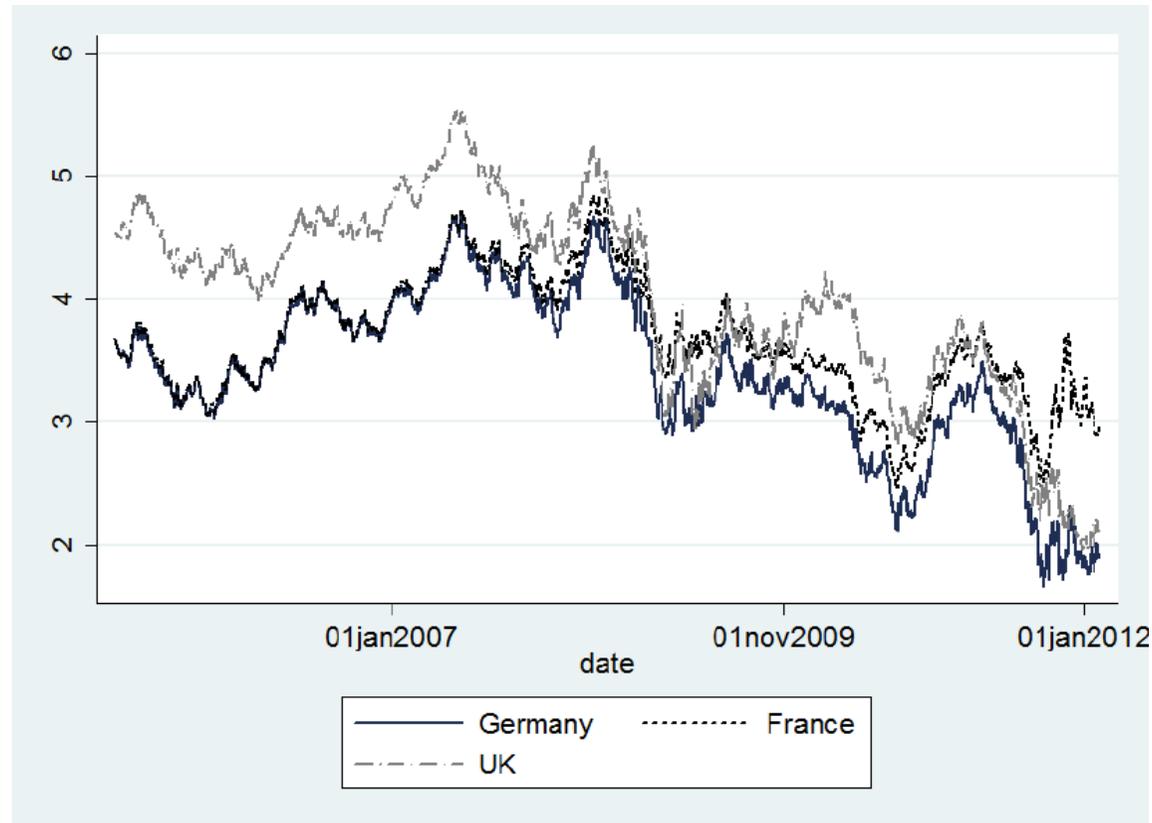
Panel B. Sovereign bond return correlations (2005)

	Greece	Italy	Portugal	Spain	Ireland	Germany	France	UK
Greece	1.00							
Italy	0.97	1.00						
Portugal	0.65	0.67	1.00					
Spain	0.96	0.98	0.65	1.00				
Ireland	0.92	0.93	0.64	0.93	1.00			
Germany	0.96	0.98	0.66	0.98	0.94	1.00		
France	0.96	0.98	0.66	0.98	0.94	0.98	1.00	

Panel C. Sovereign bond return correlations (2011/2012)

	Greece	Italy	Portugal	Spain	Ireland	Germany	France	UK
Greece	1.00							
Italy	0.12	1.00						
Portugal	0.19	0.22	1.00					
Spain	0.13	0.77	0.17	1.00				
Ireland	0.26	0.17	0.33	0.23	1.00			
Germany	-0.13	-0.27	-0.10	-0.19	-0.17	1.00		
France	-0.02	0.22	0.00	0.23	-0.03	0.51	1.00	

Divergence of French Government Bond Yields EOY 2011



- French government bond yields rose sharply towards end of 2011
- Probably higher expected bailout costs for heavily exposed large banks

Table III. Descriptive Statistics on Bank Characteristics

Panel A. Cross-section

	Obs	Mean	Std-Dev	Min	P50	Max
Log-Assets	51	11.88	1.65	7.82	11.99	14.38
ST-LVG	43	0.33	0.14	0.00	0.31	0.71
RWA / Assets	50	0.52	0.17	0.18	0.55	0.84
Book-LVG	51	21.61	10.09	2.02	18.68	59.22
Tier-1 Ratio (%)	50	9.30	1.65	6.66	9.05	13.97
<i>"Stressed" Tier 1 Ratios</i>						
Tier1_{07/2010}	49	0.10	0.02	0.07	0.10	0.17
Tier1_{07/2011}	50	0.08	0.03	-0.01	0.08	0.14
Tier1_{12/2011}	41	0.10	0.03	0.06	0.09	0.20
<i>Capital Issuance Activity & ECB Funding</i>						
<i>Jan 2007 - Feb 2012</i>						
Capital (Yes/No)	51	0.86	0.35	0.00	1.00	1.00
Log-Capital	44	14.18	1.64	7.77	14.39	16.81
ECB-Funding / Repo	32	0.47	0.29	0.01	0.50	1.00

Table III. Descriptive Statistics on Bank Characteristics (cont'd)

Panel B. Time-series

	Obs	Mean	Std-Dev	Min	P50	Max
<i>Daily returns January 2007 - March 2012</i>						
Realized Return	63,105	-0.0014	0.04	-1.10	0.00	0.55
Bank CDS	31,116	182.85	274.73	3.80	104.24	3,183
Δ Log (Bank CDS).	31,109	0.00	0.06	-0.82	0.00	1.34
<i>Quarterly returns Q1 2008 - Q1 2012</i>						
Realized Return	833	-0.06	0.26	-0.87	-0.07	1.61
Predicted Return	833	-0.08	0.38	-2.75	-0.08	1.86
β_{Italy}	833	1.55	2.89	-7.94	0.87	25.87
β_{Greece}	833	0.09	2.02	-18.23	0.14	11.08
β_{Germany}	833	-2.96	2.35	-20.05	-2.68	8.39

Panel C. Sovereign bond holdings

	Greece	Italy	Spain	Portugal	Ireland
July 2010	2,073	5,934	3,065	639	533
July 2011	1,500	4,882	2,975	544	282
December 2011	569	5,142	3,007	646	380

Table IV. Stock and Bond Return Correlations

	(1) Greece	(2) Italy	(3) Spain	(4) Portugal	(5) Ireland	(6) GIPSI
Greece	0.114*** (5.29)					0.076*** (4.09)
Italy		0.475*** (3.90)				0.410*** (3.18)
Spain			0.413*** (5.20)			-0.062 (-0.60)
Portugal				0.120** (2.31)		-0.015 (-0.82)
Ireland					0.267*** (3.73)	0.127* (1.79)
Germany	-1.337*** (-7.15)	-1.439*** (-6.67)	-1.470*** (-7.23)	-1.348*** (-6.90)	-1.372*** (-6.98)	-1.433*** (-7.25)
ΔVSTOXX	-0.005*** (-8.68)	-0.005*** (-8.49)	-0.005*** (-8.63)	-0.005*** (-8.42)	-0.005*** (-8.55)	-0.005*** (-8.72)
Constant	-0.001 (-1.41)	-0.001* (-1.65)	-0.001 (-1.58)	-0.001 (-1.60)	-0.001 (-1.55)	-0.001 (-1.46)
Observations	62,748	62,748	62,748	62,748	62,748	62,748
R-squared	0.21	0.21	0.21	0.21	0.21	0.22

- Standard errors clustered in two dimensions: bank and quarter
- Factor loadings provide us with an estimate of size and direction of exposure to each security

Carry Trade Behavior of European Banks

- Positive correlation of GIPSI bond returns and stock returns suggest that banks are long GIPSI government debt
 - Particularly Greece and Italy
- Negative factor loading on German government bonds suggest banks are effectively „short“ German government bonds
- Consistent with carry trade behavior of European banks
 - They appear to have invested in long-term peripheral bonds
 - Financed in short-term wholesale markets to maximize the carry
- Negative factor loading on German bunds reflect „flight to quality“
 - Upon adverse economic or financial news, investors „fly“ into long-term German bunds, reducing their supply of short-term funding for banks
 - If banks are exposed to short-term funding, it appears as if banks were short long-term German bunds

Table IV. Stock and Bond Return Correlations (cont'd)

	(1) Home	(2) Macro	(3) PCA	(4) Funding Leg	(5) Maturity	(6) $\Delta \text{Log}(\text{Bank CDS})$	(7)
Greece	0.052*** (2.72)	0.076*** (4.59)		0.081*** (3.88)	0.013*** (3.49)	-0.143*** (-4.08)	
Italy	0.399*** (2.88)	0.351*** (2.69)		0.642*** (4.62)	0.156*** (2.63)	-0.179 (-0.99)	
Spain	-0.069 (-0.64)	0.100 (1.42)		-0.110 (-0.74)	0.051 (0.80)	-0.197 (-1.19)	
Portugal	-0.024 (-1.14)	-0.016 (-0.99)		-0.024 (-0.59)	-0.013 (-1.27)	-0.095* (-1.73)	
Ireland	0.125* (1.67)	0.176*** (2.63)		0.134* (1.87)	0.044*** (2.69)	-0.208* (-1.77)	
Germany	-1.570*** (-8.02)	-1.200*** (-7.36)	-1.463*** (-7.35)		-1.332*** (-7.24)	2.029*** (4.25)	2.083*** (4.03)
ΔVSTOXX	-0.005*** (-8.78)	-0.003*** (-10.99)	-0.005*** (-8.82)	-0.006*** (-7.14)	-0.005*** (-8.89)	0.005*** (5.69)	0.005*** (5.72)
Home	0.169*** (3.18)						
STOXX Global 1800 Index		0.662*** (5.73)					
$\Delta \text{European Economic Sentiment}$		0.001*** (3.99)					
PC1			0.002*** (6.92)				-0.004*** (-4.09)
France				-1.168*** (-3.84)			
Constant	-0.001 (-1.36)	-0.002 (-0.49)	-0.001* (-1.73)	-0.001 (-1.55)	-0.001 (-1.58)	0.002* (1.67)	0.003** (2.10)
Observations	55,919	62,649	62,748	62,748	62,748	30,971	30,971
R-squared	0.23	0.25	0.22	0.20	0.21	0.12	0.12

- Other variables included in (2): Term Structure, Bond Default Spread, 1m Euribor, Δ Level of Industrial Production, Δ European Consumer Price Index

Tests Supporting the Notion of “Carry Trade” Behavior

- Home bias in domestic sovereign bonds
 - Include home country bond return in analysis
- Principal component analysis (PCA)
 - Use linearly independent eigenvector which is a linear combination of GIPSI bond returns that explains largest part of variation in GIPSI bond returns.
 - This „index“ is used instead of GIPSI bond returns in regressions.
 - Results are unchanged
- Funding leg
 - We use French government bond returns as funding leg.
 - We find similar (albeit weaker) results
 - See the divergence between French and German government bond returns since EOY 2011...

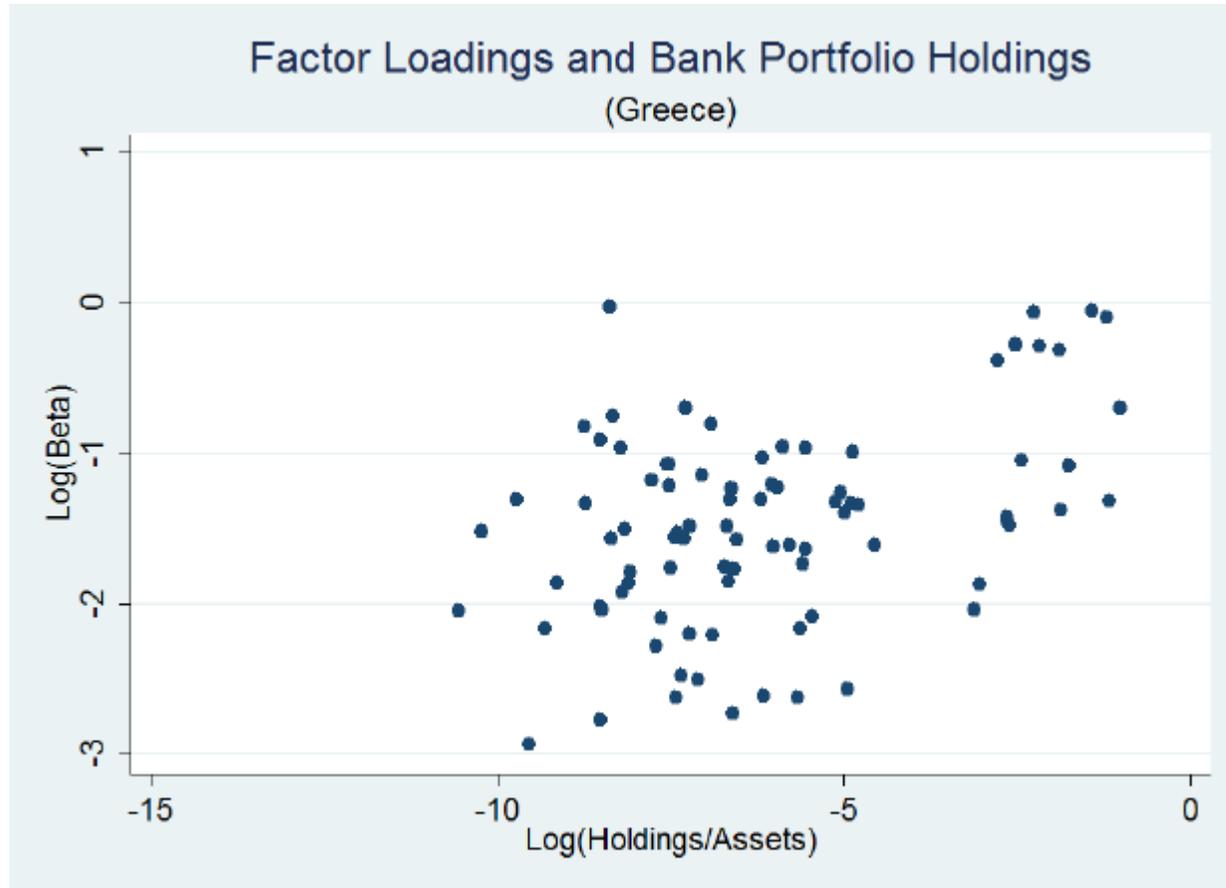
Tests Supporting the Notion of “Carry Trade” Behavior (cont’d)

- Maturity
 - Carry trades are most profitable if investments are as long-dated and funding as short-term as possible
 - Use 2-year GIPSI government bonds returns instead of 10-year
 - GIPSI coefficient reduced by factor 6
- Bank CDS spreads
 - CDS spreads important proxy for bank risk and funding costs
 - CDS spreads should reflect a widening of the gap between GIPSI and German government bonds
 - We find that if Greek bond prices fall, CDS spreads appreciate consistent with higher solvency risk of banks
 - Using PCA shows similar results

Factor Loadings and Bank's Direct Exposure

- Do these exposures relate to actual government bond holdings of banks or simply reflect some other underlying economic exposures and linkages?
- We use disclosures of sovereign bond holdings after each of the 3 stress tests
- Use same setup as in Table IV but restrict sample 60 days before and after reporting dates associated with each stress test and extract factor loadings from regressions
- Figure 4 plots $\text{Log}(\text{Beta})$ on $\text{Log}(\text{Holdings}/\text{Assets})$

Figure 4. Factor Loadings and Bank Portfolio Holdings



- Banks with larger Greek government bond holdings divided by total assets have larger factor loadings

Table V. Bond Holdings and Factor Loadings

Panel B: Correcting for Home Bias when calculating factor loading

Dependent Variables	Log(Beta _{Greece})			Log(Beta _{Italy})				Log(Beta _{Spain})				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Log(Holding)	0.189*** (3.11)		0.310*** (3.49)		0.237*** (4.21)		0.920*** (4.11)		0.130** (2.54)		-0.247 (-0.72)	
Log(Holding / Assets)		0.164*** (4.25)		0.288*** (3.52)		0.242*** (3.57)		0.951*** (4.46)		0.131*** (2.88)		-0.177 (-0.48)
Constant	-3.037*** (-7.19)	-0.785*** (-3.05)	-3.815*** (-6.68)	-0.002 (-0.00)	-2.273*** (-4.65)	0.839** (2.55)	-7.326*** (-4.42)	4.801*** (4.03)	-1.347*** (-3.15)	0.349 (1.48)	1.244 (0.53)	-1.544 (-0.68)
Bank Fixed Effects	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES
Observations	80	80	80	80	73	73	73	73	68	68	68	68
R-squared	0.13	0.15	0.06	0.05	0.13	0.11	0.12	0.14	0.05	0.05	0.01	0.00

Panel C: Correcting for Home Bias & Macro Factors when calculating factor loading

Dependent Variables	Log(Beta _{Greece})			Log(Beta _{Italy})				Log(Beta _{Spain})				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Log(Holding)	0.173*** (3.03)		0.196*** (2.80)		0.243*** (4.16)		0.688*** (3.01)		0.174*** (5.29)		-0.329 (-1.55)	
Log(Holding / Assets)		0.160*** (4.59)		0.178** (2.73)		0.251*** (3.12)		0.704*** (3.31)		0.136*** (3.75)		-0.284 (-1.45)
Constant	-2.876*** (-7.40)	-0.747*** (-3.34)	-3.022*** (-6.68)	-0.631 (-1.53)	-2.403*** (-4.37)	0.807** (2.15)	-5.687*** (-3.37)	3.370*** (2.80)	-1.601*** (-5.77)	0.421* (1.85)	1.762 (1.44)	-2.227* (-1.80)
Bank Fixed Effects	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES
Observations	80	80	80	80	73	73	73	73	68	68	68	68
R-squared	0.15	0.20	0.03	0.02	0.15	0.14	0.13	0.14	0.15	0.09	0.05	0.04

- Estimated factor loadings are positively correlated with actual holdings around the 3 EBA stress tests (cross-section and within-bank).

Bank Risk and Leverage

- One motive for banks to participate in carry trades is to exploit an implicit bailout guarantee from their domestic sovereign
 - $\text{Log}(\text{Assets})$: Large banks have higher likelihood to be bailed out
- We use a direct measure of short-term leverage (ST-LVG).
 - Banks financed with more short-term leverage should benefit more from carry trades, i.e. they can pocket the largest carry
- As proxy for bank risk on the asset side of the balance, we use the size of the loan portfolio divided by total assets (Loans / Assets)
- All risk proxies are lagged by 1 year

Table VI. Risk and Leverage

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Greece	Greece	Greece	Greece	Italy	Italy	Italy	Italy	Spain	Spain	Spain	Spain
GIPSI_t	-0.024 (-0.27)	0.051 (1.34)	0.109** (2.05)	-0.330*** (-2.74)	-0.132 (-0.45)	0.232* (1.89)	0.275* (1.65)	-2.017*** (-4.17)	-0.105 (-0.26)	0.291** (2.20)	0.138 (0.86)	-1.960*** (-3.91)
GIPSI x Log-Assets_{t-1}	0.011* (1.67)			0.019*** (2.87)	0.049** (2.05)			0.112*** (3.99)	0.042 (1.38)			0.109*** (3.64)
GIPSI x ST-LVG_{t-1}		0.190* (1.76)		0.229* (1.83)		0.778** (2.10)		0.973*** (2.94)		0.426 (1.30)		0.664* (1.93)
GIPSI x Loans / Assets_{t-1}			0.010 (0.10)	0.249** (2.48)			0.327 (1.30)	1.452*** (5.12)			0.465 (1.52)	1.484*** (4.94)
Germany_t	1.973** (2.48)	-0.833*** (-3.23)	-1.984*** (-4.61)	2.684* (1.76)	1.979** (2.33)	-0.810*** (-2.92)	-2.046*** (-4.47)	3.255** (2.10)	2.006** (2.25)	-0.876*** (-3.10)	-2.023*** (-4.35)	3.417** (2.13)
Germany x Log-Assets_{t-1}	-0.276*** (-4.25)			-0.280*** (-3.32)	-0.284*** (-4.16)			-0.300*** (-3.52)	-0.289*** (-4.02)			-0.311*** (-3.47)
Germany x ST-LVG_{t-1}		-1.550*** (-2.78)		-0.742* (-1.77)		-1.939*** (-2.97)		-1.326** (-2.46)		-1.835*** (-2.76)		-1.265** (-2.27)
Germany x Loans / Assets_{t-1}			1.131* (1.83)	-0.772 (-0.82)			1.068 (1.56)	-1.185 (-1.22)			0.974 (1.37)	-1.334 (-1.37)
ΔVSTOXX	-0.005*** (-8.68)	-0.005*** (-8.98)	-0.005*** (-8.58)	-0.005*** (-8.92)	-0.005*** (-8.49)	-0.005*** (-8.79)	-0.005*** (-8.38)	-0.005*** (-8.73)	-0.005*** (-8.62)	-0.005*** (-8.95)	-0.005*** (-8.51)	-0.005*** (-8.87)
Constant	-0.003** (-1.97)	-0.001 (-1.08)	-0.001 (-0.93)	-0.001 (-1.03)	-0.002** (-1.97)	-0.001 (-1.15)	-0.001 (-0.91)	-0.001 (-0.89)	-0.003** (-2.00)	-0.001 (-1.11)	-0.001 (-0.95)	-0.001 (-0.89)
Observations	62,508	46,514	61,211	45,217	62,508	46,514	61,211	45,217	62,508	46,514	61,211	45,217
R-squared	0.22	0.22	0.21	0.22	0.22	0.22	0.21	0.22	0.22	0.22	0.21	0.22

- Particularly large banks and banks with short-term funding are undertaking more carry trades.

Regulatory Capital Ratios

- Another motive to invest in government debt is regulatory capital arbitrage because of how banks' balance sheet exposure is treated under existing capital rules.
 - The Capital Requirement Directive (CRD) assigns a zero risk weight for *“exposures to Member States' central government [...] denominated and funded in the domestic currency of that central government”* (BIS (2011)).
 - Under the standardized approach, sovereign debt has zero risk weights. Even under the internal ratings based (IRB) approach there is a loophole (*“IRB permanent partial use”*).
- Particularly banks with low Tier 1 capital ratios have an incentive to shift into high risk assets (risk-shifting motive)
- Banks with high risk weighted assets have an incentive to invest in assets with lower risk weights (regulatory capital arbitrage motive)
 - We use Tier 1 ratio and RWA Assets as proxies for capitalization

Table VII. Regulatory Capital Ratios

	(1) Greece	(2) Greece	(3) Greece	(4) Italy	(5) Italy	(6) Italy	(7) Spain	(8) Spain	(9) Spain
GIPSI_t	-0.023 (-0.22)	-0.138 (-1.20)	-0.364** (-1.97)	0.309 (0.86)	-0.960* (-1.91)	-0.612 (-1.34)	0.167 (0.35)	-1.050** (-2.14)	-1.210** (-2.03)
GIPSI x Log-Assets_{t-1}	0.012* (1.77)	0.017** (2.16)	0.024*** (2.79)	0.055** (2.02)	0.090** (2.51)	0.099*** (4.19)	0.051* (1.69)	0.089*** (2.60)	0.116*** (4.09)
GIPSI_t x Tier 1_{t-1}	-0.001 (-0.14)		0.002 (0.28)	-0.049** (-1.99)		-0.070*** (-3.73)	-0.036 (-1.60)		-0.043* (-1.91)
GIPSI_t x RWA / Assets_{t-1}		0.098 (1.27)	0.199* (1.95)		0.672** (2.32)	0.513** (1.97)		0.745** (2.40)	0.819*** (2.62)
GIPSI_t x ST-LVG_{t-1}			0.218* (1.74)			1.181*** (4.04)			0.808*** (2.77)
Germany_t	2.054** (2.12)	1.393 (1.33)	2.453 (1.28)	1.749* (1.66)	1.740 (1.51)	2.196 (1.04)	1.794* (1.65)	1.860 (1.57)	2.376 (1.15)
Germany x Log-Assets_{t-1}	-0.264*** (-4.08)	-0.239*** (-3.40)	-0.266*** (-2.94)	-0.278*** (-3.93)	-0.264*** (-3.41)	-0.279*** (-2.91)	-0.283*** (-3.83)	-0.274*** (-3.42)	-0.291*** (-3.02)
Germany x Tier 1_{t-1}	-0.022 (-0.58)		-0.028 (-0.46)	0.012 (0.29)		0.022 (0.32)	0.011 (0.27)		0.021 (0.32)
Germany_t x RWA / Assets_{t-1}		0.278 (0.48)	-0.239 (-0.26)		0.003 (0.01)	-0.214 (-0.21)		-0.068 (-0.10)	-0.340 (-0.34)
Germany x ST-LVG_{t-1}			-0.699 (-1.61)			-1.463*** (-2.70)			-1.379*** (-2.60)
ΔVSTOXX	-0.005*** (-8.76)	-0.005*** (-9.05)	-0.005*** (-9.66)	-0.005*** (-8.55)	-0.005*** (-8.88)	-0.005*** (-9.45)	-0.005*** (-8.70)	-0.005*** (-9.01)	-0.005*** (-9.63)
Constant	-0.004** (-2.37)	-0.001 (-0.60)	-0.005 (-1.22)	-0.004** (-2.27)	-0.001 (-0.58)	-0.004 (-1.09)	-0.004** (-2.16)	-0.001 (-0.59)	-0.003 (-0.78)
Observations	60,602	60,649	44,716	60,602	60,649	44,716	60,602	60,649	44,716
R-squared	0.31	0.31	0.31	0.31	0.31	0.32	0.31	0.31	0.32

- We measure the effect individually and jointly, including ST-LVG as proxy for bank funding risk as well as size and interaction terms with size.

Risk-shifting and Regulatory Capital Arbitrage

- We find that banks with higher Tier1 capital ratios have lower exposure to Italian sovereign debt.
 - Tier1 capital increases if banks have higher RWA or if they decide to hold more economic capital. For a given amount of RWA, the negative coefficient implies higher risk-shifting incentives.
- Moreover, the positive coefficient on RWA / Assets (unlike the sign on Tier1) suggests that there is a regulatory arbitrage motive.
 - Only including one of these variables might result in biased estimates of the coefficients due to confounding effects.
 - Including both variables in the same model shows that the coefficient of Tier1 is even more negative. This result suggests that the discretionary part of Tier1 capital is more strongly related to the risk-shifting motive. In other words, not controlling for RWA understates the risk-shifting effect.
- The effects on Greek government bond holdings are (not surprisingly) somewhat muted.

Predicting Capital Raisings with Carry Trades

- As the crisis unfolded, GIPSI yields continued to rise while market value of banks dropped substantially
- Do banks with high exposures to carry trades need to increase their capital more than other banks?
- We collect all common and preferred stock issuances of our sample banks over the January 2007 to February 2012 period on a quarterly basis.
 - Capital (Yes / No) is an indicator variable that is 1 if the bank raises capital in the current quarter. 86% of sample banks have raised capital during this period.
 - Log-Capital is the natural logarithm of the amount of common and preferred capital raised.
- We use quarterly regressions for each bank and calculate the predicted return based on the estimated factor loadings and the constant term. The predicted return can be interpreted as the part of the returns that is induced by carry trades

Table IX. Capital Raisings and ECB Funding

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Capital (Yes/No)	Log-Capital						
	Logit	OLS	Logit	OLS	Logit	OLS	Logit	OLS
Realized Return_{t-1}	-1.584*** (-2.81)	-2.036*** (-3.60)			-1.609*** (-3.02)	-2.289*** (-3.94)	-1.537*** (-2.75)	-2.028*** (-3.56)
Predicted Return_{t-1}			-1.042*** (-3.14)	-1.755*** (-3.10)				
$\beta_{\text{Greece},t-1}$					0.184** -2.17	0.263*** -3.25		
$\beta_{\text{Italy},t-1}$					-0.023 (-0.24)	-0.05 (-0.35)	-0.062 (-0.60)	-0.095 (-0.59)
$\beta_{\text{Germany},t-1}$							-0.058 (-1.19)	-0.102* (-1.72)
Log-Assets_{t-1}	0.156** -2.43	0.243*** -3.01	0.093 -1.44	0.140* -1.79	0.150** -2.49	0.241*** -3.18	0.149** -2.4	0.234*** -2.99
Constant	-4.210*** (-5.14)	-1.622* (-1.72)	-3.850*** (-4.82)	-1.084 (-1.19)	-4.235*** (-5.28)	-1.722* (-1.88)	-4.180*** (-5.06)	-1.576 (-1.66)
Observations	750	750	750	750	750	750	750	750
R-squared		0.02		0.03		0.04		0.02
Pseudo R-squared	0.03		0.03		0.04		0.03	

Carry Trades and ECB Dependence

- Banks with lower realized returns as well as larger banks need to raise capital in the subsequent quarter and they need to raise more capital.
- It is not the exposure in and of itself but the impairments and capital loss incurred that consequently prompt banks to raise capital.
 - During our sample period, banks only impaired their Greek bond holdings because of the “private sector involvement” when negotiating the bailouts.
- Were the banks which did carry trades also the ones that became particularly dependent on ECB funds?
- We collect information about each bank’s liabilities from repurchase agreements to banks, customers and the ECB from their annual reports over the 2008 – 2010 period.

Carry Trades and ECB Dependence (cont'd)

- ECB Funding / Repo (dependent variable) is the percentage of each bank's funding obtained from the ECB in each year divided by total repos with banks, customers and the ECB.
- Realized Return, Predicted Return, and the factor loadings (independent variables) are measured annually and are lagged by 1 year.
 - We always include Log-Assets as bank size seems to be an important determinant. For example, implicit bailout guarantees of large banks from their governments help them obtaining financing in secured or unsecured interbank markets.
- The top 5 ECB dependent firms are Bankinter, ATEbank, Banco Commerciale Portugese, Piraeus Bank, and Alpha Bank.
- The least 5 bank dependent firms are RBS, Société Générale, BNP Paribas, Banco Sabadell and Crédit Agricole.

Table IX. Capital Raisings and ECB Funding (cont'd)

	(1)	(2)	(3)	(4)
	ECB (% Total Repo)			
Realized Return _{t-1}	-0.226 (-1.68)		-0.160 (-0.78)	-0.030 (-0.16)
Predicted Return _{t-1}		-0.249* (-1.74)		
$\beta_{\text{Greece},t-1}$			0.046*** (2.93)	
$\beta_{\text{Italy},t-1}$				-0.014 (-0.75)
$\beta_{\text{Germany},t-1}$			-0.055** (-2.09)	-0.067** (-2.51)
Log-Assets _{t-1}	-0.131*** (-4.12)	-0.147*** (-5.24)	-0.140*** (-4.55)	-0.139*** (-4.30)
Constant	2.041*** (4.86)	2.111*** (5.37)	2.067*** (4.99)	2.046*** (4.77)
Observations	80	80	80	80
R-squared	0.37	0.38	0.41	0.39

- Predicted Return is negative and significant suggesting that the part of the return that is due to carry trade behavior is an important determinant of future ECB funding.
- Private sector involvement associated with the Greece bailouts seems to explain a large part of the variation in ECB dependence among banks exposed to this country.
- Banks that are heavily exposed to short-term wholesale markets are more reliant on ECB funding as well.

Role of ECB in Funding Carry Trades

- In the “original” 1-year Long Term Refinancing Operations (LTRO) in 2009, the ECB lent about EUR 614 billion to European banks at an interest rate of 1 percent.
- *“The original LTROs, for instance, allowed some banks to go on a buying spree – using inexpensive ECB funds to snap up higher-yielding assets in a classic “carry trade”. Unfortunately many of those investments appear to have taken the form of government debt from the region’s weaker nations, strengthening the link between troubled sovereigns and banks which Europe is trying to desperately break.”* (Tracy Alloway, FT, October 2011).
- Moreover, *“the banks pretty much used the last opportunity of getting cheap money to invest in sovereign debt they thought was even cheaper”* (Gary Jenkins, Head of Fixed Income at Evolution Securities).

Figure 4. Time Series of Stock and Bond Return Correlations

This graphic shows the 30-day rolling correlations between (1) stock returns and 10-year Italian bond returns and (2) stock returns and 10-year German bond returns for all European banks included in the sample. The red lines indicate the four 1-year LTROs of the ECB on June 6, 2009, September 30, 2009, December 16, 2009 and October 27, 2011 as well as the first 3-year LTRO on December 20, 2012.

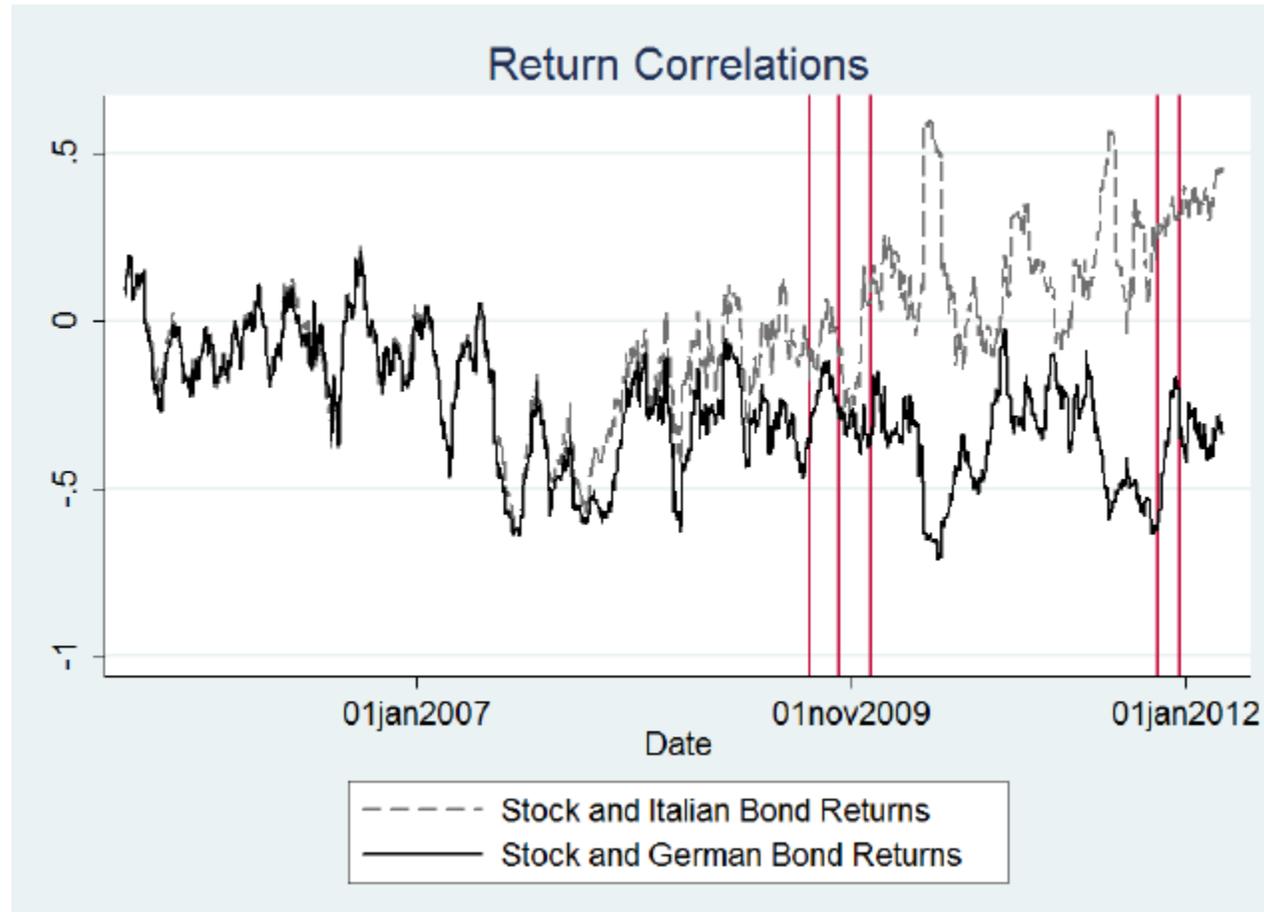
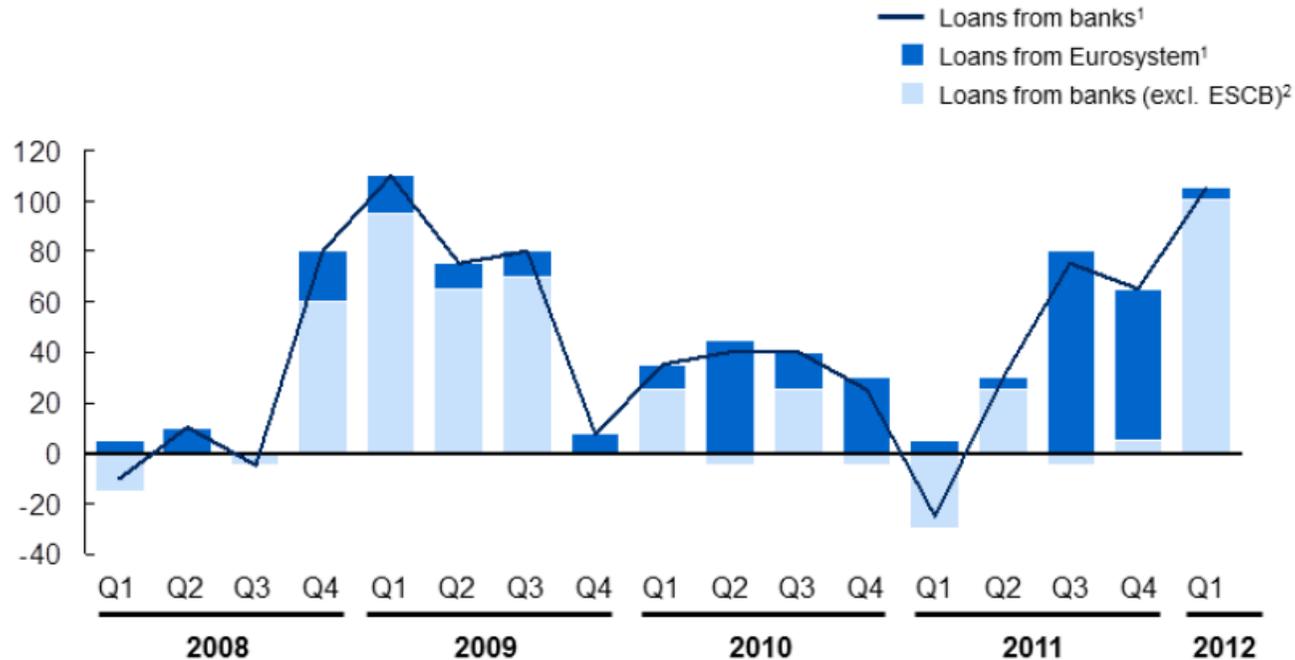


Figure 5. Loans and Sovereign Bond Flows into Public Sector



1 ECB
2 Bundesbank calculation based on ECB data

SOURCE: ECB, Deutsche Bundesbank

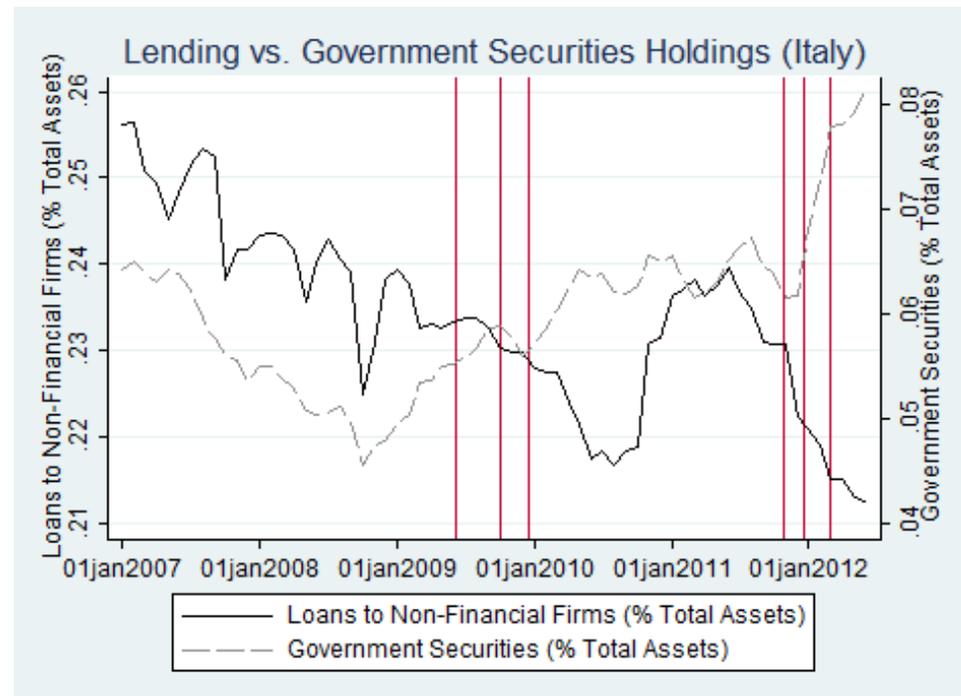
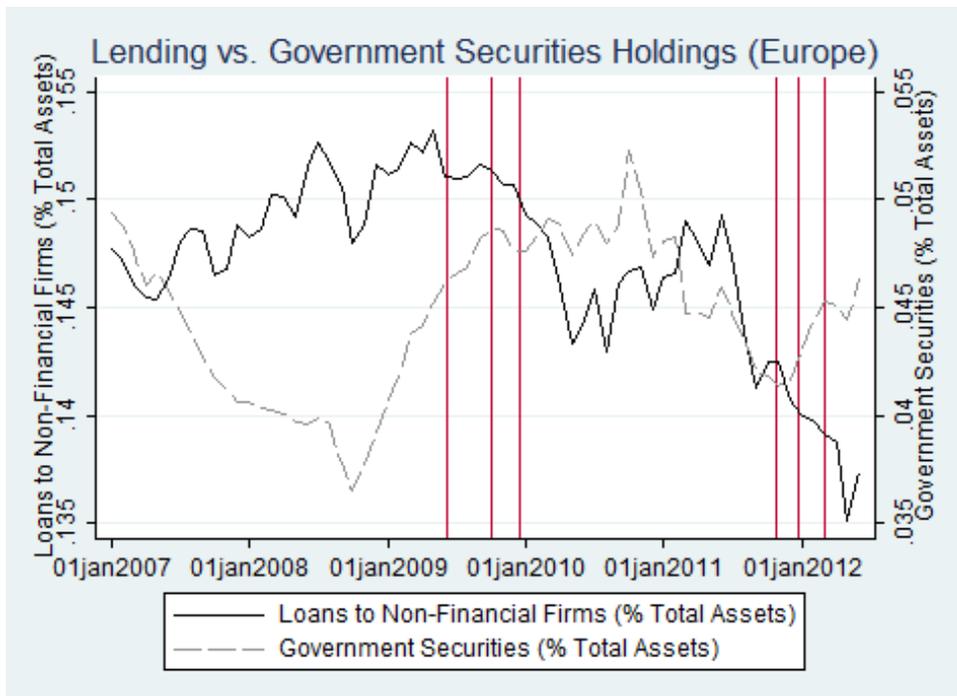
- Over EUR 280 billion invested by banks after the third 1-year LTRO. While banks have been net seller of sovereign debt in Q1 and Q3 2011, they purchased again in Q4 2011 after the fourth 1-year LTRO. About EUR 130 billion of flows in Q3 and Q4 2011 were coming from the Eurosystem.

Table X. ECB LTRO Operations

	(1) July 2011	(2) Aug 2011	(3) Sept 2011	(4) Oct 2011	(5) Nov 2011	(6) Dec 2011	(7) Jan 2012	(8) Feb 2012
GIPSI_t	-0.615 (-0.54)	-0.448 (-0.80)	-1.701 (-0.62)	-0.406 (-0.07)	-0.951 (-1.27)	-0.577 (-0.61)	-0.599 (-0.36)	-2.095 (-0.99)
GIPSI x Log-Assets_{t-1}	0.103* (1.71)	0.098*** (2.90)	0.045 (0.36)	-0.011 (-0.06)	0.105** (2.48)	0.068 (1.37)	0.191* (1.75)	0.271** (2.50)
GIPSI_t x Tier 1_{t-1}	-0.035 (-0.60)	-0.095*** (-3.02)	0.026 (0.31)	-0.014 (-0.05)	-0.060* (-1.83)	-0.001 (-0.04)	-0.125*** (-8.12)	-0.234*** (-5.67)
GIPSI_t x RWA / Assets_{t-1}	-0.262 (-0.52)	0.674** (2.44)	1.930 (1.47)	0.373 (0.17)	0.760 (1.66)	0.174 (0.36)	1.608** (2.11)	2.120* (1.69)
GIPSI_t x ST-LVG_{t-1}	0.951 (1.48)	0.409 (0.99)	0.969 (0.84)	1.572 (0.55)	1.020 (1.59)	-0.084 (-0.13)	0.417 (0.56)	4.434* (2.00)
Germany_t	6.154** (2.42)	4.683 (1.08)	6.493 (1.62)	0.794 (0.24)	-0.768 (-0.24)	2.588 (0.97)	4.135 (0.97)	3.747 (0.68)
Germany x Log-Assets_{t-1}	-0.433*** (-3.70)	-0.495** (-2.56)	-0.624*** (-2.78)	-0.385** (-2.39)	-0.025 (-0.17)	-0.246** (-2.20)	-0.134 (-0.55)	-0.262 (-0.92)
Germany x Tier 1_{t-1}	-0.029 (-0.29)	0.012 (0.10)	-0.113 (-1.12)	0.149* (1.73)	-0.006 (-0.04)	0.014 (0.11)	-0.503*** (-6.32)	-0.405*** (-3.11)
Germany_t x RWA / Assets_{t-1}	-2.160* (-1.93)	0.064 (0.03)	1.089 (0.52)	0.032 (0.02)	1.049 (0.59)	-1.230 (-0.82)	1.202 (0.67)	-1.532 (-0.48)
Germany x ST-LVG_{t-1}	-0.985 (-0.79)	-2.108 (-1.11)	0.893 (0.46)	-2.356* (-1.69)	1.307 (0.57)	-3.660* (-1.90)	6.104** (2.46)	4.262 (1.39)
ΔVSTOXX	-0.007*** (-5.02)	-0.004*** (-13.11)	-0.006*** (-10.06)	-0.001 (-0.80)	-0.009*** (-14.44)	-0.001 (-1.29)	-0.006*** (-4.42)	0.007** (2.34)
Constant	-0.048** (-2.11)	-0.021 (-1.49)	-0.039** (-2.12)	-0.016 (-0.75)	0.021 (0.95)	-0.002 (-0.29)	0.010 (0.56)	-0.028* (-1.81)
Observations	760	808	786	755	800	752	713	370
R-squared	0.31	0.25	0.43	0.28	0.28	0.22	0.26	0.26

- After the fourth 1-year LTRO, the coefficient of Italian bond returns even tripled from November 2011 to February 2012.
- Before the LTROs in Q3 and Q4 2011, interbank market froze and investors flew into German government bonds causing bond prices to rise.

Figure 6. Lending to Non-Financial Corporates vs. Government Securities Holding by European Banks



- The red lines indicate the four 1-year LTROs of the ECB on June 6, 2009, September 30, 2009, December 16, 2009 and October 27, 2011 as well as the two 3-year LTRO on December 20, 2011 and March 1, 2012.

Table XI. Do Investments in Government Bonds Crowd Out Lending? Panel A: ECB country level data

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Loans / Government Securities				Government Securities (% Total Assets)			Loans (% Total Assets)		
			Not Italy and Spain	Only Italy and Spain		Not Italy and Spain	Only Italy and Spain		Not Italy and Spain	Only Italy and Spain
2009 LTROs	-0.4963*** (-3.50)	-0.4960*** (-3.50)	-0.4765*** (-2.85)	-0.8044*** (-3.35)	0.0042*** (5.23)	0.0046*** (5.12)	0.0041*** (3.22)	0.0009 (0.76)	0.0013 (0.90)	-0.0000 (-0.02)
Oct 2011 / Dec 2011 LTRO	-0.4333 (-1.32)	-0.4468 (-1.35)	-0.4235 (-1.09)	-0.0460 (-0.10)	0.0004 (0.21)	-0.0008 (-0.42)	0.0005 (0.19)	-0.0057*** (-2.59)	-0.0050** (-2.51)	-0.0058 (-1.06)
March 2012 LTRO	-0.6889 (-1.47)	-0.7226 (-1.53)	-0.5931 (-1.07)	-0.7576 (-1.30)	0.0009 (0.32)	-0.0033 (-1.13)	0.0124*** (4.48)	-0.0086** (-2.51)	-0.0063** (-2.00)	-0.0153** (-2.47)
Log-IA	-8.2986*** (-8.71)	-8.2175*** (-8.55)	-8.5886*** (-7.43)	2.0756 (0.64)	0.0151*** (3.26)	0.0139*** (2.76)	-0.0370** (-2.24)	-0.0583*** (-9.09)	-0.0392*** (-6.22)	-0.0287 (-0.90)
Log-Banks	-0.2187* (-1.85)	-0.1893 (-1.52)	-0.2774** (-2.28)	1.4570 (0.13)	-0.0014 (-1.58)	-0.0005 (-0.62)	-0.0701 (-1.30)	-0.0129*** (-7.12)	-0.0134*** (-7.93)	-0.1706* (-1.87)
Capital (Yes / No)		-0.1119 (-0.73)			0.0021** (2.41)			0.0000 (0.03)		
ΔEuropean Economic Sentiment	-0.0417*** (-7.35)	-0.0422*** (-7.37)	-0.0444*** (-6.62)	-0.0161** (-2.50)	0.0002*** (10.56)	0.0003*** (9.97)	0.0001* (1.73)	-0.0002*** (-5.21)	-0.0001*** (-4.46)	-0.0001** (-2.42)
Constant	64.6945*** (9.64)	63.9712*** (9.42)	66.9856*** (8.27)	-20.3176 (-0.35)	-0.0711** (-2.04)	-0.0672* (-1.80)	0.8173*** (2.81)	0.6417*** (12.99)	0.5111*** (10.58)	1.6390*** (3.61)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	725	725	593	132	725	593	132	725	593	132
R-squared	0.72	0.72	0.71	0.78	0.84	0.85	0.84	0.98	0.97	0.89

- Negative sign of the coefficients in models (1) – (4) indicates that banks use the ECB liquidity to purchase sovereign debt rather than increase lending to firms.
- Banks, on average, do not increase lending after increasing capital.
- Particularly Italian and Spanish banks increased sovereign debt purchases after recent 3-year LTRO.

Table XI. Do Investments in Government Bonds Crowd Out Lending? Panel B: Bank level analysis

	(1)	(3) Loans / Government Securities		(4)	(5)	(6) Government Securities (% Total Assets)		(7)	(8)	(9) Loans (% Total Assets)		(10)
			Not Italy and Spain	Only Italy and Spain			Not Italy and Spain	Only Italy and Spain			Not Italy and Spain	Only Italy and Spain
2009 LTROs	-0.685** (-2.47)	-0.623** (-2.24)	-0.811*** (-2.80)	-0.182 (-0.26)	0.013*** (3.86)	0.015*** (3.92)	0.005 (0.76)	-0.002 (-0.96)	-0.002 (-0.64)	-0.005 (-0.89)		
Dec'11 / March'12 LTROs	0.305 (0.62)	0.325 (0.65)	0.282 (0.72)	-2.382* (-1.97)	-0.006 (-0.81)	-0.007 (-0.89)	0.019* (1.88)	-0.004 (-0.67)	-0.001 (-0.15)	-0.013** (-2.01)		
Log-TA	-0.934 (-0.85)	-0.979 (-0.89)	0.404 (0.49)	-12.659** (-2.27)	0.014 (0.89)	0.007 (0.40)	0.076** (2.05)	0.053*** (-2.81)	0.041** (-2.06)	0.137*** (-3.02)		
Capital Raising		-0.432 (-1.53)			-0.002 (-0.48)			-0.000 (-0.10)				
Constant	17.226 (1.32)	17.779 (1.36)	0.418 (0.04)	162.037** (2.41)	-0.025 (-0.13)	0.081 (0.43)	-0.839* (-1.86)	1.218*** (5.51)	1.046*** (4.50)	2.352*** (4.31)		
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Observations	362	362	291	71	373	292	81	559	439	120		
R-squared	0.73	0.73	0.72	0.71	0.90	0.89	0.84	0.98	0.97	0.94		

- Note that we cannot distinguish between the 2011 and 2012 LTROs because of the closeness of the ECB interventions which results in overlapping quarters. The results show similar patterns as observed using monthly country level data.
- Overall, our results suggest that the success of the ECB as to channel liquidity into the real sector was rather limited. Instead, banks used the liquidity to increase their portfolios of sovereign debt crowding-out lending to the real sector.

Conclusion

- During the past 2 years, increasing economic imbalances between core Europe and the periphery have caused a surge in the yield spread of peripheral countries (such as Greece, Italy, Ireland, Portugal and Spain) and a flight into German bunds.
- In this paper, we argue that European banks have placed bets on the diverging economic development within the euro area expecting (hoping!) yield spreads between, for example, Italy and Germany or Spain and Germany to converge.
- These bets or “carry trades” were designed as investments in GIPSI government bonds financed with short-term debt. As the sovereign debt crisis deepened and the situation materialized as it is, European banks lost a substantial portion of their market value.

Conclusion (cont'd)

- We consider various motives for banks to participate in carry-trades such as implicit bailout guarantees, risk-shifting, regulatory capital arbitrage, and cheap ECB financing that may have made these trades attractive for European banks.
 - We find that large banks as well as banks with more short-term debt relative to total debt, low Tier-1 ratios and high risk-weighted assets have larger carry trade exposures.
- Banks used ECB liquidity to increase their portfolios of sovereign debt rather than lending to the real sector.
- Our paper has important policy implications:
 - It speaks to the treatment of sovereign debt in the calculation of regulatory capital that a bank is required to hold. Zero risk weights imposed by the regulator increase the benefits of carry trades vis-à-vis private sector lending.
 - More broadly, it questions the role of banks in financing government debt.