EUROPEAN CENTRAL BANK

EUROSYSTEM

Working Paper Series

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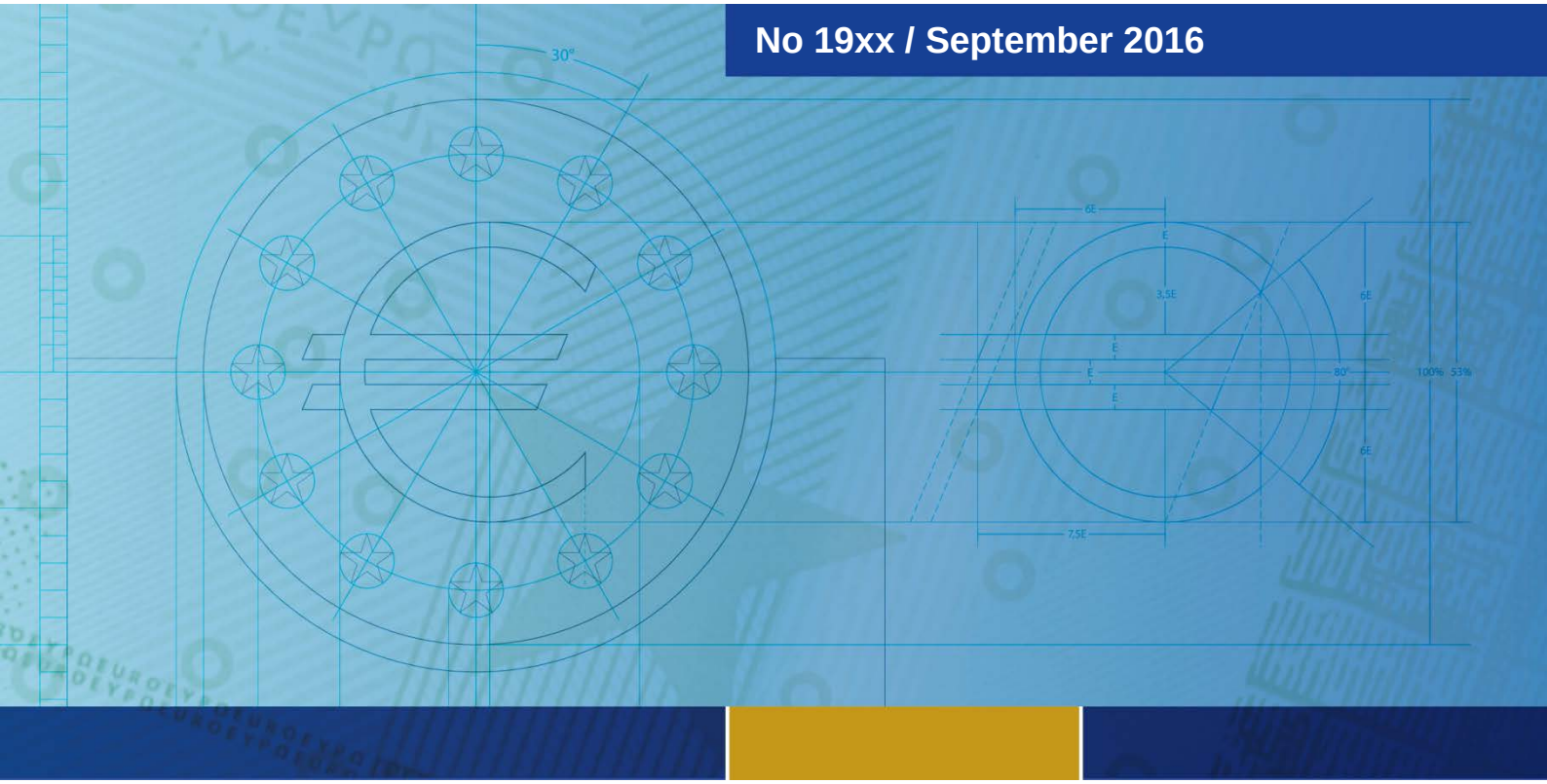
Bank exposures and sovereign stress transmission

No 19xx / September 2016



Abstract

Using novel monthly data for 226 euro-area banks from 2007 to 2015, we investigate the determinants of changes in banks' sovereign exposures and their effects during and after the euro crisis. First, the publicly owned, recently bailed out and less strongly capitalized banks reacted to sovereign stress by increasing their domestic sovereign holdings more than other banks, suggesting that their choices were affected both by moral suasion and by yield-seeking. Second, their exposures significantly amplified the transmission of risk from the sovereign and its impact on lending. This amplification of the impact on lending does not appear to arise from spurious correlation or reverse causality.

JEL classification: E44, F3, G01, G21, H63.

Keywords: sovereign exposures, sovereign risk, credit risk, diabolic loop, euro debt crisis.

1 Introduction

The euro-area sovereign debt crisis dramatically spotlighted the nexus between governments and banks and its powerful effects on lending and economic activity. The repricing of sovereign debt in Ireland, Italy, Portugal and Spain after the Greek default in 2010 led to a repricing of banks in these countries, reflecting both banks' losses on their sovereign holdings and concerns about their public bailout guarantees. But the rise in sovereign yields enticed banks to increase their sovereign exposures, further reinforcing the government-bank nexus. These large exposures implied that, in stressed countries, subsequent changes in public debt prices affected strongly banks' lending behavior: public debt repricing led to large equity losses and forced weaker banks to deleverage, reducing loan supply; symmetrically, the announcement of the Outright Monetary Transactions (OMT) program in 2012 by the ECB, by reducing sovereign stress, bestowed capital gains on stressed countries' banks in proportion to their exposures, and allowed them to expand credit again.

Hence, in stressed countries banks' holdings of domestic sovereign debt played a key role in the government-bank nexus, both during and after the crisis. In this paper we investigate both their response to sovereign stress and their impact on bank lending and risk, relying on a novel monthly panel data for 226 euro-area banks from 2007 to 2015. Exploiting the heterogeneity across the banks present in this dataset, we establish three sets of results.

First, in stressed euro-area countries, domestic publicly-owned and recently bailed-out banks reacted to sovereign stress by increasing their holdings of domestic public debt significantly more than other banks: the closer connection with government is likely to explain these banks' greater propensity to support public issuance in times of stress, consistently with the "moral suasion" hypothesis proposed by Uhlig (2013).[1] Moreover, in stressed countries, the banks with low regulatory capital increased their holdings of distressed public debt more than the others, which is consistent with the thesis that they followed a "carry trade" strategy to gamble

[1] Uhlig shows that fiscally vulnerable governments have an incentive to allow domestic banks to hold home risky bonds, in order to borrow more cheaply, while non-vulnerable governments will impose tighter regulation. Battistini, Pagano and Simonelli (2014) argue that sovereign stress heightens this incentive, generating a positive relationship between sovereign yields and banks' holdings of domestic debt, and refer to this prediction as the "moral suasion" hypothesis, a label also used in subsequent work.

Table 11: Lending Rates and Sovereign Exposures in Stressed Countries

The dependent variable is the change in the average interest rate charged on new loans by bank i to non-financial corporations in country j and quarter t. The stressed countries are Ireland, Italy, Portugal, Spain and Slovenia. $\Delta P_{jt}/P_{jt-1}$ is sovereign debt repricing, defined as the percentage change of government bond prices in country j and quarter t, based on 10-year yields in columns 1-3 and on 5-year yields in columns 4-6. Exp_{ijt-1} is the domestic sovereign exposure of bank i in country j and quarter $t-1$, defined as the ratio of sovereign debt holdings to main assets. The controls are the bank-level (lagged) capital-asset ratio and the lagged deposit-liability ratio. The estimation method is OLS in columns 1, 2, 4 and 5 and IV in columns 3 and 6, using $Bailout_{it}\times\Delta P_{jt}/P_{jt-1}$ and $Public_{ijt}\times\Delta P_{jt-1}/P_{jt-2}$ as instruments for $Exp_{ijt-1}\times\Delta P_{jt}/P_{jt-1}$. $Bailout_{ijt}$ equals 1 starting in the quarter t in which bank i in country j was bailed out (unless acquired in the two subsequent quarters), and 0 before quarter t. $Bailout_{ijt}$ equals 1 starting in the quarter t in which bank i in country j was bailed out (unless acquired in the two subsequent quarters), and 0 before quarter t. $Public_{ijt}$ is the fraction of banks' shares owned by local or national government or publicly controlled institutions (*Fondazioni* in Italy, *Fundaciones* and *Cajas* in Spain, and *Sparkasse* and *Landesbank* in Germany). The sample ranges from 2008:Q1 to 2014:Q4. Standard errors are clustered at the bank level and are shown in parentheses: $^{***}p<0.01,^{**}p<0.05,^{*}p<0.01$.

	10-Year Debt Repricing			5-Year Debt Repricing		
	(1)	(2)	(3)	(4)	(5)	(6)
$\frac{\Delta P_{jt}}{P_{jt-1}}\times Exp_{ijt-1}$	−0.06***	−0.06***	−0.01	−0.03***	−0.03***	−0.01
	(0.02)	(0.02)	(0.06)	(0.01)	(0.01)	(0.03)
Exp_{ijt-1}	0.80**	0.79**	0.24	0.67*	0.66*	0.36
	(0.35)	(0.35)	(0.76)	(0.36)	(0.35)	(0.64)
Controls	No	Yes	No	No	Yes	No
Bank FE	Yes	Yes	No	Yes	Yes	No
Time × Country FE	Yes	Yes	No	Yes	Yes	No
Adjusted R^2	0.47	0.46	−0.15	0.47	0.46	−0.15
Banks	55	55	55	55	55	55
First-stage F-Test			59			86
Observations	1482	1474	1482	1482	1474	1482

Table 12: Lending Rates and Sovereign Exposures in Non-Stressed Countries

The dependent variable is the change in the average interest rate charged on new loans by bank i to non-financial companies in country j and quarter t. The non-stressed countries are Austria, Belgium, Estonia, Finland, Germany, Luxembourg, Malta, the Netherlands and Slovakia. $\Delta P_{jt}/P_{jt-1}$ is sovereign debt repricing, defined as the percentage change of government bond prices in country j and quarter t, based on 10-year yields in columns 1-3 and on 5-year yields in columns 4-6. Exp_{ijt-1} is the domestic sovereign exposure of bank i in country j and quarter $t-1$, defined as the ratio of sovereign debt holdings to main assets. The controls are the bank-level (lagged) capital-asset ratio and the lagged deposit-liability ratio. The estimation method is OLS in columns 1, 2, 4 and 5 and IV in columns 3 and 6, using $Bailout_{it} \times \Delta P_{jt}/P_{jt-1}$ and $Public_{ijt} \times \Delta P_{jt-1}/P_{jt-2}$ as instruments for $Exp_{ijt-1} \times \Delta P_{jt}/P_{jt-1}$. $Bailout_{ijt}$ equals 1 starting in the quarter t in which bank i in country j was bailed out (unless acquired in the two subsequent quarters), and 0 before quarter t. $Public_{ijt}$ is the fraction of banks' shares owned by local or national government or publicly controlled institutions (*Fondazioni* in Italy, *Fundaciones* and *Cajas* in Spain, and *Sparkasse* and *Landesbank* in Germany). The sample ranges from 2008:Q1 to 2014:Q4. Standard errors are clustered at the bank level and are shown in parentheses: $^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.01$.

	10-Year Debt Repricing			5-Year Debt Repricing		
	(1)	(2)	(3)	(4)	(5)	(6)
$\frac{\Delta P_{jt}}{P_{jt-1}} \times Exp_{ijt-1}$	−0.01	−0.01	−0.08	−0.01	−0.01	−0.06
	(0.01)	(0.01)	(0.09)	(0.01)	(0.01)	(0.04)
Exp_{ijt-1}	−0.03	−0.12	0.78	0.08	−0.02	
	(0.38)	(0.38)	(1.08)	(0.36)	(0.36)	
Controls	No	Yes	No	No	Yes	No
Bank FE	Yes	Yes	No	Yes	Yes	No
Time × Country FE	Yes	Yes	No	Yes	Yes	No
Adjusted R^2	0.39	0.39	−0.15	0.39	0.39	−0.14
Banks	105	105	105	101	101	101
First stage F-Test			4			4
Observations	2672	2670	2672	2612	2612	2612

Table 13: Sovereign Risk Transmission to Banks: CDS Premia

The dependent variable is the change in banks' 5-year CDS premia in quarter t (defined as the difference between the end-of-period values in quarter t and quarter $t-1$). The stressed countries are Ireland, Italy, Portugal, Slovenia and Spain. The non-stressed countries are Austria, Belgium, Finland, France, Germany and the Netherlands. ΔCDS^S_{jt} is the change in the 5-year sovereign CDS premium in country j and quarter t. Exp_{ijt} is the average domestic sovereign exposure of bank i in country j and quarter t, defined as the ratio of sovereign debt holdings to main assets. D_{ij} equals 1 if bank i in country j is domestic and 0 otherwise, and $F_{ij}= 1 - D_{ij}$. The controls are the bank-level (lagged) capital-asset ratio and the lagged deposit-liability ratio. The sample ranges from 2008:Q1 to 2014:Q4. Standard errors are clustered at the bank level and are shown in parentheses: $^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.01$.

	Stressed Countries		Non-Stressed Countries	
	(1)	(2)	(3)	(4)
$D_{ij}\times\Delta CDS^S_{jt}\times Exp_{ijt}$	7.01***	6.98***	−3.02	−2.84
	(1.33)	(1.32)	(2.80)	(2.74)
$F_{ij}\times\Delta CDS^S_{jt}\times Exp_{ijt}$	−0.86	−0.91	−0.51	−0.51
	(0.82)	(0.83)	(0.63)	(0.63)
$D_{ij}\times Exp_{ijt}$	−67.86	−93.11	−3.08	−18.79
	(84.96)	(92.62)	(89.33)	(88.67)
$F_{ij}\times Exp_{ijt}$	15.21	16.80	−29.43	−49.46
	(110.18)	(94.72)	(28.77)	(33.99)
Controls	No	Yes	No	Yes
Bank FE	Yes	Yes	Yes	Yes
Time × Country FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.61	0.61	0.58	0.58
Banks	44	44	61	61
Observations	1142	1112	1601	1569

Table 14: Sovereign Risk Transmission to Banks: Yield Surprises

The dependent variable is the change of banks' 5-year CDS premia in quarter t (defined as the difference between the end-of-period values in quarter t and quarter $t-1$). The stressed countries are Italy and Spain. The non-stressed countries are France, Germany and the Netherlands. Y_{jt} is the 10-year government bond yield of country j in quarter t, and Y_{jt}^{E} is the consensus estimate of the same yield made at the end of quarter $t-1$, so that $(Y_{jt}-Y_{jt}^{E})/Y_{jt-1}$ is the unexpected percentage change ("surprise") in the domestic sovereign yield in quarter t. Exp_{ijt} is the average domestic sovereign exposure of bank i in country j and quarter t, defined as the ratio of sovereign debt holdings to main assets. The controls are the bank-level (lagged) capital-asset ratio and the lagged deposit-liability ratio. The sample ranges from from 2008:Q1 to 2014:Q4. Standard errors are clustered at the bank level and are shown in parentheses: $^{***}p<0.01,^{**}p<0.05,^{*}p<0.01$.

	Stressed Countries		Non-stressed Countries	
	(1)	(2)	(3)	(4)
$\frac{Y_{jt}-Y_{jt}^{E}}{Y_{jt-1}}\times Exp_{ijt}$	9.68**	9.62**	−1.24	−1.42
	(4.37)	(4.36)	(3.36)	(3.37)
Exp_{ijt}	−113.83	−119.54	−13.09	−35.51
	(84.92)	(86.36)	(128.52)	(128.08)
Controls	No	Yes	No	Yes
Bank FE	Yes	Yes	Yes	Yes
Time × Country FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.61	0.61	0.53	0.52
Banks	26	26	46	46
Observations	680	672	1201	1169

7 Appendix

Table A1: List of Variables, Definitions and Sources

Variable	Symbol	Definition	Source	Units
Ownership	$Public_{ij}$	Fraction of bank equity held in country j and quarter t by local or national government or by publicly controlled institutions (Fondazioni in Italy, Fundaciones and Cajas in Spain, and Sparkasse and Landesbank in Germany).	Bankscope and authors' calculations	
Sovereign debt repricing	$\Delta P_{jt}/P_{jt-1}$	Percentage change of debt prices in country j and quarter t, based on 10- or 5-year debt prices.	Datastream and authors' calculations	
Foreign subsidiary	F_{ij}	Dummy variable equal to 1 if bank i in country j is a foreign subsidiary and 0 otherwise.	ECB	
Bailout	$Bailout_{ijt}$	Dummy variable equal to 1 starting in the quarter t in which bank i in country j was bailed out (unless acquired in the two subsequent quarters), and 0 before t..	EU Commission - State Aid Database	
Sovereign holding growth rate	Sov. Holding Growth	Percentage growth rate of banks' sovereign holdings in quarter t.	IBSI-ECB and authors' calculations	
Tier-1 common equity over risk-weighted assets	$T1/RWA_{ijt-1}$	Ratio between Tier-1 common equity and risk-weighted assets of bank i in country j and quarter $t-1$	SNL	
Sovereign CDS (first difference)	ΔCDS^{S}_{jt}	Change of the 5-year sovereign CDS premium in country j and quarter t.	Datastream	%
Bank CDS (first differences)	Bank CDS	Change of banks' 5-year CDS premia in quarter t (defined as the difference between the end-of-period value in quarter t and that in period $t-1$).	Datastream	%
Domestic sovereign exposures	Exp_{ijt}	Ratio between domestic sovereign debt holdings and the main assets (total assets minus derivatives) of bank i in country j and quarter $t-1$	IBSI-ECB	
Domestic	D_{ij}	Dummy variable equal to 1 if bank i in country j is domestic and 0 otherwise.	ECB	
10-year government yield	Y_{jt}	10-year benchmark government bond yield in country j and quarter t	Datastream	
10-year government yield forecast	Y^{E}_{jt}	Consensus estimate of the 10-year government yield of country j for quarter t made by professional forecasters at the end of quarter $t-1$.	Consensus Economics	
Surprise in sovereign yield	$(Y_{jt} - Y^{E}_{jt})/Y_{jt-1}$	Unexpected percentage change (with respect to consensus forecast) in the domestic sovereign yield of country j in quarter t.	Authors' calculations	%
Bank lending growth		Percentage growth rate of loans granted by bank i in country j to non-financial companies in quarter t.	IBSI-ECB and authors' calculations	%
Domestic sovereign exposure of head banks	$Exp.Head_{iht}$	Indirect exposure of subsidiary i operating in country j to the sovereign risk of its home country $h \neq j$, arising from the sovereign holdings of the head bank of subsidiary i. Set to zero if bank i is a domestic bank of country j, i.e. if $h = j$.	IBSI-ECB and authors' calculations	
Bank-level loan interest rate (first differences)	ΔR_{ijt}	Change in the interest rate charged on new loans by bank i to non-financial coroporations in country j and quarter t.	IMIR-ECB and authors' calculations	%

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Variable	Symbol	Definition	Source	Units
Bank loan-asset ratio		Bank loans to non-financial corporations as a fraction of the corresponding bank's total assets.	IBSI - ECB	
Deposit-liabilities ratio		Ratio of bank's deposits to its total liabilities.	IBSI - ECB	

Table A2: Banks' Non-Performing Loans, Public Ownership and Bailouts

The dependent variable is the ratio of non-performing loans to total loans of bank i in country j and quarter t. The stressed countries are Ireland, Italy and Spain. The non-stressed countries are Austria, Belgium, Finland, France, Germany, and the Netherlands. $Public_{ijt}$ is the fraction of banks' shares owned by local or national government or publicly controlled institutions (*Fondazioni* in Italy, *Fundaciones* and *Cajas* in Spain, and *Sparkasse* and *Landesbank* in Germany). $VLTRO_t$ equals 1 in December 2011 and March 2012, and 0 otherwise. $Bailout_{ijt}$ equals 1 starting in the quarter t in which bank i in country j was bailed out (unless acquired in the two subsequent quarters), and 0 before quarter t. $\Delta P^{10}_{jt-1}/P^{10}_{jt-2}$ and $\Delta P^{5}_{jt-1}/P^{5}_{jt-2}$ measure the percentage change of government bond prices in country j and quarter $t-1$, respectively for 10-year and 5-year debt. The sample ranges from 2008:Q1 to 2014:Q4. Standard errors are clustered at the bank level and are shown in parentheses: $^{***}p<0.01,^{**}p<0.05,^{*}p<0.01$.

	Stressed Countries		Non-Stressed Countries	
	(1)	(2)	(3)	(4)
$Bailout_{ijt-1}$	0.01	0.01	0.05	0.05
	(0.03)	(0.03)	(0.03)	(0.03)
$Public_{ijt-1}$	-0.00	-0.00	0.00*	0.00**
	(0.00)	(0.00)	(0.00)	(0.00)
$Bailout_{ijt-1} \times \frac{\Delta P^{10}_{jt-1}}{P^{10}_{jt-1}}$	0.00		0.00	
	(0.00)		(0.00)	
$Public_{ijt-1} \times \frac{\Delta P^{10}_{jt-1}}{P^{10}_{jt-1}}$	0.00		0.00	
	(0.00)		(0.00)	
$Bailout_{ijt-1} \times \frac{\Delta P^{5}_{jt-1}}{P^{5}_{jt-1}}$		-0.00		0.00
		(0.00)		(0.00)
$Public_{ijt-1} \times \frac{\Delta P^{5}_{jt-1}}{P^{5}_{jt-1}}$		0.00		0.00
		(0.00)		(0.00)
Banks	33	33	30	30
Observations	300	287	351	351

Table A3: Banks' Non-Performing Loans and Sovereign Exposures

The dependent variable is the ratio of non-performing loans to total loans of bank i in country j and quarter t. The stressed countries are Ireland, Italy and Spain. The non-stressed countries are Austria, Belgium, Finland, France, Germany, and the Netherlands. ΔCDS^S_{jt} is the change in the 5-year sovereign CDS in quarter t, Exp_{ijt} is the average domestic sovereign exposure of bank i in country j and quarter t, defined as the ratio of sovereign debt holdings to main assets, D_{ij} equals 1 if bank i in country j is domestic and 0 otherwise, and $F_{ij} = 1 - D_{ij}$. The controls are the bank-level (lagged) capital-asset ratio and the lagged deposit-liability ratio. The sample ranges from 2008:Q1 to 2014:Q4. Standard errors are clustered at the bank level and are shown in parentheses: $^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.01$.

	Stressed Countries		Non-Stressed Countries	
	(1)	(2)	(3)	(4)
$D_{ij} \times \Delta CDS^S_{jt} \times Exp_{ijt}$	−0.00	−0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
$F_{ij} \times \Delta CDS^S_{jt} \times Exp_{ijt}$	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
$D_{ij} \times Exp_{ijt}$	0.20**	0.19**	0.15	0.15
	(0.09)	(0.09)	(0.23)	(0.23)
$F_{ij} \times Exp_{ijt}$	−0.01	0.06	0.07	0.06
	(0.09)	(0.10)	(0.07)	(0.07)
Controls	No	Yes	No	Yes
Bank FE	Yes	Yes	Yes	Yes
Time × Country FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.84	0.85	0.86	0.86
Banks	35	35	43	43
Observations	378	374	519	498

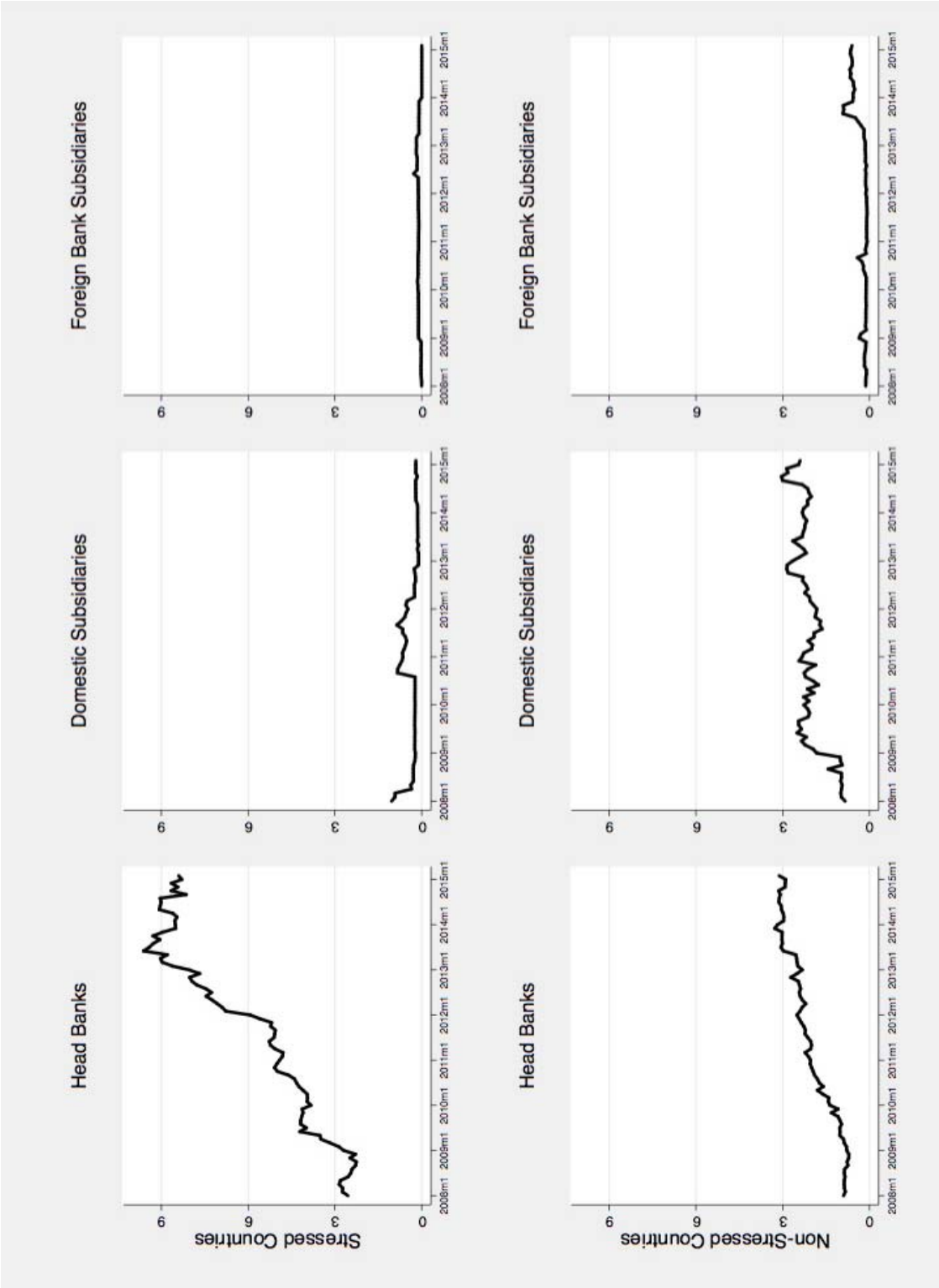

Figure 1: Median domestic sovereign exposure of head banks, domestic and foreign subsidiaries, monthly values. Domestic sovereign exposure is the ratio of domestic sovereign debt holdings to main assets (total assets less derivatives).

Acknowledgements
We thank Viral Acharya, Efraim Benmelech, Markus Brunnermeier, Elena Carletti, Charles Calomiris, Hans Degryse, Itamar Drechsler, Tim Eisert, Andrew Ellul, Nicola Gennaioli, Rony Hamaui, Balint Horvath, Luc Laeven, José Maria Liberti, Andrea Polo, Steven Ongena, Thomas Philippon, Philipp Schnabl, Harald Uhlig, and Luigi Zingales for insightful discussions and suggestions. Useful comments were provided by participants in seminars at the Central Bank of Ireland, ETH Zurich, ECB, Graduate Institute (Geneva), Humboldt University, UPF, UNSW, LUISS, Macquaire University, National Bank of Belgium, the CSEF-IGIER Symposium on Economics and Institutions, the 2016 EEA and EFA meetings, the ETH-NYU Conference on Governance and Risk-Taking, CSEF-CIM-UCL Conference on Macroeconomics after the Great Recession, the 2016 NBER Summer Institute, RELTIF workshop, 2015 RIDGE Workshop on Financial Stability, 2015 SIE conference, Workshop on Systemic Risk, Financial Networks and the Real Economy (Milan), and 2016 Riksbank Macroprudential Conference. Part of the project was done while Saverio Simonelli was visiting the ECB. Pagano and Simonelli acknowledge financial support from the CEPR/Assonime RELTIF Programme and EIEF. The opinions in this paper are those of the authors and do not necessarily reflect the views of the European Central Bank and the Eurosystem.

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ISSN	1725-2806 (pdf)
ISBN	xxx-xx-xxx-xxxx-x (pdf)
DOI	xx.xxxx/xxxxxx (pdf)
EU catalogue No	QB-xx-xx-xxx-EN-N (pdf)