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## Monetary Policy, Bank Bailouts and the Sovereign-Bank Risk Nexus in the Euro Area

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# **Online appendix to “Monetary policy, bank bailouts and the sovereign-bank risk nexus in the euro area”**

15 June 2018

This appendix contains additional material to the paper entitled “Monetary policy, bank bailouts and the sovereign-bank risk nexus in the euro area”. Section 1 describes the data, definitions and sources used in the empirical analysis. Section 2 presents additional analyses for the baseline model. Section 3 and 4 contain robustness tests of the baseline model for the euro area and for the country-specific models, respectively.

# 1 Data, sources, and definitions

**Table 1A: Data, sources, and definitions of variables**

The table shows the data, sources, and definitions used in the empirical analysis.

Endogenous variables by country					
Sovereign CDS	Banks CDS	Non-financials CDS	Short rate*	Stock market index**	Sample start***
euro area: unweighted average of all countries except of Greece	Unweighted average of all bank CDS spreads (see below)	Unweighted average of all non-financial corporate CDS spreads (see below)	Term spread: unweighted average of country term spreads	Euro Stoxx 50	24.10.2006
Austria	Erste Group Bank, Raiffeisen Zentralbank, BAWAG PSK	Telekom Austria	Interbank	ATX	20.01.2004
Belgium	KBC Bank	Solvay	Treasury bill	BEL 20	12.05.2005
France	BNP Paribas, Credit Agricole, Natixis, Societe Generale	Accor, Air France, Alstom, Capgemini, Carrefour, Casino, Guipchin, Electricite de France, GDF Suez, Lafarge, Legrand France, Michelin, Pernod Ricard, Renault, Sanofi-Aventis, Schneider Electrical, Technip, Vinci, Vivendi	Treasury bill	CAC 40	16.08.2005
Germany	Bayerische Landesbank, Commerzbank, Deutsche Bank, HSH Nordbank, IKB Deutsche Industriebank, LB Badenwürttemberg, LB Hessen-Thüringen, Nord-LB, Portigon	BASF, Bayer, Deutsche Post, E.ON, HeidelbergCement, Henkel, Linde, REW, Thyssen Krupp, Volkswagen	Interbank	DAX 30	09.02.2004
Greece	Alpha Bank	Hellenic Telecom	Interbank	ATHEX COMPOSITE	09.01.2004
Ireland	Allied Irish BanksThe Governor and Company, Permanet SB Public	Smurfit Kappa	Interbank	IRELAND SE OVERALL (ISEQ)	24.10.2006
Italy	Banca Monte dei Paschi di Siena, Banco Popolare, Banca Popolare di Milano Soco, BNL, Mediobanca, Unicredito Italiano, Unione die Banche, Intesa Sanpaolo	Enel, Eni, Fiat, Finmeccanica, Telekom Italia	Interbank	FTSE MIB INDEX	02.03.2004

Netherlands	Coöptieve Cente Rabobank, SNS Bank, Fortis Bank, ING Bank	Aegon, Akzo Nobel, Heineken, Koninklijke Philips, Unilever, Wolters Kluwer, Eneco Holding, Essent, Koninklijke Ahold, Koninklijke DSM, Koninklijke KPN	Interbank	AEX	23.10.2006
Portugal	Banco Commercial Portugues, Banco Espirito Santo, Caixa Geral de Diposits	EDP – Energias de Portugal, Portugal Telekom, Brisa – Auto-Estradas de Portugal	Interbank	PSI-20	23.11.2005
Spain	Banco Popular Espanol, Bankinter, BBV Argentaria, Banco Santander	Endesa, Gas Natural, Iberdrola, Repsol, Telefonica	Interbank	IBEX 35	23.10.2006

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**Exogenous variables**

All for sample period 06.01.2004-31.07.2013

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Money market spread	3 Month Euribor – 3M OIS spread
ECB non-standard measures	Announcement dummies for LTROs between 6 and 12 months (28 Mar., 4 Sep., and 15 Oct. 2008; 7 May 2009; 4 Aug. and 6 Oct. 2011), Allotted amounts in LTROs (in bn. Euro)  Announcement dummy for LTROs between 12 and 36 months (8 Dec. 2011), Allotted amounts in LTROs (in bn. Euro, equally split over three days before and on day after the auction)  SMP announcement dummies (10 May 2010, 8 Aug. 2011), Change in SMP holdings (Euro bn., split over the week)  OMT announcement dummies (26 Jul. and 6 Sep. 2012)
Bailout announcements	CGFS, & BIS (2010, October 27). Financial sector rescue plan database, maintained by the BIS, under the auspices of the Committee on the Global Financial System (29sep2008, 30sep2008, 06oct2008, 07oct2008, 08oct2008, 09oct2008, 10oct2008, 13oct2008, 14oct2008, 15dec2008)
Implied volatility	Vdax New
Macroeconomic news	Difference between realization and median forecast of forecasters surveyed by Bloomberg several days prior to data release for the following variables: Ifo Pan Germany Business Climate, ECB M3 Annual Growth Rate SA, Eurostat Eurozone Core MUICP YoY NSA, European Commission Consumer Confidence, European Commission Manufacturing Confidence, Eurozone Industrial Confidence, European Commission Economic Sentiment Indicator, ZEW Germany Expectation of Economic Growth, Germany Industrial Production MoM SA, Italy Business Confidence, France Households Consumption Goods Expenditure Total MoM, Bank of France Business Sentiment Indicator, Germany Manufacturing Orders MoM SA, Germany Retail Sales Const.2005 Prices YoY NSA, Germany GDP Chain Linked Pan German QoQ, USA GDP YoY

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Notes: \* 3 month; long rate is always yield on 10 year benchmark government bond, \*\* total return indices, \*\*\* sample end is always 31.07.2013, except for Greece (ends on 23.02.2012)

Source: All financial market data are downloaded from Datastream and Bloomberg; Within Datastream we combine CDS data from two sources, Thomson Reuters and Credit Market Analysis (CMA). Since CMA data end in 2010, we use growth rates of respective Reuters series for updating. The correlation between prices from both sources is mostly higher than 0.98 for an overlapping period 2007-2010. Data on ECB measures are downloaded from the ECB's website.

**Table 2A: Summary statistics**

The table provides summary statistics for the main variables used in the structural VARs for the euro area and in the event studies. All variables except of policy announcements, allotments and surprises are in first (log) differences. For further details on the variables see Table 1A.

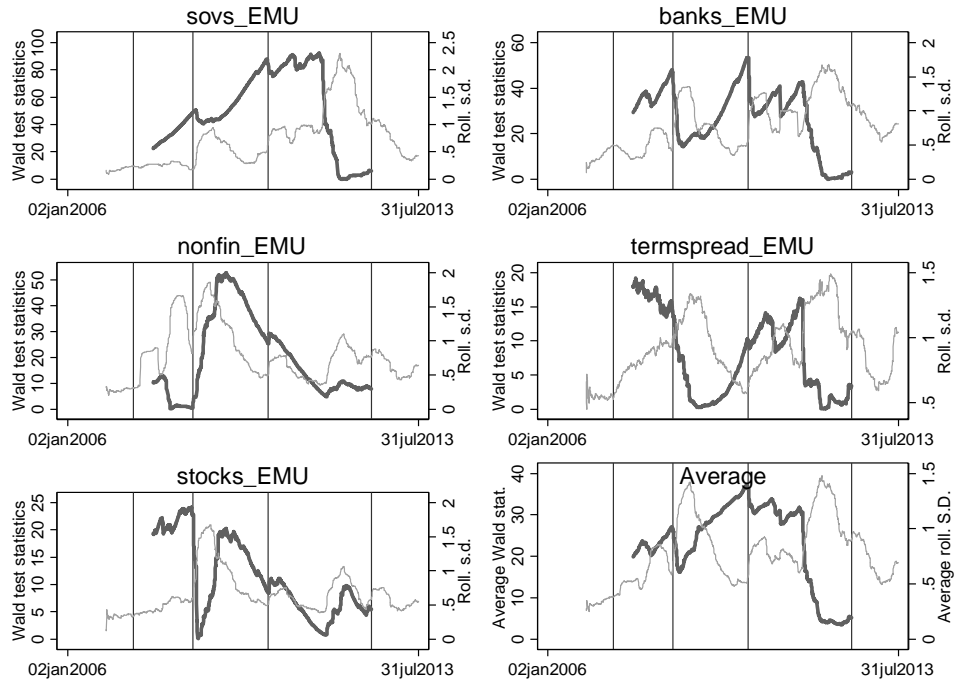
	Observations	Mean	Standard dev.	Minimum	Maximum
Sovereign CDS spreads EMU (b.p)	1766	0.080	7.30	-57.33	71.28
Bank CDS spreads EMU (b.p)	2096	0.119	4.75	-49.94	31.93
Nonfinancial CDS spreads EMU (b.p)	2182	0.022	3.81	-33.55	28.55
Term spread EMU (b.p)	2486	0.041	4.10	-31.26	27.93
Sovereign CDS spreads core (b.p)	1767	0.017	3.53	-37.30	26.65
Bank CDS spreads core (b.p)	2486	0.059	3.52	-33.33	27.73
Sovereign CDS spreads periphery (b.p)	1766	0.158	13.10	-112.82	127.08
Bank CDS spreads periphery (b.p)	2096	0.178	6.84	-72.09	44.94
VDax New (option implied volatility) (%)	2486	-0.001	1.58	-15.05	21.92
Money market spread (3M Euribor – OIS) (b.p)	2486	0.002	2.15	-15.00	28.60
Euro Stoxx 50 (%)	2486	0.014	1.44	-8.19	10.44
<u>ECB and bailout measures</u>					
Announcement LTRO 6-12 month	2487	0.002	0.05	0.00	1.00
Announcement LTRO 36 month	2487	0.000	0.02	0.00	1.00
Announcement SMP	2487	0.001	0.03	0.00	1.00
Announcement OMT	2487	0.001	0.03	0.00	1.00
Allotted amounts in LTRO 6-12m (bn.)	2487	0.394	9.48	0.00	442.24
Allotted amounts in LTRO 36m (bn.)	2487	0.410	14.45	0.00	529.53
Announcement deposit guarantees EMU	2487	0.000	0.01	0.00	0.22
Announcement debt guarantees EMU	2487	0.000	0.01	0.00	0.44
Announcement capital injections EMU	2487	0.000	0.01	0.00	0.33
<u>Macroeconomic surprises</u>					
GRIFPBUS	2487	0.156	0.89	-2.80	9.50
ECMAM3YY	2487	-0.003	0.11	-2.10	1.20
EUCCEMU	2487	-0.008	0.46	-5.40	6.50
EUICEMU	2487	0.039	0.66	-5.80	12.30
EUESEMU	2487	0.062	0.72	-4.00	14.20
GRZEWI	2487	-0.010	1.91	-19.90	27.80
GRIPIMOM	2487	-0.001	0.26	-3.90	3.40
ITBCI	2487	0.368	2.12	-3.50	18.20
GRiORTMM	2487	0.007	0.65	-6.90	7.10
GRFRINYY	2487	0.023	0.61	-6.90	7.70
GRGDPPGQ	2487	0.001	0.05	-1.10	1.00
GDPCQQQ	2487	-0.008	0.18	-3.70	2.30

## 2 Specification tests and additional results for euro area models

### 2.1 Additional statistical analyses

**Figure 1A: Wald supremum tests for structural break in variance at unknown date**

The figure shows supremum Wald tests for a structural break in the level of the squared reduced-form residuals of the baseline five-variable VAR model at an unknown break date, using a symmetric trimming rate of 15% (black line, left axis), and the rolling standard deviation of the equation-specific reduced-form residuals (grey line, right axis).



**Table 3A: Portmanteau test for autocorrelation**

The table shows the Q-statistics and p-values of Portmanteau tests of the null hypothesis of no autocorrelation at lag 1 to 1-5 in the reduced-form residuals of the endogenous variables of the five-variable VAR(5) specification for the euro area.

<b>Residual of equation</b>					
Lags	Sovereign risk	Bank risk	Nonfin. risk	Term spread	Stock market
			<u>Q statistic</u>		
1	2.589	0.101	1.432	0.972	8.512
1-2	2.956	2.078	1.525	1.123	11.837
1-3	3.280	2.245	1.858	2.046	15.489
1-4	4.661	2.705	1.863	2.127	16.415
1-5	4.662	7.809	2.757	2.135	16.659
			<u>P-value</u>		
1	0.108	0.750	0.231	0.324	0.004
1-2	0.228	0.354	0.466	0.570	0.003
1-3	0.350	0.523	0.602	0.563	0.001
1-4	0.324	0.608	0.761	0.712	0.003
1-5	0.459	0.167	0.737	0.830	0.005

**Table 4A: Durbin's alternative test for autocorrelation**

The table shows the  $d$ -statistics and  $p$ -values of Durbin's alternative test of the null hypothesis of no autocorrelation at lag 1 to 1-5 in the reduced-form residuals of the endogenous variables of the five-variable VAR(5) specification for the euro area.

Lags	Residual of equation				
	Sovereign risk	Bank risk	Nonfin. risk	Term spread	Stock market
	<u><math>d</math> statistic</u>				
1	2.148	0.662	0.478	1.797	14.039
1-2	1.112	2.590	0.488	1.004	8.230
1-3	1.063	1.758	0.380	1.813	7.065
1-4	0.907	1.718	0.299	1.525	5.657
1-5	0.807	2.554	0.542	1.190	4.506
	<u><math>p</math>-value</u>				
1	0.143	0.416	0.489	0.180	0.000
1-2	0.329	0.075	0.614	0.367	0.000
1-3	0.364	0.153	0.768	0.143	0.000
1-4	0.459	0.143	0.878	0.192	0.000
1-5	0.544	0.026	0.744	0.311	0.000

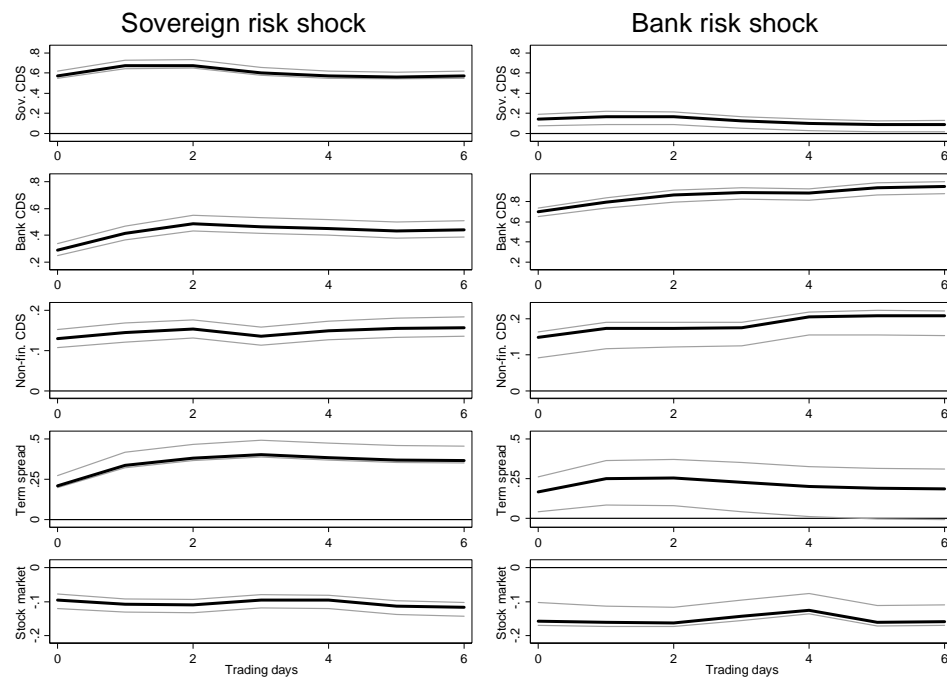




## 2.2 Impulse responses

**Figure 2A: Impulse responses to sovereign and bank risk shocks**

The table shows the cumulative effects of one standard deviation sovereign and bank risk shocks on the standardized endogenous variables over a horizon of 6 trading days, based on a five-variable SVAR for the euro area. Shocks are in columns, responses in rows. The sample period is 24 October 2006 until 31 July 2013. The number of observations is 1761. 90 percent confidence bands are based on 1000 bootstrap replications.



### ***2.3 Interpretation of structural shocks***

Figure 3A shows the structural shock series (grey bars) together with their 200 days rolling standard deviations (black line). Generally, the volatilities peak around two episodes. Intuitively, the peaks correspond to the global financial crisis and the European debt crisis. Nevertheless, there are important differences across peaks.

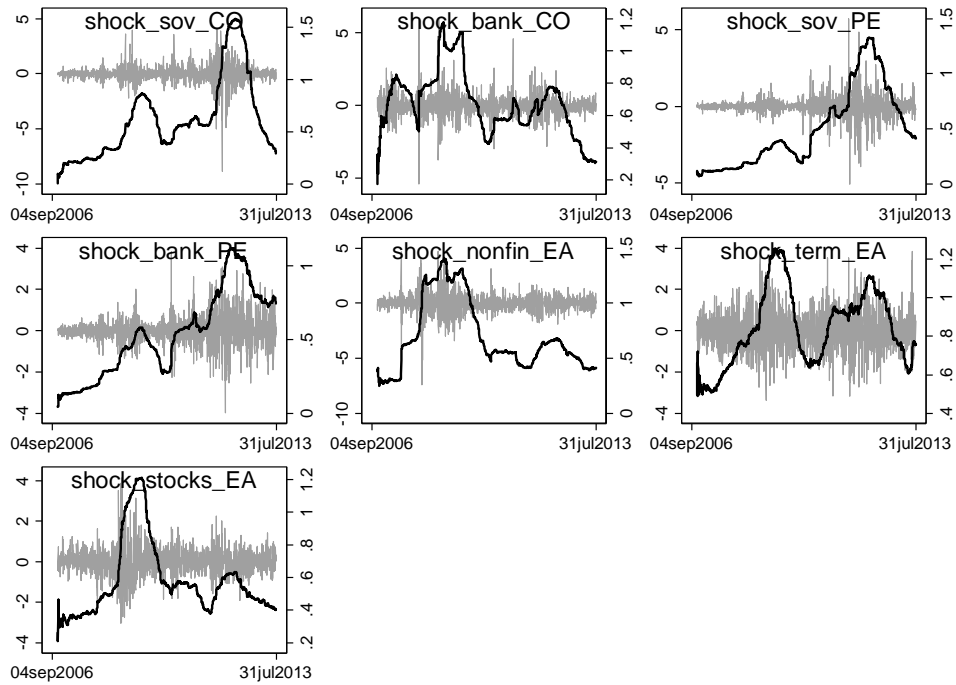
Regarding shocks to core sovereign risk, the first peak is lower. It mirrors the steep recession which impaired public finances in these countries. The second volatility peak is higher by a factor of roughly two. This is plausible given that at that time even the sustainability of public finances of several core countries was questioned, which by then had gained massive exposure to the banking sector and to other sovereigns. In terms of single shocks, the largest (negative) shock occurred on November 30, 2011, the first trading day after finance ministers agreed upon leveraging the EFSF. Conversely, for shocks to core bank risk, the first volatility peak is higher. Again, this squares with our shock interpretation as during this period stress in US financial markets was transmitted to the European banking sector. In addition, banks received rescue packages following the bankruptcy of Lehman brothers. The bailouts transferred large parts of the credit risks on banks' balance sheets to their sovereigns. Accordingly, the second peak is lower. Further, there is a third peak at the beginning of the sample. It reflects tensions in the US market for mortgage backed securities which affected European banks – but not sovereigns. Regarding single days, the largest bank shock materialised on September 26, 2008, when Washington Mutual failed.

Regarding sovereign and bank risk shocks in the periphery, volatilities peak during the second crisis. This is consistent with periphery banks being less affected by spillovers from the US, but more by domestic factors, as in Spain for example. Regarding the relative height of the peaks, the increase in volatility is stronger for sovereign shocks. This confirms that the main source of credit shocks in the periphery was the sovereign sector, as for example in Italy. In fact, the largest shock to sovereign risk was on November 1<sup>st</sup>, 2011, when Greece announced a referendum on the bailout offered by its European partners. The largest (negative) bank risk shock occurred on January 3<sup>rd</sup>, 2011. On that day, the ECB announced that the Belgian Peter Praet was to succeed Jürgen Stark into the executive board, instead of the German Jörg Asmussen.

Concerning shocks to non-financial risk and to the stock market, volatility is higher during the first crisis. This seems reasonable given that the associated recession was deeper. For term spread shocks, both peaks are of similar height. The first spike coincides with massive downward revisions of growth expectations and aggressive monetary easing, which affected the business cycle component of the term spread. The second hike reflects elevated credit risk premia in the European government bond market.

**Figure 3A: Interpretation of structural shocks for core-periphery specification**

The figure shows the daily structural shocks (grey bars, left axis) together with their 200 days rolling standard deviations (black line, right axis). The estimated shocks are based on a seven-variable VAR for the euro area core and periphery. The sample period is 24 October 2006 until 31 July 2013.



### 3 Sensitivity analysis of the baseline model for the euro area

**Table 6A: Effects among endogenous variables when including money market spread and VDAX as endogenous variables**

The table shows the estimated direct effects and overall effects of a unit structural shock on the endogenous variables, based on a seven-variable SVAR for the euro area that includes the money market spread and the VDAX as endogenous variables. The direct effects are contained in the matrix  $A$  of the structural model  $Ay_t = \tilde{c} + \tilde{A}_1 y_{t-1} + \Lambda + \varepsilon_t$ . The overall effects are contained in  $A^{-1}$  and refer to the structural model pre-multiplied by  $A^{-1}$ :  $y_t = c + A_1 y_{t-1} + \Lambda + A^{-1} \varepsilon_t$ . The overall effects capture all contemporaneous propagation among variables. Impulse variables are in columns, response variables are in rows. The sample period is 24 October 2006 until 31 July 2013. The number of observations is 1761. \*\*\*, \*\*, \* denotes significance at the 1%, 5%, 10% level, respectively. P-values based on 1000 bootstrap replications are below point estimates.

Response	Impulse						
	Sov. risk	Bank risk	Nonfin. risk	Term spread	Stock market	Money M.	VDAX
	<u>Direct effects</u>						
Sovereign risk	1	0.11***	0.03***	0.02***	-0.06***	0.00***	-0.01***
<i>p-value</i>	.	(0.00)	(-0.04)	(-0.16)	(-0.01)	(-0.4)	(-0.38)
Bank risk	0.53***	1	0.24***	-0.02***	-0.01***	0.06***	-0.09***
<i>p-value</i>	(0.00)	.	(0.00)	(-0.34)	(-0.31)	(0.00)	(0.00)
Nonfin risk	0.07***	0.12***	1	0.15***	-0.36***	-0.04***	0.11***
<i>p-value</i>	(0.00)	(0.00)	.	(0.00)	(0.00)	(-0.23)	(-0.01)
Term spread	0.37***	0.21***	-0.34***	1	0.07***	-0.15***	0.05***
<i>p-value</i>	(0.00)	(0.00)	(0.00)	.	(-0.14)	(0.00)	(-0.2)
Stock market	-0.12***	-0.24***	-0.13***	0.06***	1	0.04***	-0.37***
<i>p-value</i>	(0.00)	(0.00)	(0.00)	(-0.06)	.	(-0.3)	(0.00)
Money M.	0.07***	-0.15***	0.06***	-0.07***	-0.40***	1	-0.09***
<i>p-value</i>	(-0.04)	(-0.02)	(-0.26)	(-0.11)	(0.00)	.	(-0.18)
VDAX	0.07***	0.14***	0.02***	-0.05***	-0.38***	-0.01***	1
<i>p-value</i>	(-0.04)	(0.00)	(-0.3)	(-0.09)	(0.00)	(-0.42)	.
	<u>Overall effects</u>						
Sovereign risk	1.12***	0.17***	0.09***	0.02	-0.11***	0.00	0.03
<i>p-value</i>	(0.00)	(0.00)	(0.00)	(0.18)	(0.00)	(0.42)	(0.17)
Bank risk	0.67***	1.16***	0.32***	0.02	-0.19***	0.04*	0.00
<i>p-value</i>	(0.00)	(0.00)	(0.00)	(0.34)	(0.00)	(0.07)	(0.47)
Nonfin risk	0.41***	0.39***	1.14***	0.12**	-0.51***	-0.06	0.30***
<i>p-value</i>	(0.00)	(0.00)	(0.00)	(0.03)	(0.00)	(0.22)	(0.00)
Term spread	0.39***	0.16**	-0.32***	0.98***	0.23***	-0.11**	-0.08
<i>p-value</i>	(0.00)	(0.02)	(0.00)	(0.00)	(0.00)	(0.02)	(0.15)
Stock market	-0.43***	-0.47***	-0.33***	0.06	1.32***	0.04	-0.48***
<i>p-value</i>	(0.00)	(0.00)	(0.00)	(0.26)	(0.00)	(0.42)	(0.00)
Money M.	0.12***	0.00	0.16*	-0.08*	-0.5***	0.98***	0.11
<i>p-value</i>	(0.00)	(0.44)	(0.05)	(0.08)	(0.00)	(0.00)	(0.2)
VDAX	0.32***	0.36***	0.22***	-0.07	-0.56***	-0.01	1.20***
<i>p-value</i>	(0.00)	(0.00)	(0.00)	(0.18)	(0.00)	(0.46)	(0.00)

**Table 7A: Effects among endogenous variables when excluding money market spread and VDAX form exogenous variables**

The table shows the estimated direct effects and overall effects of a unit structural shock on the endogenous variables, based on a five-variable SVAR for the euro area that excludes the money market spread and the VDAX from the exogenous variables. The direct effects are contained in the matrix  $A$  of the structural model  $Ay_t = \tilde{c} + \tilde{A}_1 y_{t-1} + \Lambda + \varepsilon_t$ . The overall effects are contained in  $A^{-1}$  and refer to the structural model pre-multiplied by  $A^{-1}$ :  $y_t = c + A_1 y_{t-1} + \Lambda + A^{-1} \varepsilon_t$ . The overall effects capture all contemporaneous propagation among variables. Impulse variables are in columns, response variables are in rows. The sample period is 24 October 2006 until 31 July 2013. The number of observations is 1761. \*\*\*, \*\*, \* denotes significance at the 1%, 5%, 10% level, respectively. P-values based on 1000 bootstrap replications are below point estimates.

Response	Impulse				
	Sovereign risk	Bank risk	Nonfin. risk	Term spread	Stock market
	Direct effects				
Sovereign risk	1	0.10***	0.03***	0.01***	-0.05***
<i>p-value</i>	.	(-0.01)	(-0.04)	(-0.23)	(0.00)
Bank risk	0.55***	1	0.24***	-0.04***	0.04***
<i>p-value</i>	(0.00)	.	(0.00)	(-0.21)	(-0.11)
Nonfin risk	0.09***	0.11***	1	0.16***	-0.41***
<i>p-value</i>	(0.00)	(0.00)	.	(0.00)	(0.00)
Term spread	0.38***	0.26***	-0.34***	1	0.15***
<i>p-value</i>	(0.00)	(0.00)	(0.00)	.	(-0.03)
Stock market	-0.13***	-0.32***	-0.20***	0.02***	1
<i>p-value</i>	(0.00)	(0.00)	(0.00)	(-0.36)	.
	Overall effects				
Sovereign risk	1.11***	0.15***	0.09***	0.02	-0.09***
<i>p-value</i>	(0.00)	(0.00)	(0.00)	(0.21)	(0.00)
Bank risk	0.68***	1.15***	0.32***	0.01	-0.13***
<i>p-value</i>	(0.00)	(0.00)	(0.00)	(0.39)	(0.00)
Nonfin risk	0.42***	0.36***	1.13***	0.16**	-0.45***
<i>p-value</i>	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)
Term spread	0.39***	0.17**	-0.32***	0.95***	0.26***
<i>p-value</i>	(0.00)	(0.04)	(0.00)	(0.00)	(0.00)
Stock market	-0.44***	-0.46***	-0.35***	-0.02	1.15***
<i>p-value</i>	(0.00)	(0.00)	(0.00)	(0.40)	(0.00)

**Table 8A: Bidirectional effects at the euro area level when excluding individual countries**

The table shows the estimated overall effects between sovereign risk and bank risk, based on a five-variable SVAR for the euro area when excluding one country at a time from euro area averages. \*\*\*, \*\*, \* denotes significance at the 1%, 5%, 10% level, respectively, based on 1000 bootstrap replications. Bootstrap p-values are below point estimates.

	<u>Country excluded</u>								
	AT	BE	DE	ES	FR	IE	IT	NL	PT
Bank risk on sov. risk	0.24***	0.24***	0.28***	0.16***	0.22***	0.25***	0.12***	0.24***	0.10*
<i>p-value</i>	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.05)
Sovereign on bank risk	0.54***	0.53***	0.54***	0.57***	0.53***	0.53***	0.48***	0.56***	0.64***
<i>p-value</i>	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

**Table 9A: Bidirectional effects at the euro area level using alternative bank and nonfinancial indices**

The table shows the estimated overall effects between sovereign risk and bank risk, based on a five-variable SVAR for the euro area when using alternative CDS indices for banks (columns 1-3) and for nonfinancial corporations (columns 4-5). The nonfinancial index in column (5) is constructed as an unweighted average of 13 Thomson Reuters sector indices CDS 5Y excluding banks, insurance companies, and financial service companies. \*\*\*, \*\*, \* denotes significance at the 1%, 5%, 10% level, respectively, based on 1000 bootstrap replications. Bootstrap p-values are below point estimates.

	<u>Alternative bank index</u>			<u>Alternative nonfinancial index</u>	
	(1)	(2)	(3)	(4)	(5)
	ITRAXX SEN	ITRAXX	EU BANKS	ITRAXX	EU NONFIN
	FINL 5Y	SUB FINL	SECTOR CDS	HIVOL 5Y	SECTOR CDS
		5Y	INDEX 5Y		INDEX 5Y
Bank risk on sov. risk	0.14***	0.18***	0.07**	0.18***	0.18***
<i>p-value</i>	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
Sovereign on bank risk	0.39***	0.51***	0.53***	0.56***	0.56***
<i>p-value</i>	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)



**Table 10A: Overall effects at the euro area level using GDP-weights**

The table shows the estimated overall effects of a unit structural shock on the endogenous variables, based on a five-variable SVAR using GDP-weights to construct euro area averages. Impulse variables are in columns, response variables are in rows. The sample period is 24 October 2006 until 31 July 2013. The number of observations is 1761. \*\*\*, \*\*, \* denotes significance at the 1%, 5%, 10% level, respectively, based on 1000 bootstrap replications.

Response	Impulse				
	Sovereign risk	Bank risk	Nonfin. risk	Term spread	Stock market
Sovereign risk	1.10***	0.13**	0.06***	0.03	-0.10***
<i>p-value</i>	(0.00)	(0.02)	(0.00)	(0.12)	(0.00)
Bank risk	0.66***	1.11***	0.32***	0.08	-0.22***
<i>p-value</i>	(0.00)	(0.00)	(0.00)	(0.18)	(0.00)
Nonfin risk	0.29***	0.13**	1.04***	0.14***	-0.43***
<i>p-value</i>	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
Term spread	0.40***	0.09	-0.24***	0.98***	0.14**
<i>p-value</i>	(0.00)	(0.30)	(0.00)	(0.00)	(0.04)
Stock market	-0.24***	-0.18***	-0.13***	0.01	1.08***
<i>p-value</i>	(0.00)	(0.00)	(0.00)	(0.48)	(0.00)

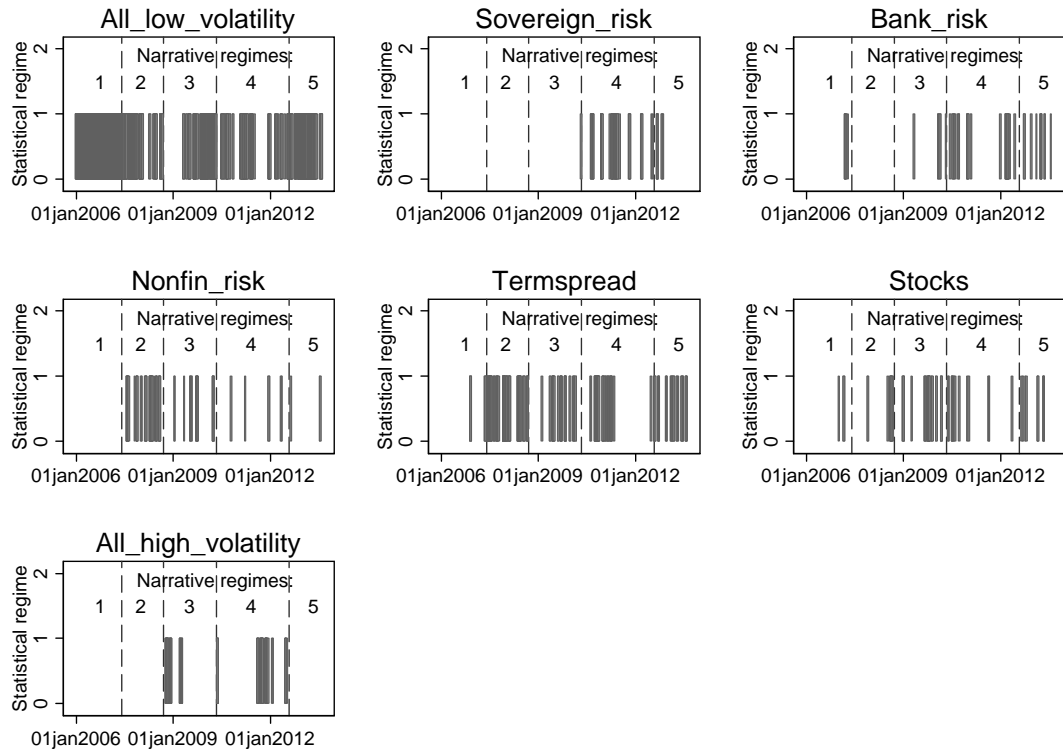
**Table 11A: Summary statistics of statistically defined regimes**

The table shows the number of observations and the fraction of observations per volatility regime based on a statistical definition of regimes using the 8 days rolling standard deviation and a threshold of one for the reduced-form residuals.

Statistical Regime	Observations	%
1	752	42.6
2	54	3.1
3	48	2.7
4	70	4.0
5	155	8.8
6	58	3.3
7	37	2.1
Dropped	592	33.5
Total	1766	100

**Figure 4A: Comparison of narrative and statistical regimes**

The figure shows the observations which are classified into the seven volatility categories of the statistical regime definition (grey bars, left axis) and the volatility regimes of the narrative definition (dashed lines).



**Table 12A: Direct and overall effects at the euro area level using GARCH(1,1) volatility regimes**

The table shows the estimated direct effects (contained in the matrix  $A$ ) and overall effects (in  $A^{-1}$ ) of a unit structural shock on the endogenous variables, based on a five-variable SVAR for the euro area and volatility regimes defined using variances of GARCH(1,1) models. The approach defines one low volatility regime where the GARCH variances of all variables are below their sample means, one high volatility regime where all GARCH variances are above their means, and one regime per variable where only the GARCH variance of that variable is above its mean and all other variances are below their means. The corresponding observations are classified accordingly into the seven GARCH volatility regimes. Impulse variables are in columns, response variables are in rows. The sample period is 24 October 2006 until 31 July 2013. The number of observations is 1761. \*\*\*, \*\*, \* denotes significance at the 1%, 5%, 10% level, respectively. P-values based on 1000 bootstrap replications are below point estimates.

Response	Impulse Sovereign risk	Bank risk	Nonfin. risk	Term spread	Stock market
<u>Direct effects</u>					
Sovereign risk	1	0.37***	-0.10***	0.04***	-0.17***
<i>p-value</i>	.	(0.00)	(0.00)	(-0.09)	(-0.18)
Bank risk	0.24***	1	0.25***	0.15***	-0.20***
<i>p-value</i>	(0.00)	.	(0.00)	(0.00)	(-0.09)
Nonfin risk	0.15***	0.03***	1	0.11***	-0.17***
<i>p-value</i>	(0.00)	(-0.18)	.	(-0.18)	(-0.09)
Term spread	0.56***	0.00***	-0.20***	1	0.46***
<i>p-value</i>	(0.00)	(-0.27)	(0.00)	.	(0.00)
Stock market	0.02***	-0.09***	-0.12***	-0.07***	1
<i>p-value</i>	(-0.55)	(0.00)	(0.00)	(-0.09)	.
<u>Overall effects</u>					
Sovereign risk	1.18***	0.46***	-0.01	0.13***	-0.23
<i>p-value</i>	(0.00)	(0.00)	(0.36)	(0.00)	(0.27)
Bank risk	0.45***	1.20***	0.23***	0.24***	-0.24*
<i>p-value</i>	(0.00)	(0.00)	(0.00)	(0.00)	(0.09)
Nonfin risk	0.27***	0.14***	1***	0.16***	-0.18*
<i>p-value</i>	(0.00)	(0.00)	(0.00)	(0.00)	(0.09)
Term spread	0.56***	0.17***	-0.26***	0.99***	0.37
<i>p-value</i>	(0.00)	(0.00)	(0.00)	(0.00)	(0.18)
Stock market	-0.10***	-0.14***	-0.13***	-0.11***	1.02***
<i>p-value</i>	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

**Table 13A: Overall effects at the euro area level when controlling for day-of-week effects**

The table shows the estimated overall effects of a unit structural shock on the endogenous variables, based on a five-variable SVAR including day-of-week dummies. Impulse variables are in columns, response variables are in rows. The sample period is 24 October 2006 until 31 July 2013. The number of observations is 1761. \*\*\*, \*\*, \* denotes significance at the 1%, 5%, 10% level, respectively, based on 1000 bootstrap replications.

Response	Impulse				
	Sovereign risk	Bank risk	Nonfin. risk	Term spread	Stock market
Sovereign risk	1.12***	0.23***	0.07***	0.02	-0.10***
<i>p-value</i>	(0.00)	(0.00)	(0.00)	(0.25)	(0.00)
Bank risk	0.55***	1.16***	0.30***	0.02	-0.20***
<i>p-value</i>	(0.00)	(0.00)	(0.00)	(0.32)	(0.00)
Nonfin risk	0.24***	0.22***	1.05***	0.14***	-0.42***
<i>p-value</i>	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Term spread	0.46***	0.25**	-0.26***	0.97***	0.15**
<i>p-value</i>	(0.00)	(0.01)	(0.00)	(0.00)	(0.03)
Stock market	-0.19***	-0.22***	-0.14***	0.00	1.08***
<i>p-value</i>	(0.00)	(0.00)	(0.00)	(0.45)	(0.00)

#### 4 Sensitivity analysis of monetary policy effects at the member state level

**Table 14A: Announcement and implementation effects of monetary policy on sovereign credit risk of euro area member states**

The table shows the effects of non-standard monetary policy measures by the ECB on *sovereign CDS spreads* of euro area countries, based on the sovereign risk equation of the corresponding country-specific SVAR. The dependent variable is in basis points. The upper part of the table shows the cumulative announcement effects of specific monetary policy measures. The lower part shows the cumulative implementation effects. Statistical significance is indicated with \*\*\*, \*\*, \* for the 1%, 5%, and 10% level, respectively, and refers to testing whether the sum of lags 0-10 for announcement and 0-1 for implementation effects is equal to zero. We consider the following announcement dates: LTROs with maturity up to 12 months (28 March, 4 September, and 15 October 2008; 7 May 2009; 4 August and 6 October 2011), three-year LTRO (8 December 2011), SMP (10 May 2010 and 8 August 2011), OMT (26 July, 2 August, and 6 September 2012).

	EMU	AT	BE	DE	FR	NL	ES	IE	GR	IT	PT
	<u>Cumulative announcement effects (in basis points)</u>										
LTRO12m	-6.3	-4.1	5.2	-2.6	2.8	-4.7	-7.0	-6.8	-79.6	-9.1	-41.4
<i>p-value</i>	(0.529)	(0.624)	(0.534)	(0.498)	(0.629)	(0.451)	(0.632)	(0.686)	(0.569)	(0.524)	(0.32)
LTRO36m	36.7***	23.9***	49.9***	14.2***	59.9***	50.8***	34.1***	44.7***	2646***	52.0***	56.3
<i>p-value</i>	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.118)
SMP	-11.8	4.5	6.2	-3.0	6.1	-3.8	-35.4	59.8*	61.3	-33.9	18.0
<i>p-value</i>	(0.463)	(0.744)	(0.699)	(0.636)	(0.605)	(0.673)	(0.229)	(0.088)	(0.802)	(0.152)	(0.765)
OMT	-64.7***	-9.4	-28.6	-8.4**	-29.8***	-22.8***	-135.8***	-83.1***	.	-119.8***	-119.9**
<i>p-value</i>	(0.000)	(0.244)	(0.102)	(0.027)	(0.003)	(0.000)	(0.000)	(0.002)	.	(0.001)	(0.017)
	<u>Cumulative implementation effects (in basis points)</u>										
LTRO12m	-0.025	-0.028***	-0.016	-0.008*	-0.010	-0.017***	-0.024	-0.050**	-0.446	-0.034*	-0.054
<i>p-value</i>	(0.121)	(0.000)	(0.197)	(0.083)	(0.368)	(0.001)	(0.199)	(0.031)	(0.341)	(0.076)	(0.214)
LTRO36m	-0.008**	-0.010***	-0.036***	-0.008***	-0.024***	-0.012***	-0.026***	0.028***	-2.224***	-0.068***	0.054**
<i>p-value</i>	(0.034)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.005)	(0.000)	(0.019)
R squared	0.28	0.17	0.24	0.17	0.22	0.33	0.3	0.26	0.36	0.32	0.23
N	1761	2477	2139	2467	2071	1762	1762	1463	1580	2451	2000

**Table 15A: Announcement and implementation effects of monetary policy on bank credit risk of euro area member states**

The table shows the effects of non-standard monetary policy measures by the ECB on *bank CDS spreads* of euro area countries, based on the sovereign risk equation of the corresponding country-specific SVAR. The dependent variable is in basis points. The upper part of the table shows the cumulative announcement effects of specific monetary policy measures. The lower part shows the cumulative implementation effects. Statistical significance is indicated with \*\*\*, \*\*, \* for the 1%, 5%, and 10% level, respectively, and refers to testing whether the sum of lags 0-10 for announcement and 0-1 for implementation effects is equal to zero. We consider the following announcement dates: LTROs with maturity up to 12 months (28 March, 4 September, and 15 October 2008; 7 May 2009; 4 August and 6 October 2011), three-year LTRO (8 December 2011), SMP (10 May 2010 and 8 August 2011), OMT (26 July, 2 August, and 6 September 2012).

	EMU	AT	BE	DE	FR	NL	ES	IE	GR	IT	PT
<u>Cumulative announcement effects (in basis points)</u>											
LTRO12m	0.1	-6.8	14.2	5.0	5.9	-5.9	21.2	29.3	-0.1	-11.3	-3.7
<i>p-value</i>	(0.993)	(0.714)	(0.624)	(0.617)	(0.662)	(0.527)	(0.172)	(0.435)	(0.995)	(0.236)	(0.805)
LTRO36m	20.3***	4.9	48.5***	15.0***	27.7***	-0.20	20.5***	-90.1***	132***	5.8	42.2**
<i>p-value</i>	(0.000)	(0.345)	(0.000)	(0.000)	(0.000)	(0.958)	(0.000)	(0.000)	(0.008)	(0.509)	(0.042)
SMP	-8.9	14.5	27.8	-6.9	-0.6	12.1	-23.6	121.7	-117.4	-17.2	-3.5
<i>p-value</i>	(0.601)	(0.56)	(0.184)	(0.51)	(0.98)	(0.381)	(0.268)	(0.174)	(0.109)	(0.333)	(0.929)
OMT	-34.4***	-39.6**	-22.0**	-6.7	-26.4***	-18.3***	-47.4**	23.0	.	-65.7***	-49.6*
<i>p-value</i>	(0.000)	(0.028)	(0.024)	(0.113)	(0.000)	(0.006)	(0.025)	(0.388)	.	(0.000)	(0.078)
<u>Cumulative implementation effects (in basis points)</u>											
LTRO12m	-0.014*	-0.026*	-0.004	-0.008	-0.020**	-0.012**	-0.020*	-0.023	0.020	-0.014	-0.005
<i>p-value</i>	(0.056)	(0.057)	(0.808)	(0.181)	(0.036)	(0.039)	(0.084)	(0.261)	(0.686)	(0.245)	(0.539)
LTRO36m	-0.014***	-0.028***	-0.046***	-0.020***	-0.015***	-0.002	-0.008**	0.005	-0.182***	-0.013***	-0.034***
<i>p-value</i>	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.242)	(0.019)	(0.648)	(0.008)	(0.000)	(0.007)
R squared	0.35	0.19	0.25	0.17	0.3	0.16	0.3	0.12	0.32	0.31	0.24
N	1761	2477	2139	2467	2071	1762	1762	1463	1581	2451	2000