

Financial sector linkages
and the dynamics of sovereign and bank credit spreads

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Sovereign credit risk

- ▶ The risk of the banking system has become an important element in the determination of sovereign risk
- ▶ Interlinkages and spillovers through the banking system is a key concern
- ▶ We show that an explicit modeling of the financial linkages contributes beyond 'common factors' in explaining bank and (hence) sovereign risk
- ▶ Main focus will be on bank CDS dynamics - an important step for understanding sovereign risk
- ▶ The paper also looks at transfer of bank risk to sovereign risk through guarantees

A small sample of related literature

- ▶ Enormous literature on sovereign debt
- ▶ Three closely related papers are
 - ▶ Degryse, Elahi and Penas (2010)
 - ▶ Longstaff, Pan, Pedersen, Singleton (2011)
 - ▶ Acharya, Drechsler and Schnabl (2011)
- ▶ Key distinguishing features are
 - ▶ Dynamic exposure measure using BIS statistics to capture the size of foreign exposures, and CDS premia to measure riskiness
 - ▶ Addition of domestic exposures (corporate and government) weighted according to weight on balance sheet
 - ▶ Analysis of effects of guarantees using similar measures

The BIS exposure matrix

- ▶ We use BIS "Consolidated international banking statistics"
- ▶ Give us foreign claims of a given banking system on foreign 'residents' (public, banks and non-banks)
- ▶ We have, for example, the exposure of the Austrian banking system to Hungarian government bonds, Hungarian banks and Hungarian non-banks (citizens, non-financial corporations)
- ▶ We use this information for each country in our sample to compute what we denote a BIS exposure matrix, i.e. the weighted CDS spread of the countries to which the banks are exposed
- ▶ For emerging markets with insufficient data on CDS for largest banks, we use sovereign CDS spreads. For non-emerging markets we use average of bank CDS for largest banks

Austria's foreign exposures decomposed by origin

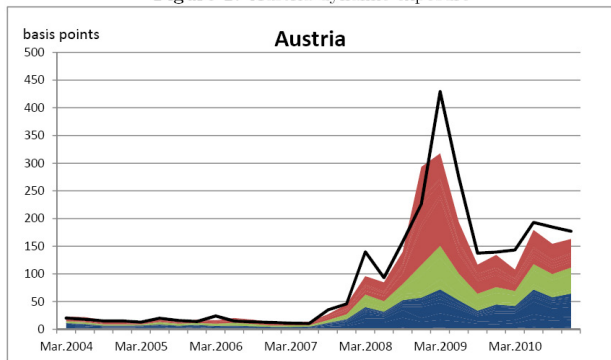
Table 1: The foreign exposure matrix: Austria

Rank	Country	Average (USD bn)	Q4 2010 (USD bn)	Share	Acc	Spread	Type	Share*CDS
1	DE	42.9	48.2	0.10	0.10	126	Bank	13
2	CZ	34.8	59.6	0.13	0.23	91	Sov	12
3	HU	23.2	35.0	0.07	0.34	378	Sov	28
4	RO	23.1	39.5	0.08	0.42	297	Sov	25
6	GB	21.6	15.8	0.03	0.26	169	Bank	6
5	HR	19.5	31.3	0.07	0.49	256	Sov	17
7	SK	18.8	27.9	0.06	0.55	82	Sov	5
9	US	17.4	16.3	0.03	0.58	132	Bank	5
8	IT	17.1	22.2	0.05	0.63	176	Bank	8
10	RU	11.0	15.2	0.03	0.66	147	Sov	5
11	NE	10.8	15.7	0.03	0.70	113	Bank	4
12	PL	9.6	14.3	0.03	0.73	144	Sov	4
13	SI	8.4	15.4	0.03	0.80	77	Sov	3
14	FR	8.3	9.3	0.02	0.75	142	Bank	3
15	RS	7.7	7.0	0.01	0.76	256	Sov	4
16	CH	7.7	11.2	0.02	0.82	100	Bank	2
17	UA	6.1	8.8	0.02	0.84	510	Sov	10
18	IE	6.0	2.9	0.01	0.83	1052	Bank	6
19	ES	5.5	6.7	0.01	0.86	259	Bank	4
-	Others	-	66.3	0.14	1.00	-	-	-
-	Total	-	468.7	1.00	1.00	-	-	163

There is not liquid historical CDS spread on Serbia (RS) and we thus use the one on Croatia (HR).

Austria dynamic exposure

Figure 1: Austria dynamic exposure



The graphs show the total value of exposures in billions of USD divided into major geographical regions. Red: Eastern Europe non-neighboring countries. Green: Eastern Europe neighboring countries (Czech Republic, Hungary, Slovakia and Slovenia). Blue: Other countries. The black curve shows the average CDS spread of the two largest Austrian banks.

Red: EE non-neighbors; Green: EE neighbors; Blue: Other countries;
Black: Average Bank CDS spread

The bank CDS regression equation

- ▶ Left hand side: Changes in average of 5-yr CDS premium for two largest banks

$$\begin{aligned}\Delta\text{b-cdsavg}_{k,t} &= \alpha_{0,k} + \alpha_1\Delta(\text{BIS Measure})_{k,t} \\ &+ \alpha'_2(\text{Local Variables})_{k,t} + \alpha'_3(\text{Global Variables})_t\end{aligned}$$

- ▶ We also use changes for local and global variables
- ▶ We have seen how 'BIS Measure' is computed (Austria example)

Variables used in bank CDS regression

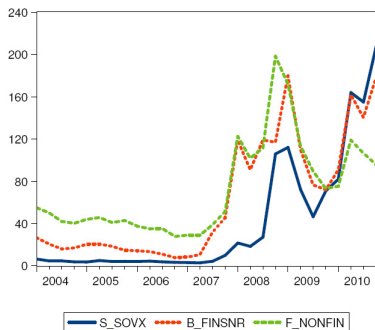
- ▶ The local and global variables are:
 - ▶ Real estate (including construction) EDFs
 - ▶ Non-financial corporate EDFs
 - ▶ Excess return over last quarter of average NYSE, AMEX and NASDAQ stocks
 - ▶ Volatility risk premium (a difference between VIX and realized volatility of SP500)
 - ▶ Percentage change in 5-yr CMT yield
 - ▶ Percentage change in investment grade US corporate yield spreads, BBB - AAA industrials
 - ▶ Percentage change in spread between BB and BBB indices
 - ▶ Percentage change in 3 month US LIBOR-OIS spread

Controlling for common movements in CDS using CDS indices

- ▶ We add to global variables on the right hand side various iTraxx CDS indices
- ▶ Idea is to show that the effect of linkages survive even when correcting for 'general' variations in default risk?
- ▶ We use both the indices themselves and residuals from regression of BIS exposures on CDS indices (shown)
- ▶ We also do a 'time-fixed effects' regression replacing the global variables with a time-fixed effect (not shown)
- ▶ I.e. we capture the variations in our exposure measure that are not due to market-wide variations in credit risk
- ▶ We find significance of BIS measure

Itraxx Financial, Non-Financial and SovX

Figure 5: iTraxx Financial, Non-Financial and SovX basis points



Bank CDS on BIS, local and global variables, controlling with CDS indices

VARIABLES	I	II	III
INTERCEPT	-2.201 (-0.791)	-1.258 (-0.489)	0.462 (0.244)
$\Delta(\text{B_BIS_CDS})$	0.465*** (3.555)		0.922*** (5.085)
$\Delta(\text{B_BIS_RES})$		0.207*** (2.930)	
$\Delta(\text{R2_EDF})$	10.67*** (7.476)	10.37*** (7.438)	12.07*** (7.105)
$\Delta(\text{C2_EDF})$	-5.234 (-0.222)	-0.770 (-0.028)	-4.726 (-0.192)
ER3M	16.65 (0.266)	-0.949 (-0.015)	-78.44 (-1.249)
VPSPX	0.976 (1.421)	0.609 (0.776)	1.614 (2.258)
% $\Delta 5\text{YCMT}$	-2.253 (-0.277)	-6.512 (-0.824)	-5.114 (-0.600)
% ΔHY	-4.109 (-0.563)	13.74 (1.176)	-16.76 (-1.057)
% ΔIG	10.21 (0.969)	1.575 (0.148)	-6.693 (-0.577)
% $\Delta(\text{OISUS})$	1.590 (0.806)	1.976 (0.959)	4.531 (1.576)
$\Delta(\text{S_RISK})$	0.798*** (3.379)	0.796*** (3.400)	0.850*** (4.095)
$\Delta(\text{S_SOVX})$	0.236 (0.808)	0.240 (0.811)	
$\Delta(\text{F_NONFIN})$	-0.279 (-1.237)	-0.346 (-1.588)	
$\Delta(\text{B_FINSNR})$	0.735*** (3.312)	1.128*** (5.526)	
Adjusted R-squared	0.4637	0.4603	0.4328

An extension of the BIS measure

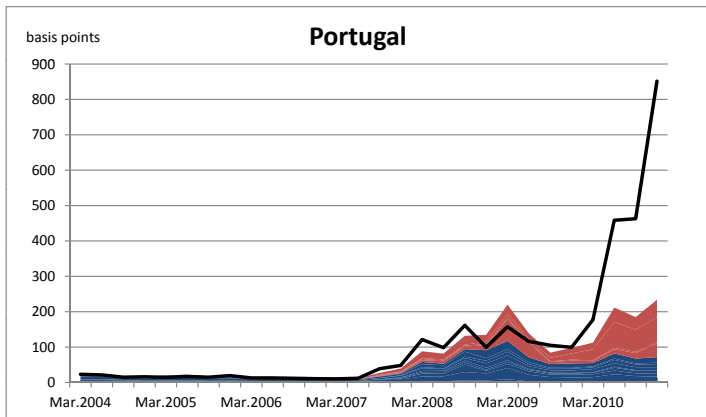
- ▶ We also define a measure that takes into account exposure to domestic (non-govt) borrowers and the 'domestic' govt

Table 2: The total exposure: Austria

Claims on	USD bn	% GDP	Share
Non-nationals	468.7	124	0.46
Domestic sovereign	77.7	20	0.08
Other domestic residents	464.0	122	0.46
Total	1010.4	266	1.00

The table shows the composition of assets for Austrian banks. The claims on the domestic sovereign include the domestic general government and the central bank.

Not all bank CDS are driven by foreign exposures: Portugal

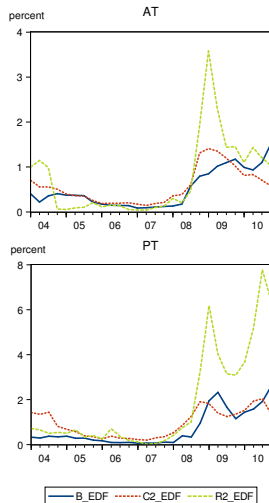


Red: Greece, Spain, Italy, Ireland; Blue: Other countries; Black: Average Bank CDS spread for Portugal

A measure of default probability: EDFs

- ▶ How can we measure domestic exposure?
- ▶ Moody's EDFs (Expected Default Frequency, originally launched by KMV) - an estimate of the default probability of a borrower
- ▶ We have obtained an extensive set of EDFs that allows us to compute aggregate measures of default risk for banks, non-financial corporates, real-estate financials and construction
- ▶ Measure of the riskiness of a large set of borrowers in each country
- ▶ We use the medians within each sector
- ▶ We include 'Construction' in our real estate measure R2EDF

Median EDFs for Austria and Portugal in different sectors



An extension of the BIS measure

$$\begin{aligned}\Delta(\text{Bank Credit Risk})_{k,t} &= \left(\frac{\text{Foreign claims}}{\text{Total}}\right)_{k,t} \times \Delta(\text{B_BIS_CDS})_{k,t} \\ &+ \left(\frac{\text{Domestic credit}}{\text{Total}}\right)_{k,t} \times \Delta(\text{C_EDF})_{k,t} \\ &+ \left(\frac{\text{Claims on sovereign}}{\text{Total}}\right)_{k,t} \times \Delta(\text{S_CDS})_{k,t}\end{aligned}$$

- ▶ Idea is to weigh risk measures by the exposures of the banks
- ▶ Highly significant - also in both subsamples

Bank credit risk on total bank credit risk, local and global variables, and indices

VARIABLES	FULL SAMPLE	Q1 2004 - Q4 2007	Q1 2008 - Q4 2010
INTERCEPT	-2.524 (-0.785)	-0.659 (-1.439)	-2.184 (-0.457)
Δ(B_CREDIT_RISK)	0.182*** (3.124)	0.017*** (3.752)	0.188** (2.517)
ER3M	-14.20 (-0.195)	29.76** (2.511)	39.37 (0.367)
VPSPX	0.818 (1.163)	0.190 (1.369)	0.688 (0.401)
%Δ5YCMT	3.868 (0.415)	6.384*** (3.387)	6.447 (0.285)
%ΔHY	-5.043 (-0.877)	3.486** (2.175)	-14.83 (-0.213)
%ΔIG	13.90 (1.444)	1.531 (1.302)	22.87 (0.929)
%Δ(OISUS)	1.669 (1.086)	0.952*** (3.049)	9.679* (1.908)
Δ(S_SOVM)	0.386 (1.150)	2.312*** (4.155)	0.268 (0.706)
Δ(F_NONFIN)	-0.447* (-2.269)	0.216** (1.988)	-0.315 (-1.030)
Δ(B_FINSNR)	1.097** (4.533)	0.065 (0.583)	1.108*** (4.319)
Adjusted R-squared	0.4050	0.6157	0.3898

Sovereign CDS analysis - guarantees

- ▶ Banks have become an important real or potential liability of sovereigns
- ▶ An explicit guarantee was made in most European countries Q4:2008 following the Irish guarantee end of September, 2008.
- ▶ We use the size of the guarantee relative to GDP as reported by IMF
- ▶ We also use a measure of the implicit guarantee, combining the size of the domestic banking system relative to GDP with a measure of risk (CDS or EDF)
- ▶ Finally, use 'domestic government variables':
 - ▶ General government net interest expenditure compared to GDP (quarterly, interpolated)
 - ▶ Revisions in general government net lending projections. We look at changes in the sum of one-year ahead and two-year net lending projections

The main results in words

- ▶ Both implicit and explicit guarantees highly significant
- ▶ This is true both for measure using CDS and measure using EDFs
- ▶ Excess return on US equity market and yield spread between investment grade and high-yield bonds are significant
- ▶ Limited influence of domestic variables
- ▶ Looking at what moves the individual sovereign 'away from market', guarantees remain robust
- ▶ After using central bank collateralized loans to local banks as instrument (related to bank risk, but not to sovereign) we have importance of interest rate to revenue

Sovereign CDS - guarantees with indices

VARIABLES	I	II	III	IV	V
INTERCEPT	-0.059 (-0.021)	-0.374 (-0.140)	-3.008 (-0.730)	-3.336 (-0.834)	4.893* (1.678)
$\Delta(S_IRN_REV)$	-5.126 (-1.526)	-5.094 (-1.496)	-5.554 (-1.447)	-5.532 (-1.435)	-5.154** (-2.094)
S_FDEF_GDP	0.148 (0.281)	0.307 (0.627)	-0.824 (-1.101)	-0.649 (-0.841)	3.465* (1.816)
GUARANTEES		0.143** (2.362)		0.146* (1.859)	0.179** (2.128)
$\Delta(B_CDS)*B_GDP$	0.084** (2.545)	0.084** (2.570)			0.233** (2.374)
$\Delta(B_EDF)*B_GDP$			1.600*** (7.522)	1.636*** (7.490)	
ER3M	25.52* (1.697)	24.01 (1.602)	14.89 (0.708)	13.18 (0.640)	30.39 (0.792)
VPSPX	0.139 (0.326)	0.223 (0.549)	0.746 (1.136)	0.835 (1.334)	-0.685* (-1.771)
% $\Delta 5Y CMT$	-16.11* (-1.708)	-15.57* (-1.684)	-20.68** (-1.990)	-20.13* (-1.957)	-6.256 (-0.638)
% ΔHY	7.337** (2.456)	7.129** (2.328)	7.482*** (3.555)	7.303*** (3.424)	9.773* (1.921)
% ΔIG	3.736 (0.730)	3.870 (0.746)	11.97** (2.426)	12.09** (2.412)	-13.54* (-1.794)
% $\Delta(OISUS)$	-1.883*** (-3.854)	-1.786*** (-3.598)	-1.476** (-2.234)	-1.377** (-2.181)	-2.596** (-2.584)
$\Delta(S_SOVX)$	0.843*** (4.273)	0.815*** (3.918)	0.959*** (3.579)	0.931*** (3.313)	0.585*** (4.059)
$\Delta(F_NONFIN)$	-0.002 (-0.034)	-0.020 (-0.266)	-0.100 (-1.556)	-0.118** (-1.829)	0.177 (1.215)
$\Delta(B_FINSNR)$	-0.213* (-1.805)	-0.190 (-1.509)	0.078 (1.339)	0.101* (1.654)	-0.784*** (-2.630)
Adjusted R-squared	0.5274	0.5284	0.4120	0.4128	

Concluding remarks

- ▶ CDS spreads for banks reflect financial linkages
- ▶ This is true even after controlling for common credit risk factors
- ▶ Proxy hedging based on these linkages could be an explanation
- ▶ We use one linkage risk measure that looks only at foreign exposures and one that looks at the entire asset side
- ▶ Both are highly significant
- ▶ Sovereign credit spreads are (perhaps unsurprisingly) closely linked with banking systems
- ▶ Both implicit and explicit guarantees play a major role in explaining sovereign risk