# The Impact of Government Interventions on CDS and Equity Markets

Frederic Schweikhard   Zoe Tsesmelidakis

Goethe University Frankfurt, House of Finance

8th Annual Credit Risk Conference
Moody's and NYU Stern School of Business, May 2012

1. Introduction

Average CDS levels in the U.S. banking sector

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Crisis prevention: Regulatory approaches

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  ○ Structural change in which "default" is no longer perceived as the same event across debt and equity markets

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Crisis prevention: Regulatory approaches

▷ Standalone credit risk

  ○ Better gauge of financial health than observed CDS price (cf. Hart and Zingales, 2009)

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Q. How much are the pecuniary subsidies large financial institutions enjoy?

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▷ Capitalized subsidies calculated from bond offerings over the period 2007-2010 amount to USD 129.2 billion

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⇒ Contrast default risk as explicitly priced in the CDS market to the default risk as it is implicitly priced in the stock market
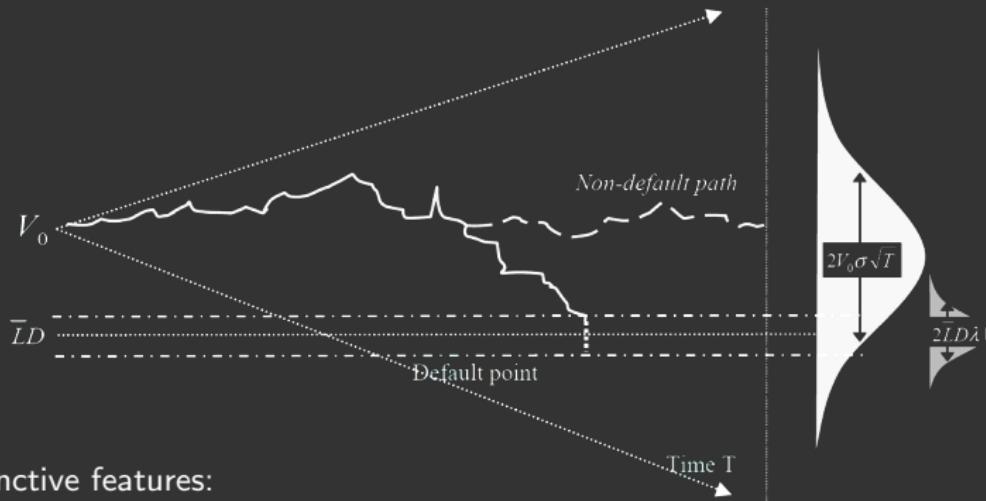
Distinctive features:

- ▷ Default may occur at any time

- ▷ Stochastic default barrier, which is only revealed at default

▷ Model input factors:

- ○ Stock prices (from CRSP)

- ○ Option implied volatilities (from OptionMetrics)

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Sample Composition

	Firms	Observations									
		2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
Sectors											
Consumer Disc	96	5,861	10,597	15,342	19,256	20,656	22,230	20,830	18,682	13,416	146,870
Consumer Staples	37	2,258	4,340	5,977	7,981	8,055	8,662	8,774	7,907	5,691	59,645
Energy	41	1,474	3,123	5,134	6,774	7,832	9,352	9,717	9,696	6,955	60,057
Financials	74	4,297	7,935	11,412	14,602	15,333	16,218	15,511	13,146	9,994	108,448
Banks	27	2,530	4,004	4,953	5,503	6,075	6,088	5,489	4,123	3,026	41,791
Insurance	24	1,571	2,885	4,088	5,179	4,986	5,389	5,274	4,534	3,406	37,312
Real Estate	18	143	737	1,725	2,851	3,279	3,801	3,848	3,596	2,886	22,866
Others	5	53	309	646	1,069	993	940	900	893	676	6,479
Health Care	42	1,672	3,814	6,099	8,107	8,631	9,562	9,111	8,699	5,796	61,491
Industrials	68	4,194	7,513	10,907	12,802	13,575	14,383	14,591	13,984	10,475	102,424
IT	34	2,001	3,308	4,844	6,128	6,533	7,222	7,158	6,583	5,138	48,915
Materials	52	2,258	4,805	7,273	9,471	10,059	11,317	11,165	9,940	7,695	73,983
Telecom Svcs	13	533	1,038	1,605	1,972	2,583	3,122	2,926	2,486	1,532	17,797
Utilities	41	1,833	4,411	6,055	8,270	8,504	8,962	9,125	8,131	6,057	61,348
Total	498	26,381	50,884	74,648	95,363	101,761	111,030	108,908	99,254	72,749	740,978

▷ Determine $\bar{L}_i$ by minimizing the sum of squared errors between model ($\widehat{CDS}$) and market spreads (CDS) over a number of observations N in the period 01/2003–07/2007:

$$\min_{\bar{L}_i} \sum_{n=1}^{N} (\widehat{CDS}_{i,n}(\bar{L}_i) - CDS_{i,n})^2$$

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	Whole Sample Period				Pre-Crisis Period		Crisis Period		Post-Crisis Period	
Ival	$\bar{N}$	$\bar{\bar{L}}$	cRMSE	ME	RMSE	ME	RMSE	ME	RMSE	ME	RMSE
50	16	1.053	40.97	20.14	159.70	-9.17	46.92	68.38	246.92	30.48	141.67
10	76	1.070	39.80	20.60	158.14	-8.90	44.79	69.16	246.30	31.05	138.96
3	253	1.076	39.35	20.47	158.40	-8.84	44.71	68.85	246.89	30.54	138.76
1	757	1.077	38.93	19.94	158.77	-8.93	44.72	67.84	247.60	29.27	138.75

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▷ In the pre-crisis period the model underpredicts observed spreads due to nondefault components, like illiquidity, in line with the literature (Eom, Helwege, and Huang (2004), Longstaff (2004), Tang and Yan (2007)).

Predicted vs. observed CDS spreads – Firm-level results
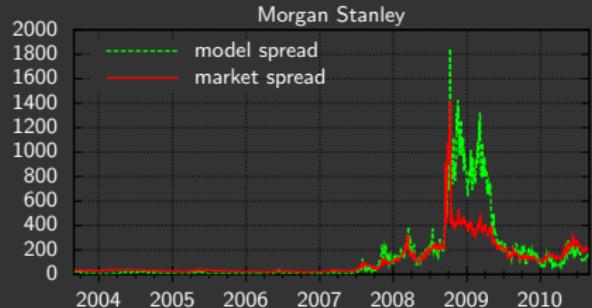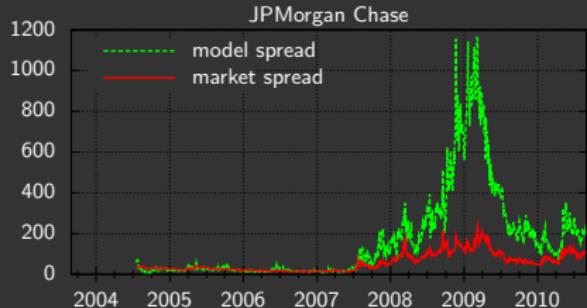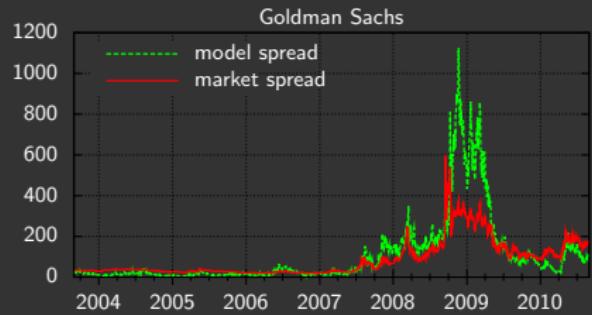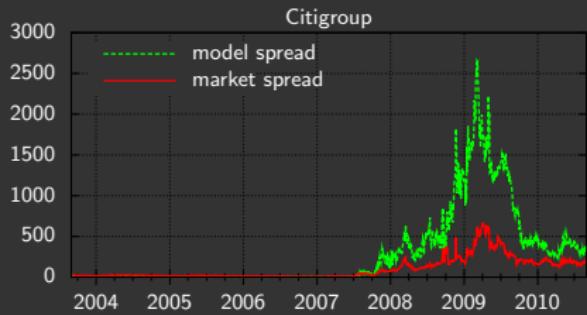
Predicted vs. observed CDS spreads – Aggregate results
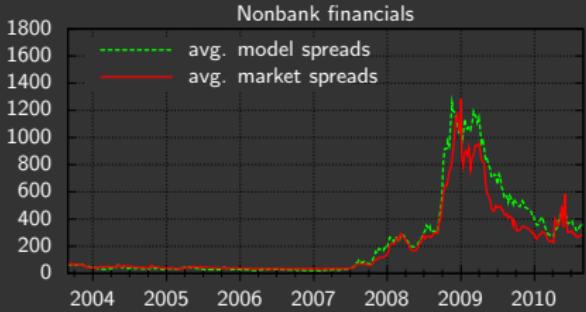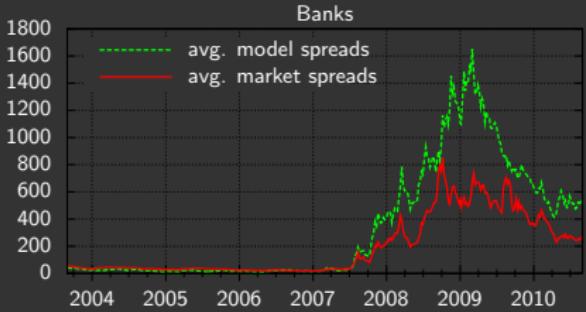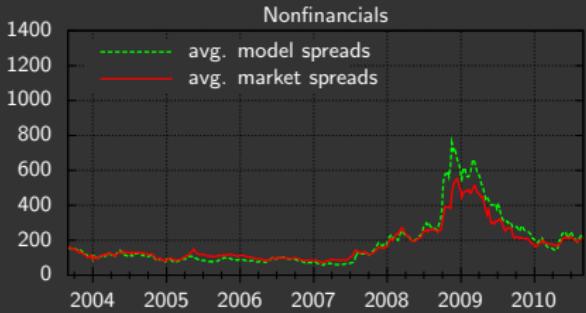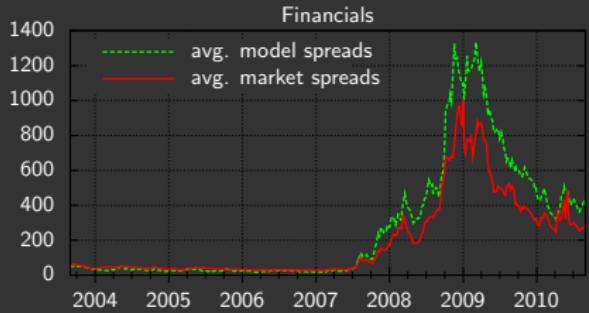
Predicted vs. observed CDS spreads – Relative deviations

Relative deviations

Legend:
- Banks
- Other financials
- Other sectors
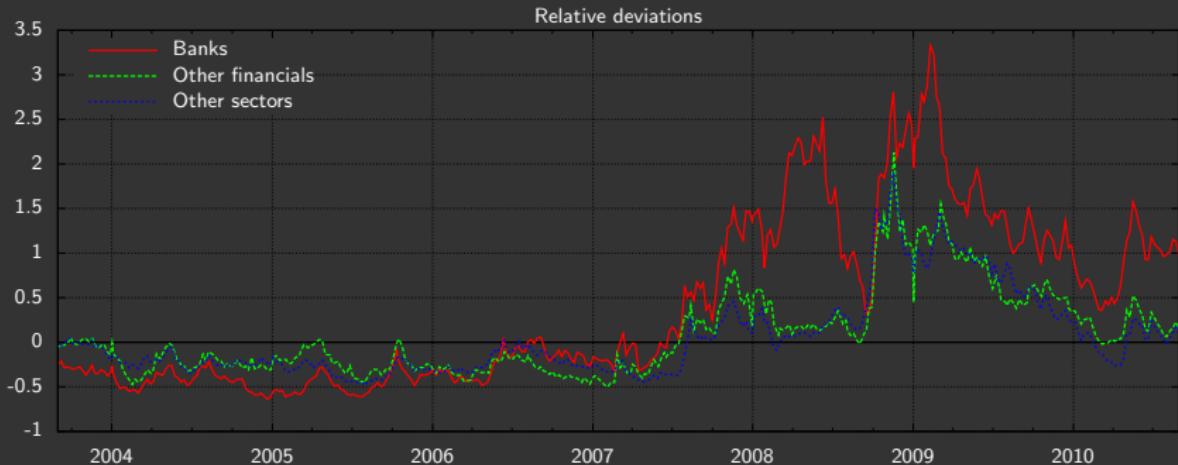
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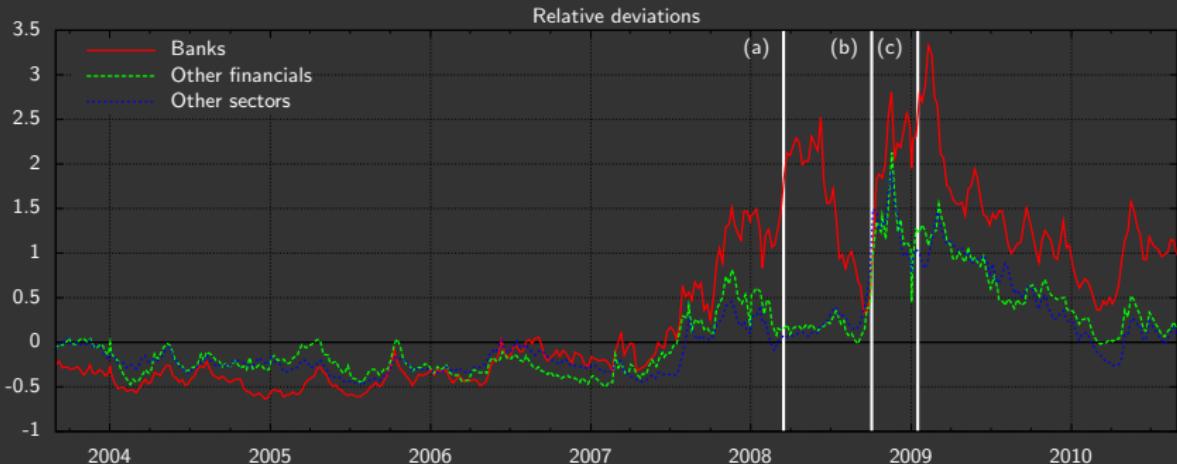
(a) Acquisition of Bear Stearns by JPMorgan

(b) TARP

(c) Rescue package for Bank of America

Predicted vs. observed CDS spreads – Sector results

	Pre-Crisis Period				Crisis Period				Post-Crisis Period			
	Mean			Std	Mean			Std	Mean			Std
	Market	Model	Dev	Dev	Market	Model	Dev	Dev	Market	Model	Dev	Dev
Consumer Disc	133.96	126.22	-7.74	65.52	509.81	574.32	64.50	798.43	295.59	369.33	73.74	182.74
Consumer Staples	65.60	58.58	-7.02	37.74	138.33	170.56	32.23	131.46	107.18	89.72	-17.45	56.34
Energy	101.70	92.74	-8.96	54.27	199.62	253.23	53.61	155.27	180.11	146.76	-33.35	88.69
Financials	45.42	38.53	-6.89	27.17	400.16	583.48	183.32	426.12	321.69	447.52	125.83	483.53
Banks	41.61	35.91	-5.70	24.92	393.27	743.73	350.46	456.17	341.73	579.20	237.47	333.18
Insurance	47.20	40.07	-7.12	25.58	308.88	442.53	133.65	332.40	333.15	370.25	37.10	695.26
Real Estate	54.22	46.72	-7.50	34.50	549.43	613.18	63.75	414.18	301.58	473.70	172.12	281.46
Others	35.96	23.53	-12.44	26.41	332.30	347.96	15.66	462.66	259.84	139.11	-120.73	164.85
Health Care	66.29	54.56	-11.73	38.43	153.64	238.92	85.28	174.24	138.16	160.61	22.45	104.91
Industrials	133.97	126.36	-7.61	85.75	316.70	329.67	12.97	410.90	206.36	223.43	17.07	143.66
IT	135.06	122.21	-12.85	60.83	219.78	283.44	63.66	217.47	172.81	200.43	27.62	102.84
Materials	108.41	98.95	-9.46	59.82	226.91	311.41	84.51	209.43	168.89	174.98	6.09	118.89
Telcom Svcs	298.00	275.97	-22.03	183.47	256.03	330.89	74.86	186.32	191.61	197.87	6.26	134.76
Utilities	113.98	104.77	-9.20	88.93	167.77	166.01	-1.76	137.97	159.31	133.62	-25.69	136.02

Predicted vs. observed CDS spreads – Sector results

	Pre-Crisis Period				Crisis Period				Post-Crisis Period			
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$$\frac{\widehat{CDS}_{i,t} - CDS_{i,t}}{CDS_{i,t}}$$

4. Explaining the divergence

$$\frac{\widehat{CDS}_{i,t} - CDS_{i,t}}{CDS_{i,t}} = c + \beta_m Macro_{i,t} + \epsilon_{i,t}$$

4. Explaining the divergence

$$\frac{\widehat{CDS}_{i,t} - CDS_{i,t}}{CDS_{i,t}} = c + \beta_m Macro_{i,t} + \beta_f Firm_{i,t} + \epsilon_{i,t}$$

$$\frac{\widehat{CDS}_{i,t} - CDS_{i,t}}{CDS_{i,t}} = c + \beta_m Macro_{i,t} + \beta_f Firm_{i,t} + \epsilon_{i,t}$$

		Pre-Crisis				Crisis				Post-Crisis			
		Mean	Std	Min	Max	Mean	Std	Min	Max	Mean	Std	Min	Max
Macrofinancial Variables													
Business Climate													
S&P 500 Return $r_{S\&P500}$ (%)	−	0.02	0.12	-0.56	0.33	-0.08	0.22	-0.89	0.52	0.04	0.11	-0.23	0.31
VIX	+	17.54	6.83	9.89	45.08	31.25	12.99	16.12	80.86	23.53	5.11	15.58	45.79
Interest Rate Term Structure													
Treasury Rate	±	2.71	1.60	0.81	5.19	1.43	1.40	0.00	4.95	0.12	0.05	0.02	0.18
Term Spread	±	1.73	1.42	-0.64	3.85	2.21	0.99	-0.17	3.82	3.27	0.40	2.33	3.83
Illiquidity													
On/Off Spread $L_{On/Off}$	−	-0.01	0.06	-0.11	0.19	0.03	0.06	-0.08	0.17	0.04	0.02	-0.01	0.08
Refcorp Spread L_{Ref}	−	0.09	0.08	-0.14	0.34	0.58	0.39	0.03	1.54	0.59	0.14	0.29	0.80
Firmspecific Variables													
Ratings													
S&P Issuer Ratings	+												
Firm Condition													
Stock Return r_S (%)	−	0.03	1.87	-85.05	48.84	0.00	4.07	-73.17	97.42	-0.07	2.36	-31.02	48.83
Stock Volatility σ_S	+	0.27	0.10	0.03	1.99	0.45	0.22	0.03	2.97	0.36	0.14	0.06	2.59
Size													
Total Assets (bn)	+	0.05	0.15	0.00	2.22	0.06	0.20	0.00	2.36	0.05	0.21	0.00	2.36
Total Liab. + Market Cap. (bn)	+	0.06	0.16	0.00	2.35	0.07	0.20	0.00	2.47	0.06	0.21	0.00	2.30
TARP	+												
Default Correlation													
$\beta_{r_S}^{DF}$	+	0.79	0.32	-0.20	3.04	0.94	0.44	-0.11	3.70	1.00	0.40	0.02	3.20
Counterparty Risk													
$\beta_{r_{CDS}}^{PD}$	+	0.23	0.44	-16.33	12.75	0.28	0.25	-3.58	3.35	0.33	0.26	-1.37	3.88

For robustness see also *dynamics of relative price deviations*, *alternative subsamples*, and *determinants of changes*.

	(4)			(5)			(6)			(7)			(8)		
	Coef.	t		Coef.	t		Coef.	t		Coef.	t		Coef.	t	
$r_{\text{S\&P500}}$	-24.1100	-5.42	***	-21.1758	-4.55	***	-46.2296	-9.54	***	-23.9967	-5.35	***	-74.1502	-3.39	***
Treasury Rate	-0.0104	-0.87		-0.0104	-0.87		-0.0544	-4.36	***	-0.0109	-0.89		-0.2062	-3.34	***
Term Spread	0.0118	0.89		0.0120	0.90		-0.0190	-1.36		0.0108	0.79		-0.2064	-2.97	***
L_{Ref}	0.5724	10.82	***	0.5733	10.83	***	0.8851	17.45	***	0.5787	10.97	***	1.2225	7.25	***
Rating (AAA)	2.1533	10.46	***	2.1374	10.36	***	1.2663	6.71	***	2.4805	10.65	***	-0.0315	-0.11	
Rating (AA)	2.3024	14.10	***	2.2836	13.90	***	1.4236	8.75	***	2.6013	12.94	***	0.3628	1.15	
Rating (A)	2.1064	14.17	***	2.0929	14.08	***	1.2184	7.95	***	2.3805	11.47	***	0.2205	0.75	
Rating (BBB)	2.2419	16.00	***	2.2279	15.89	***	1.3870	9.16	***	2.5128	12.49	***	0.1713	0.61	
Rating (BB)	1.9983	15.57	***	1.9852	15.47	***	1.3206	8.49	***	2.2683	11.74	***			
Rating (B)	1.7528	14.98	***	1.7408	14.87	***	1.3037	8.37	***	2.0221	10.91	***			
Rating (CCC)	1.2664	7.87	***	1.2555	7.81	***	1.1579	6.54	***	1.5392	7.35	***			
Rating (CC)	0.3744	1.24		0.3597	1.20		0.5881	1.52		0.5667	1.51				
r_S	-1.2602	-18.36	***	-1.2555	-18.27	***	-1.4871	-20.15	***	-1.2653	-18.25	***	-1.9824	-7.15	***
σ_S	1.6813	10.36	***	1.6709	10.32	***				1.6776	10.33	***			
Size	0.3420	2.46	**	0.3372	2.43	**							0.3175	1.92	*
Size $\times$ $r_{\text{S\&P500}}$				-70.4856	-2.72	***									
$\beta_{r_S}^{DF} \times I_{\text{Fin}}$							0.2362	3.61	***						
TARP										0.3054	2.00	**			
MES													7.6828	3.77	***
Constant	-2.8048	-14.57	***	-2.7878	-14.49	***	-1.3789	-8.91	***	-3.0702	-13.00	***	0.1150	0.30	
$Adj.R^2$	0.2162			0.2167			0.1724			0.2164			0.2260		
Observations	524,868			524,868			524,868			524,868			64,143		
Coef. Estimates	OLS			OLS			OLS			OLS			OLS		
Standard Errors	CL-F			CL-F			CL-F			CL-F			CL-F		

For robustness see also *dynamics of relative price deviations*, *alternative subsamples*, and *determinants of changes*.

	(4)		(5)		(6)		(7)		(8)	
	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
$r_{\text{S\&P500}}$	-24.1100	-5.42 ***	-21.1758	-4.55 ***	-46.2296	-9.54 ***	-23.9967	-5.35 ***	-74.1502	-3.39 ***
Treasury Rate	-0.0104	-0.87	-0.0104	-0.87	-0.0544	-4.36 ***	-0.0109	-0.89	-0.2062	-3.34 ***
Term Spread	0.0118	0.89	0.0120	0.90	-0.0190	-1.36	0.0108	0.79	-0.2064	-2.97 ***
L_{Ref}	0.5724	10.82 ***	0.5733	10.83 ***	0.8851	17.45 ***	0.5787	10.97 ***	1.2225	7.25 ***
Rating (AAA)	2.1533	10.46 ***	2.1374	10.36 ***	1.2663	6.71 ***	2.4805	10.65 ***	-0.0315	-0.11
Rating (AA)	2.3024	14.10 ***	2.2836	13.90 ***	1.4236	8.75 ***	2.6013	12.94 ***	0.3628	1.15
Rating (A)	2.1064	14.17 ***	2.0929	14.08 ***	1.2184	7.95 ***	2.3805	11.47 ***	0.2205	0.75
Rating (BBB)	2.2419	16.00 ***	2.2279	15.89 ***	1.3870	9.16 ***	2.5128	12.49 ***	0.1713	0.61
Rating (BB)	1.9983	15.57 ***	1.9852	15.47 ***	1.3206	8.49 ***	2.2683	11.74 ***		
Rating (B)	1.7528	14.98 ***	1.7408	14.87 ***	1.3037	8.37 ***	2.0221	10.91 ***		
Rating (CCC)	1.2664	7.87 ***	1.2555	7.81 ***	1.1579	6.54 ***	1.5392	7.35 ***		
Rating (CC)	0.3744	1.24	0.3597	1.20	0.5881	1.52	0.5667	1.51		
r_S	-1.2602	-18.36 ***	-1.2555	-18.27 ***	-1.4871	-20.15 ***	-1.2653	-18.25 ***	-1.9824	-7.15 ***
σ_S	1.6813	10.36 ***	1.6709	10.32 ***			1.6776	10.33 ***		
Size	0.3420	2.46 **	0.3372	2.43 **					0.3175	1.92 *
Size $\times\ r_{\text{S\&P500}}$			-70.4856	-2.72 ***						
$\beta^{DF}_{r_S} \times \mathrm{I}_{\text{Fin}}$					0.2362	3.61 ***				
TARP							0.3054	2.00 **		
MES									7.6828	3.77 ***
Constant	-2.8048	-14.57 ***	-2.7878	-14.49 ***	-1.3789	-8.91 ***	-3.0702	-13.00 ***	0.1150	0.30
$Adj.R^2$	0.2162		0.2167		0.1724		0.2164		0.2260	
Observations	524,868		524,868		524,868		524,868		64,143	
Coef. Estimates	OLS		OLS		OLS		OLS		OLS	
Standard Errors	CL-F		CL-F		CL-F		CL-F		CL-F	

For robustness see also *dynamics of relative price deviations*, *alternative subsamples*, and *determinants of changes*.

	(4)			(5)			(6)			(7)			(8)	
	Coef.	t		Coef.	t		Coef.	t		Coef.	t		Coef.	t	
$r_{\text{S\&P500}}$	-24.1100	-5.42	***	-21.1758	-4.55	***	-46.2296	-9.54	***	-23.9967	-5.35	***	-74.1502	-3.39	***
Treasury Rate	-0.0104	-0.87		-0.0104	-0.87		-0.0544	-4.36	***	-0.0109	-0.89		-0.2062	-3.34	***
Term Spread	0.0118	0.89		0.0120	0.90		-0.0190	-1.36		0.0108	0.79		-0.2064	-2.97	***
L_{Ref}	0.5724	10.82	***	0.5733	10.83	***	0.8851	17.45	***	0.5787	10.97	***	1.2225	7.25	***
Rating (AAA)	2.1533	10.46	***	2.1374	10.36	***	1.2663	6.71	***	2.4805	10.65	***	-0.0315	-0.11	
Rating (AA)	2.3024	14.10	***	2.2836	13.90	***	1.4236	8.75	***	2.6013	12.94	***	0.3628	1.15	
Rating (A)	2.1064	14.17	***	2.0929	14.08	***	1.2184	7.95	***	2.3805	11.47	***	0.2205	0.75	
Rating (BBB)	2.2419	16.00	***	2.2279	15.89	***	1.3870	9.16	***	2.5128	12.49	***	0.1713	0.61	
Rating (BB)	1.9983	15.57	***	1.9852	15.47	***	1.3206	8.49	***	2.2683	11.74	***			
Rating (B)	1.7528	14.98	***	1.7408	14.87	***	1.3037	8.37	***	2.0221	10.91	***			
Rating (CCC)	1.2664	7.87	***	1.2555	7.81	***	1.1579	6.54	***	1.5392	7.35	***			
Rating (CC)	0.3744	1.24		0.3597	1.20		0.5881	1.52		0.5667	1.51				
r_S	-1.2602	-18.36	***	-1.2555	-18.27	***	-1.4871	-20.15	***	-1.2653	-18.25	***	-1.9824	-7.15	***
σ_S	1.6813	10.36	***	1.6709	10.32	***				1.6776	10.33	***			
Size	0.3420	2.46	**	0.3372	2.43	**							0.3175	1.92	*
Size $\times$ $r_{\text{S\&P500}}$				-70.4856	-2.72	***									
$\beta_{r_S}^{DF} \times \mathsf{I}_{\text{Fin}}$							0.2362	3.61	***						
TARP										0.3054	2.00	**			
MES													7.6828	3.77	***
Constant	-2.8048	-14.57	***	-2.7878	-14.49	***	-1.3789	-8.91	***	-3.0702	-13.00	***	0.1150	0.30	
$Adj.R^2$	0.2162			0.2167			0.1724			0.2164			0.2260		
Observations	524,868			524,868			524,868			524,868			64,143		
Coef. Estimates	OLS			OLS			OLS			OLS			OLS		
Standard Errors	CL-F			CL-F			CL-F			CL-F			CL-F		

For robustness see also *dynamics of relative price deviations*, *alternative subsamples*, and *determinants of changes*.

	(4)			(5)			(6)			(7)			(8)		
	Coef.	t		Coef.	t		Coef.	t		Coef.	t		Coef.	t	
$r_{\text{S\&P500}}$	-24.1100	-5.42	***	-21.1758	-4.55	***	-46.2296	-9.54	***	-23.9967	-5.35	***	-74.1502	-3.39	***
Treasury Rate	-0.0104	-0.87		-0.0104	-0.87		-0.0544	-4.36	***	-0.0109	-0.89		-0.2062	-3.34	***
Term Spread	0.0118	0.89		0.0120	0.90		-0.0190	-1.36		0.0108	0.79		-0.2064	-2.97	***
L_{Ref}	0.5724	10.82	***	0.5733	10.83	***	0.8851	17.45	***	0.5787	10.97	***	1.2225	7.25	***
Rating (AAA)	2.1533	10.46	***	2.1374	10.36	***	1.2663	6.71	***	2.4805	10.65	***	-0.0315	-0.11	
Rating (AA)	2.3024	14.10	***	2.2836	13.90	***	1.4236	8.75	***	2.6013	12.94	***	0.3628	1.15	
Rating (A)	2.1064	14.17	***	2.0929	14.08	***	1.2184	7.95	***	2.3805	11.47	***	0.2205	0.75	
Rating (BBB)	2.2419	16.00	***	2.2279	15.89	***	1.3870	9.16	***	2.5128	12.49	***	0.1713	0.61	
Rating (BB)	1.9983	15.57	***	1.9852	15.47	***	1.3206	8.49	***	2.2683	11.74	***			
Rating (B)	1.7528	14.98	***	1.7408	14.87	***	1.3037	8.37	***	2.0221	10.91	***			
Rating (CCC)	1.2664	7.87	***	1.2555	7.81	***	1.1579	6.54	***	1.5392	7.35	***			
Rating (CC)	0.3744	1.24		0.3597	1.20		0.5881	1.52		0.5667	1.51				
r_S	-1.2602	-18.36	***	-1.2555	-18.27	***	-1.4871	-20.15	***	-1.2653	-18.25	***	-1.9824	-7.15	***
σ_S	1.6813	10.36	***	1.6709	10.32	***				1.6776	10.33	***			
Size	0.3420	2.46	**	0.3372	2.43	**							0.3175	1.92	*
Size × $r_{\text{S\&P500}}$				-70.4856	-2.72	***									
$\beta^{DF}_{r_S} \times \text{I}_{\text{Fin}}$							0.2362	3.61	***						
TARP										0.3054	2.00	**			
MES													7.6828	3.77	***
Constant	-2.8048	-14.57	***	-2.7878	-14.49	***	-1.3789	-8.91	***	-3.0702	-13.00	***	0.1150	0.30	
$Adj.R^2$	0.2162			0.2167			0.1724			0.2164			0.2260		
Observations	524,868			524,868			524,868			524,868			64,143		
Coef. Estimates	OLS			OLS			OLS			OLS			OLS		
Standard Errors	CL-F			CL-F			CL-F			CL-F			CL-F		

For robustness see also *dynamics of relative price deviations*, *alternative subsamples*, and *determinants of changes*.

	(4) Coef.	t		(5) Coef.	t		(6) Coef.	t		(7) Coef.	t		(8) Coef.	t	
$r_{S\&P500}$	-24.1100	-5.42	***	-21.1758	-4.55	***	-46.2296	-9.54	***	-23.9967	-5.35	***	-74.1502	-3.39	***
Treasury Rate	-0.0104	-0.87		-0.0104	-0.87		-0.0544	-4.36	***	-0.0109	-0.89		-0.2062	-3.34	***
Term Spread	0.0118	0.89		0.0120	0.90		-0.0190	-1.36		0.0108	0.79		-0.2064	-2.97	***
L_{Ref}	0.5724	10.82	***	0.5733	10.83	***	0.8851	17.45	***	0.5787	10.97	***	1.2225	7.25	***
Rating (AAA)	2.1533	10.46	***	2.1374	10.36	***	1.2663	6.71	***	2.4805	10.65	***	-0.0315	-0.11	
Rating (AA)	2.3024	14.10	***	2.2836	13.90	***	1.4236	8.75	***	2.6013	12.94	***	0.3628	1.15	
Rating (A)	2.1064	14.17	***	2.0929	14.08	***	1.2184	7.95	***	2.3805	11.47	***	0.2205	0.75	
Rating (BBB)	2.2419	16.00	***	2.2279	15.89	***	1.3870	9.16	***	2.5128	12.49	***	0.1713	0.61	
Rating (BB)	1.9983	15.57	***	1.9852	15.47	***	1.3206	8.49	***	2.2683	11.74	***			
Rating (B)	1.7528	14.98	***	1.7408	14.87	***	1.3037	8.37	***	2.0221	10.91	***			
Rating (CCC)	1.2664	7.87	***	1.2555	7.81	***	1.1579	6.54	***	1.5392	7.35	***			
Rating (CC)	0.3744	1.24		0.3597	1.20		0.5881	1.52		0.5667	1.51				
r_S	-1.2602	-18.36	***	-1.2555	-18.27	***	-1.4871	-20.15	***	-1.2653	-18.25	***	-1.9824	-7.15	***
σ_S	1.6813	10.36	***	1.6709	10.32	***				1.6776	10.33	***			
Size	0.3420	2.46	**	0.3372	2.43	**							0.3175	1.92	*
Size × $r_{S\&P500}$				-70.4856	-2.72	***									
$\beta_{r_S}^{DF} \times I_{Fin}$							0.2362	3.61	***						
TARP										0.3054	2.00	**			
MES													7.6828	3.77	***
Constant	-2.8048	-14.57	***	-2.7878	-14.49	***	-1.3789	-8.91	***	-3.0702	-13.00	***	0.1150	0.30	
$Adj.R^2$	0.2162			0.2167			0.1724			0.2164			0.2260		
Observations	524,868			524,868			524,868			524,868			64,143		
Coef. Estimates	OLS			OLS			OLS			OLS			OLS		
Standard Errors	CL-F			CL-F			CL-F			CL-F			CL-F		

For robustness see also *dynamics of relative price deviations*, *alternative subsamples*, and *determinants of changes*.

	(4)		(5)		(6)		(7)		(8)	
	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
$r_{S\&P500}$	-24.1100	-5.42 ***	-21.1758	-4.55 ***	-46.2296	-9.54 ***	-23.9967	-5.35 ***	-74.1502	-3.39 ***
Treasury Rate	-0.0104	-0.87	-0.0104	-0.87	-0.0544	-4.36 ***	-0.0109	-0.89	-0.2062	-3.34 ***
Term Spread	0.0118	0.89	0.0120	0.90	-0.0190	-1.36	0.0108	0.79	-0.2064	-2.97 ***
L_{Ref}	0.5724	10.82 ***	0.5733	10.83 ***	0.8851	17.45 ***	0.5787	10.97 ***	1.2225	7.25 ***
Rating (AAA)	2.1533	10.46 ***	2.1374	10.36 ***	1.2663	6.71 ***	2.4805	10.65 ***	-0.0315	-0.11
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Rating (A)	2.1064	14.17 ***	2.0929	14.08 ***	1.2184	7.95 ***	2.3805	11.47 ***	0.2205	0.75
Rating (BBB)	2.2419	16.00 ***	2.2279	15.89 ***	1.3870	9.16 ***	2.5128	12.49 ***	0.1713	0.61
Rating (BB)	1.9983	15.57 ***	1.9852	15.47 ***	1.3206	8.49 ***	2.2683	11.74 ***		
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Rating (CCC)	1.2664	7.87 ***	1.2555	7.81 ***	1.1579	6.54 ***	1.5392	7.35 ***		
Rating (CC)	0.3744	1.24	0.3597	1.20	0.5881	1.52	0.5667	1.51		
r_S	-1.2602	-18.36 ***	-1.2555	-18.27 ***	-1.4871	-20.15 ***	-1.2653	-18.25 ***	-1.9824	-7.15 ***
σ_S	1.6813	10.36 ***	1.6709	10.32 ***			1.6776	10.33 ***		
Size	0.3420	2.46 **	0.3372	2.43 **					0.3175	1.92 *
Size $\times$ $r_{S\&P500}$			-70.4856	-2.72 ***						
$\beta_{r_S}^{DF} \times I_{Fin}$					0.2362	3.61 ***				
TARP							0.3054	2.00 **		
MES									7.6828	3.77 ***
Constant	-2.8048	-14.57 ***	-2.7878	-14.49 ***	-1.3789	-8.91 ***	-3.0702	-13.00 ***	0.1150	0.30
$Adj.R^2$	0.2162		0.2167		0.1724		0.2164		0.2260	
Observations	524,868		524,868		524,868		524,868		64,143	
Coef. Estimates	OLS		OLS		OLS		OLS		OLS	
Standard Errors	CL-F		CL-F		CL-F		CL-F		CL-F	

For robustness see also *dynamics of relative price deviations*, *alternative subsamples*, and *determinants of changes*.

	(4)			(5)			(6)			(7)			(8)		
	Coef.	t		Coef.	t		Coef.	t		Coef.	t		Coef.	t	
$r_{\text{S\&P500}}$	-24.1100	-5.42	***	-21.1758	-4.55	***	-46.2296	-9.54	***	-23.9967	-5.35	***	-74.1502	-3.39	***
Treasury Rate	-0.0104	-0.87		-0.0104	-0.87		-0.0544	-4.36	***	-0.0109	-0.89		-0.2062	-3.34	***
Term Spread	0.0118	0.89		0.0120	0.90		-0.0190	-1.36		0.0108	0.79		-0.2064	-2.97	***
L_{Ref}	0.5724	10.82	***	0.5733	10.83	***	0.8851	17.45	***	0.5787	10.97	***	1.2225	7.25	***
Rating (AAA)	2.1533	10.46	***	2.1374	10.36	***	1.2663	6.71	***	2.4805	10.65	***	-0.0315	-0.11	
Rating (AA)	2.3024	14.10	***	2.2836	13.90	***	1.4236	8.75	***	2.6013	12.94	***	0.3628	1.15	
Rating (A)	2.1064	14.17	***	2.0929	14.08	***	1.2184	7.95	***	2.3805	11.47	***	0.2205	0.75	
Rating (BBB)	2.2419	16.00	***	2.2279	15.89	***	1.3870	9.16	***	2.5128	12.49	***	0.1713	0.61	
Rating (BB)	1.9983	15.57	***	1.9852	15.47	***	1.3206	8.49	***	2.2683	11.74	***			
Rating (B)	1.7528	14.98	***	1.7408	14.87	***	1.3037	8.37	***	2.0221	10.91	***			
Rating (CCC)	1.2664	7.87	***	1.2555	7.81	***	1.1579	6.54	***	1.5392	7.35	***			
Rating (CC)	0.3744	1.24		0.3597	1.20		0.5881	1.52		0.5667	1.51				
r_S	-1.2602	-18.36	***	-1.2555	-18.27	***	-1.4871	-20.15	***	-1.2653	-18.25	***	-1.9824	-7.15	***
σ_S	1.6813	10.36	***	1.6709	10.32	***				1.6776	10.33	***			
Size	0.3420	2.46	**	0.3372	2.43	**							0.3175	1.92	*
Size $\times$ $r_{\text{S\&P500}}$				-70.4856	-2.72	***									
$\beta^{DF}_{r_S} \times I_{\text{Fin}}$							0.2362	3.61	***						
TARP										0.3054	2.00	**			
MES													7.6828	3.77	***
Constant	-2.8048	-14.57	***	-2.7878	-14.49	***	-1.3789	-8.91	***	-3.0702	-13.00	***	0.1150	0.30	
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    ○ Implicit but reasonable assumption: Negative CDS-bond basis (due to illiquidity and counterparty risk) stays fixed as default risk increases.

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Panel A – Offering amounts

	2007	2008	2009	2010	Total
Banks	877.40	459.38	205.68	83.79	1626.25
Insurance	58.78	32.23	24.38	18.40	133.79
Real Estate	16.68	4.90	6.45	9.75	37.78
Others	2.25	2.97	5.07	1.25	11.54
Total	955.11	499.48	241.58	113.19	1809.36

Panel B – Subsidies calc. by increasing YTMs

	2007	2008	2009	2010	Total
Banks	3.06	31.28	54.72	2.49	91.55
Insurance	0.14	1.56	1.28	1.32	4.30
Real Estate	0.14	0.10	0.74	0.23	1.21
Others	0.00	0.21	0.76	0.01	0.98
Total	3.34	33.15	57.50	4.05	98.04

Panel C – Subsidies calc. by increasing coupon rates

	2007	2008	2009	2010	Total
Banks	3.31	38.25	77.15	2.58	121.29
Insurance	0.17	1.76	1.44	2.05	5.42
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6. Conclusion

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▷ Capitalized subsidies amount to $129.2 billion

▷ CDS prices are biased to the downside and thus unreliable to monitor the health of the financial system

Business Climate		*TBTF guarantees become particularly valuable in times of crises, when default probabilities jump up and expected recovery rates decline.*
S&P 500 Return $r_{S\&P500}$ (%)	−	Average daily return of the S&P 500 index over the past six months
VIX	+	Model-free volatility forecast for the next 30-day period implied from index options
Interest Rate Term Structure		*The effect of a rise in the spot rate is ambiguous: First, it lowers the a firm's PD by increasing the risk-neutral drift of its asset value process. Second, it can be associated with a tightened monetary policy and higher PDs. A steeper slope of the yield curve is similarly ambiguous: First, it may be associated with the expectation of a recovering economy. Second, it can accompany rising inflation and corresponding monetary countermeasures.*
Treasury Rate	±	Three-month Treasury rate
Term Spread	±	Slope between the ten-year and the three-month Treasury rates
Illiquidity		*Since illiquidity drives up market prices while model estimates remain unaffected, it should reduce price deviations.*
On/Off Spread $L_{On/Off}$	−	Five-year Treasury yield is compared to its less frequently traded off-the-run counterpart
Refcorp Spread L_{Ref}	−	Yield difference between less frequently traded five-year bonds issued by the Resolution Funding Corporation and Treasury bonds

↻

Ratings		Empirical evidence indicates that negative rating announcements increase credit spreads.
S&P Issuer Ratings	+	Dummy variables for S&P issuer credit rating classes
Firm Condition		Stock price and volatility reflect the distance-to-default.
Stock Return r_S (%)	−	Daily log returns
Stock Volatility σ_S	+	Implied volatilities of one-year at-the-money put options
Size		In line with the TBTF hypothesis, we expect government interventions to aim at very large firms and corresponding market expectations to be strongly related to firm size.
Total Assets (bn)	+	Book values collected from Compustat
Total Liab. + Market Cap. (bn)	+	Book values collected from Compustat plus market capitalization inferred from CRSP data
TARP	+	The admission of a firm under TARP can be interpreted as an explicit support commitment by the government. Therefore, we include dummies for firms that participated in the TARP program.
Default Correlation		Systemically-relevant firms are more likely to receive government support. Since contagion effects are essentially observed among financials, this measure only applies to them.
$\beta_{r_S}^{DF}$	+	Beta between a firm's daily stock return and the return of the S&P 500 Diversified Financials index over a 50-day rolling window.
Counterparty Risk		Counterparty risk may appear relevant as it moves market premiums downwards, similar to government guarantees. Interventions are most likely in times of increased systemic risk, implying higher default correlation among multiple large financial firms and a higher counterparty risk component in all CDS contracts, especially in those written on financials.
$\beta_{r_{CDS}}^{PD}$	+	Beta between a firm's daily CDS return and the variation in an index of primary dealers, calculated in two steps. First, we construct daily index values as the average of each constituent's CDS spread weighted by their market capitalization. Second, we calculate daily beta values $\beta_{r_{CDS}}^{PD} = \frac{cov(r_{CDS}; r_{PD})}{var(r_{PD})}$ for each company over a 50-day rolling window.

	Dev	Size	TARP	$\beta_{r_S}^{DF}$	$\beta_{r_{cDS}}^{PD}$	L_{Ref}	$L_{\mathrm{On/Off}}$	$r_{\mathrm{S\&P500}}$
Panel A – All companies from January 2002 to September 2010								
Dev	1							
Size	0.073	1						
TARP	0.071	0.600	1					
$\beta_{r_S}^{DF}$	0.158	0.208	0.162	1				
$\beta_{r_{cDS}}^{PD}$	0.030	0.236	0.150	0.281	1			
L_{Ref}	0.375	0.013	-0.009	0.167	0.075	1		
$L_{\mathrm{On/Off}}$	0.309	0.009	0.008	0.102	0.029	0.601	1	
$r_{\mathrm{S\&P500}}$	-0.152	-0.007	-0.006	-0.011	-0.012	-0.168	-0.196	1
Panel B – Financial companies from August 2007 to September 2009								
Dev	1							
Size	0.191	1						
TARP	0.224	0.561	1					
$\beta_{r_S}^{DF}$	0.133	0.197	0.170	1				
$\beta_{r_{cDS}}^{PD}$	0.030	0.566	0.366	0.371	1			
L_{Ref}	0.168	0.005	0.038	0.035	0.080	1		
$L_{\mathrm{On/Off}}$	0.160	0.003	0.027	0.010	-0.009	0.6671	1	
$r_{\mathrm{S\&P500}}$	-0.084	0.007	-0.007	0.027	-0.003	-0.1489	-0.125	1

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▷ Narrowing the sample and considering only financials during the crisis, indicates that the hypothesized too-big-to-fail effect is more relevant in explaining the wedge than counterparty risk.

	(1)		(2)		(3)		(4)		(5)	
	Coef.	z	Coef.	z	Coef.	z	Coef.	z	Coef.	t
Lagged Dep. Variable	0.6612	8.36 ***	0.6634	8.36 ***	0.6612	8.40 ***	0.6599	8.45 ***	0.9499	60.68 ***
$r_{\text{S\&P500}}$	-291.0800	-3.67 ***	-284.3867	-3.64 ***	-292.9566	-3.68 ***	-289.6206	-3.66 ***	-3.4609	-3.03 ***
Treasury Rate	0.3041	1.59	0.3137	1.63 *	0.3049	1.60	0.3007	1.58	0.0222	11.87 ***
Term Spread	-0.0321	-0.20	-0.0302	-0.19	-0.0326	-0.20	-0.0339	-0.21	0.0072	3.78 ***
$L_{\text{On/Off}}$	11.5784	2.80 ***	11.7749	2.83 ***	11.5357	2.80 ***	11.5654	2.81 ***	-0.0639	-3.06 ***
Rating (AAA)	0.3558	1.15	0.3173	0.95	0.5714	1.34	0.4677	1.38	0.0100	0.64
Rating (AA)	0.3629	1.16	0.3307	0.98	0.5519	1.29	0.4362	1.26	0.0283	1.61 *
Rating (A)	0.3404	1.12	0.2997	0.91	0.5055	1.20	0.4138	1.24	0.0373	2.62 ***
Rating (BBB)	0.3616	1.16	0.3191	0.95	0.5316	1.25	0.4402	1.30	0.0415	2.66 ***
Rating (BB)	0.3155	1.03	0.2738	0.82	0.4947	1.17	0.3950	1.17	0.0390	2.59 *
Rating (B)	0.3353	1.09	0.2955	0.89	0.5173	1.22	0.4125	1.22	0.0416	2.45
Rating (CCC)	0.3364	1.02	0.2818	0.79	0.4870	1.08	0.4155	1.14	0.0313	2.35
Rating (CC)	0.1713	0.47	0.1542	0.39	0.3289	0.69	0.2121	0.52	0.0178	1.03
Size	0.1674	2.72 ***	0.1156	2.13 **					0.1056	2.94 ***
Size $\times r_{\text{S\&P500}}$			-207.3666	-7.04 ***						
$\beta_{r_S}^{DF} \times I_{\text{Fin}}$					0.1389	4.08 ***				
TARP							0.2247	2.53 **		
Constant	-1.0282	-1.46	-1.0085	-1.41	-1.2127	-1.61	-1.0957	-1.55	-0.0679	-3.86 ***
Observations	9,604		9,604		9,604		9,604		404,132	
Obs Frequency	Q		Q		Q		Q		D	
Coefficient Estimates	GMM		GMM		GMM		GMM		FE	
Standard Errors									FE	
	p-value		p-value		p-value		p-value			
Arellano-Bond Test AR(1)	0.00		0.00		0.00		0.00			
Arellano-Bond Test AR(2)	0.13		0.14		0.13		0.14			
Hansen Test	0.27		0.25		0.27		0.26			

	(1)			(2)			(3)			(4)			(5)		
	Coef.	z		Coef.	z		Coef.	z		Coef.	z		Coef.	t	
Lagged Dep. Variable	0.6612	8.36	***	0.6634	8.36	***	0.6612	8.40	***	0.6599	8.45	***	0.9499	60.68	***
$r_{\text{S\&P500}}$	-291.0800	-3.67	***	-284.3867	-3.64	***	-292.9566	-3.68	***	-289.6206	-3.66	***	-3.4609	-3.03	***
Treasury Rate	0.3041	1.59		0.3137	1.63	*	0.3049	1.60		0.3007	1.58		0.0222	11.87	***
Term Spread	-0.0321	-0.20		-0.0302	-0.19		-0.0326	-0.20		-0.0339	-0.21		0.0072	3.78	***
$L_{\text{On/Off}}$	11.5784	2.80	***	11.7749	2.83	***	11.5357	2.80	***	11.5654	2.81	***	-0.0639	-3.06	***
Rating (AAA)	0.3558	1.15		0.3173	0.95		0.5714	1.34		0.4677	1.38		0.0100	0.64	
Rating (AA)	0.3629	1.16		0.3307	0.98		0.5519	1.29		0.4362	1.26		0.0283	1.61	*
Rating (A)	0.3404	1.12		0.2997	0.91		0.5055	1.20		0.4138	1.24		0.0373	2.62	***
Rating (BBB)	0.3616	1.16		0.3191	0.95		0.5316	1.25		0.4402	1.30		0.0415	2.66	***
Rating (BB)	0.3155	1.03		0.2738	0.82		0.4947	1.17		0.3950	1.17		0.0390	2.59	*
Rating (B)	0.3353	1.09		0.2955	0.89		0.5173	1.22		0.4125	1.22		0.0416	2.45	
Rating (CCC)	0.3364	1.02		0.2818	0.79		0.4870	1.08		0.4155	1.14		0.0313	2.35	
Rating (CC)	0.1713	0.47		0.1542	0.39		0.3289	0.69		0.2121	0.52		0.0178	1.03	
Size	0.1674	2.72	***	0.1156	2.13	**							0.1056	2.94	***
Size $\times$ $r_{\text{S\&P500}}$				-207.3666	-7.04	***									
$\beta_{rS}^{DF} \times \text{I}_{\text{Fin}}$							0.1389	4.08	***						
TARP										0.2247	2.53	**			
Constant	-1.0282	-1.46		-1.0085	-1.41		-1.2127	-1.61		-1.0957	-1.55		-0.0679	-3.86	***
Observations	9,604			9,604			9,604			9,604			404,132		
Obs Frequency	Q			Q			Q			Q			D		
Coefficient Estimates	GMM			GMM			GMM			GMM			FE		
Standard Errors															
	p-value			p-value			p-value			p-value					
Arellano-Bond Test AR(1)	0.00			0.00			0.00			0.00					
Arellano-Bond Test AR(2)	0.13			0.14			0.13			0.14					
Hansen Test	0.27			0.25			0.27			0.26					

| | 08-2007 to 09-2010 – All companies | | | | | | 08-2007 to 09-2010 – Only financials | | | | | |
| | (1) | | (2) | | (3) | | (4) | | (5) | | (6) | |
	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
$r_{S\&P500}$	-22.2557	-3.23 ***	-43.1111	-6.44 ***	-23.1295	-3.53 ***	-25.5557	-0.99	-34.9430	-1.69 *	-39.6285	-1.89 *
Treasury Rate	0.0991	5.69 ***	0.0875	5.06 ***	0.0986	5.65 ***	-0.0550	-0.78	-0.0438	-0.60	-0.0556	-0.92
Term Spread	0.0721	3.67 ***	0.0211	1.11	0.0704	3.55 ***	-0.1043	-1.42	-0.0897	-1.19	-0.1591	-2.28 **
L_{Ref}	0.6268	8.03 ***	1.0786	16.00 ***	0.6430	8.84 ***	0.4670	1.62	0.7685	2.43 **	0.9046	3.32 ***
Rating (AAA)	2.2655	6.87 ***	1.6966	5.01 ***	2.9417	7.44 ***						
Rating (AA)	2.4579	10.72 ***	1.9445	7.58 ***	3.0589	10.76 ***	2.0350	5.70 ***	2.7908	6.64 ***	2.0512	7.93 ***
Rating (A)	2.1857	11.83 ***	1.6332	6.99 ***	2.7664	8.93 ***	1.7829	5.92 ***	2.2773	6.28 ***	1.7808	4.85 ***
Rating (BBB)	2.2790	13.38 ***	1.7425	8.01 ***	2.8601	9.57 ***	1.5205	6.47 ***	1.8839	5.81 ***	1.5474	4.59 ***
Rating (BB)	1.8592	12.25 ***	1.5508	6.79 ***	2.4535	8.28 ***	0.9608	3.82 ***	1.2604	4.07 ***	1.2312	3.10 ***
Rating (B)	1.5025	10.97 ***	1.4706	6.42 ***	2.0994	7.17 ***	1.3609	11.98 ***	1.5844	7.50 ***	1.9506	5.46 ***
Rating (CCC)	1.1217	7.24	1.3468	6.13 ***	1.7424	5.58 ***	1.4992	6.31 ***	1.6945	5.66 ***	2.0441	4.98 ***
Rating (CC)	0.2772	0.87 ***	0.8134	1.78 *	0.7074	1.38	0.0508	0.22	0.3475	1.71 *	0.8075	1.67 *
r_S	-1.1873	-15.22 ***	-1.4406	-16.42 ***	-1.2035	-14.95 ***	-1.0899	-6.34 ***	-1.2615	-6.84 ***	-1.3517	-6.64 ***
σ_S	1.6925	8.41 ***			1.6282	8.13 ***	0.9385	3.23 ***	0.3685	1.10		
Size	0.5130	3.52 ***					0.5211	2.92 ***				
Size × $r_{S\&P500}$	-11.9110	-0.40					-27.4761	-0.58				
$\beta^{DF}_{r_S} \times I_{Fin}$			0.4063	4.12 ***					0.5026	2.56 **		
TARP					0.6985	2.33 **					0.8072	2.25 **
Constant	-3.0780	-12.66 ***	-2.0582	-9.13 ***	-3.6396	-11.06 ***	-1.4653	-3.17 ***	-2.1809	-3.45 ***	-1.2177	-3.51 ***
Adj. R^2	0.1426		0.0991		0.1471		0.1096		0.1021		0.1135	
Observations	247,189		247,189		247,189		34,218		34,218		34,218	
Coef. Estimates	OLS		OLS		OLS		OLS		OLS		OLS	
Standard Errors	CL-F		CL-F		CL-F		CL-F		CL-F		CL-F	

	(1)		(2)		(3)		(4)		(5)	
	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
$r_{S\&P500}$	-21.5784	-8.33 ***	-20.9954	-7.86 ***	-10.4251	-4.1 ***	-20.9872	-7.85 ***	-17.0695	-7.94 ***
Δ Treasury Rate	-0.0935	-5.43 ***	-0.0896	-5.15 ***	0.0722	4.16 ***	-0.089	-5.11 ***	-0.1074	-6.39 ***
Δ Term Spread	0.0588	4.49 ***	0.0616	4.65 ***	0.1079	8.54 ***	0.0622	4.68 ***	0.0476	3.72 ***
$\Delta\ L_{\mathrm{Ref}}$	-0.0428	-1.4	-0.0446	-1.45	-0.072	-2.53 **	-0.0447	-1.45	-0.0316	-1.03
r_S					-0.004	-5.02 ***				
$\Delta\ \sigma_S$					3.415	11.33 ***				
Δ Size$_{t-1}$	1.9412	4.23 ***	1.8389	4.39 ***	1.757	5.08 ***	1.83	4.38 ***		
Δ Size$_{t-1} \times r_{S\&P500}$			-0.0001	-4.09 ***			-0.0001	-4.09 ***		
$\Delta\ (\beta^{DF}_{r_S} \times \mathrm{I}_{\mathrm{Fin}})$							0.1149	2.08 **		
TARP									0.0333	1.71 *
Constant	0.0023	0.93	0.0026	1.02	0.0034	1.49	0.0025	1.00	0.001	0.4
Adj. R^2	0.025		0.0266		0.1838		0.0269		0.0215	
Observations	40,964		40,569		40,964		40,569		41,353	
Coefficient Estimates	OLS		OLS		OLS		OLS		OLS	
Standard Errors	White		White		White		White		White	

*End-of-month observations

↺

▷ Counterparty risk affects CDS prices negatively.

  ⇒ May account for a part of the wedge.

▷ In periods of high systemic risk, both the value of guarantees (the wedge) and counterparty risk rise.

  ⇒ Effects therefore hard to distinguish, but counterparty risk seems to have played a minor role overall:

    ◇ Regression: Statistical significance of counterparty risk proxy much more sensitive to control variables.

    ◇ Relative deviation graph: Wedge tightened around the Lehman collapse, a time when counterparty risk must have reached a high, and only widened after the announcement of TARP.

    ◇ Correlation matrices: Variables presumably related to TBTF (like size and TARP) are more correlated with the wedge than the counterparty risk proxy (0.03).

    ◇ Adjustment: An estimated counterparty risk adjustment to the wedge hardly affects its magnitude.

Counterparty Risk Adjustment

US Financials

US Banks