CDS and government bond spreads – how informative are they for financial stability analysis?

Irina Mihai[1] and Florian Neagu[2]

1. Introduction

Changes in CDS spreads[3] are shaping to an increasing extent markets' risk perceptions, although there is no consensus about the adequacy of the informational content provided by such instruments. Some voices (e.g. Altman, 2010; Hart and Zingales, 2009) consider CDS to be one of the most important indicators of credit quality. Other opinions highlight that the CDS market structure and pricing might endogenously bear some drawbacks, and the signals delivered by CDS should be cautiously valued (e.g. Anderson, 2010; Longstaff et al., 2007). The CDS instruments for emerging markets hold even more adverse characteristics (in terms of liquidity, concentration, deepness etc.), calling for additional caution in reading CDS spread developments.

The wider use of CDS information is taking place jointly with a fading-away of the role of government bond spreads. Alexopoulou et al. (2009) argue the bias towards CDS spreads is normal: (i) bond yields are subject to some characteristics affecting the price; (ii) the credit spread is more easily inferred from CDS contracts being directly priced, while bond spreads deliver differences based on the benchmark assumption; and (iii) the bond market is more prone to low liquidity than the CDS market (although the CDS market is more concentrated and the price displays a higher correlation with peer countries during turbulent times). Soros (2009) argues that it is easier to take a short position on an entity using a CDS contract instead of shorting a bond, as a CDS investor is not exposed to a similar loss asymmetry.

In this paper we question how germane for the macroprudential analysis is the informational content delivered by CDS and government bond spreads. We focus on the Romanian case, targeting three issues: (i) the degree to which the movements in CDS or bond spreads are linked with Romanian fundamentals and their specific risk; (ii) which instrument leads in the price discovery process; and (iii) the impact of CDS and bond spreads' dynamics on the interest rates charged by banks to their customers.

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[1] National Bank of Romania, Financial Stability Department, email: Irina.Racaru@bnro.ro

[2] National Bank of Romania, Financial Stability Department, email: Florian.Neagu@bnro.ro

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[3] CDS are instruments for which the buyer pays a regular fee (e.g. on a quarterly basis for the Romanian sovereign CDS case), and receives the full amount of the reference instruments (if physical settlement) or net of the recovered amount (if cash settlement) when a specified credit event occurs. The CDS spread represents the annualized fee that the buyer pays during the life time of the contract or until the event occurs. In the case of sovereign CDS contracts for the Eastern European countries, the credit events considered are: failure to pay, obligation acceleration, repudiation/moratorium, restructuring. The form of debt covered by CDS contracts in this case is only foreign currency internationally issued bonds (ISDA, 2010a).

In searching for answers, we combine three types of databases:

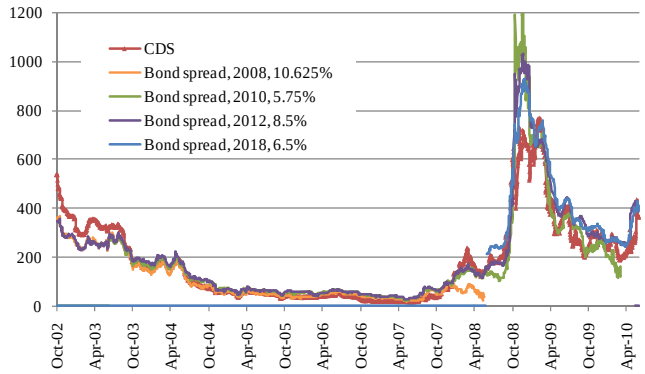
(i) Public information data, provided especially by DTCC, Bloomberg, and CMA. We present in Annexes 2 and 3 a summary of these data. We use CDS spreads for both euro and US dollar denominated contracts. We observe no significant differences between the two prices. US dollar contracts bear the advantage of longer tenure series (since October 2002, while the euro contracts last from January 2004). The 5-year CDS is the most liquid instrument for Romanian sovereign debt (similar to other Central and Eastern European countries). We use Bloomberg data to collect Romanian international bond prices, and compute the spreads against similar German bonds. We use only the 2008, 2010, and 2012 maturity issuances, because no CDS spread quotations are available before October 2002. We compute monthly data as average daily values.

(ii) An ad-hoc survey sent to all Romanian banks to get inputs from their side about the role of CDS and bond spreads in assessing risks and in impinging on their financing costs. Banks that answered the questions count for more than a 90% market share of banking sector assets. The survey included two similar subsections: one on CDS spreads and another on international bond spreads. The questions were: (i) if banks monitor the evolution of these spreads, eg they include them in their internal reports for the banks' management; (ii) if and to what extent are these spreads affecting their funding costs; and (iii) if and to what amount they pass these costs to the real sector.

(iii) Individual information about the interest rates charged by each Romanian bank to its clients (distinct for companies and households) for the new loans denominated in euros during January 2007–May 2010. Euro denominated loans account for approximately a 50% share in total household and company loans.

The Romanian sovereign CDS market is relatively small compared to other countries from the region (similar to Bulgaria). The net notional value stands at about USD 1.2 bln (June 2010). The number of contracts and the average contract value augmented after the end of October 2008, but at the cost of market concentration: net notional value has embarked on a downward trend in the last two years (decreased by 40%, October 2008–June 2010). The process is in tune with the region (Annex 1).

Chart 1:
Basis risk[4] for Romanian CDS 5-year contracts
(basis points)



Source: Bloomberg, own calculations.

[4] See Andritzky and Singh (2006) for a detailed insight into basis effects.

The outstanding amount of Romanian international bonds[5] is very thin (Annex 1), but the number of players quoting such instruments is larger than in the CDS instruments case[6].

Despite these market characteristics, the importance of CDS spreads in building up risk perception about Romania seems to be on an upward trend. Starting from 2008, there is a growing number of literature and media positions assessing Romanian risk through the CDS lens. Many domestic banks screen CDS developments to get a better flavor about the trend of perils. According to the ad-hoc survey we have conducted on Romanian banks, especially medium and large banks monitor and include information about CDS spread developments in their internal reports to the management. No Romanian bank is involved in trading CDS instruments (August 2009), whatever the purpose (hedging or speculation). Almost 75% of the Romanian banks do not pay attention in their internal reports to government bond dynamics. There are a few banks trading such bonds, both for hedging and speculative purposes, but the amount is modest (about EUR 20 mln, August 2009). The annual reports on Romania drafted by major financial institutions or rating agencies exhibit a mixed picture about the importance assigned to the information delivered by CDS or bond spreads (Table 1). There are entities putting no emphasis on such information in assessing the country risk. On the other hand, some institutions consider CDS to provide useful inputs about risk developments.

Table 1

Number of references about CDS/bond spreads in annual reports on Romania

Institution	2005	2006	2007	2008	2009	2010
Raiffeisen Romania	0/0	0/0	0/8	3/9	10/1	4/0
Unicredit Romania	n.a.	n.a.	0	7/0	1/0	5/0
ING Romania	0/0	0/0	0/0	0/0	0/0	0/0
BCR	n.a.	n.a.	0	n.a.	3/0	n.a.
BRD	n.a.	n.a.	0	0	1/0	0
Fitch	0	0	0	0	0	n.a.
Moody's	0	0	0	0	0	0
JCR	0	0	0	0	0	n.a.
IMF	n.a.	0/1	0/2	3/2	2/1	2/0
IIF	0	0	0	0	0	0

Source: Annual reports issued by the above-mentioned institutions.

[5] The analysis is focused only on international bonds as an alternative to CDS contracts in quantifying market perception on country risk. The reason stands in the fact that CDS contracts use as reference only foreign currency denominated bonds (ISDA, 2010a).

[6] According to the survey conducted on the Romanian banks, most of the data sources used by banks for CDS contracts are provided by Bloomberg and Reuters terminals. On Bloomberg, there are only two low level access data providers for Romanian sovereign CDS (as opposed to at least 20 for Romanian international bonds maturing in 2012): Raiffeisen Austria and CMA Datavision (see Annex 2). The latter is an electronic platform which collects data from other financial institutions and, if there are not enough data contributors, provides additional values on a peer group or a model based approach.

The remainder of this paper is organized as follows: Section 2 identifies the factors underlying spread movements, breaking down the determinants into regional, liquidity and specific risk components. Section 3 highlights the level of pass-through from the spread developments to the interest rates charged by banks to firms and households, while the last section concludes the main messages of the paper.

2. What do the changes in CDS and bond spreads depict?

We embark on a macroprudential approach to assess (i) the degree to which CDS and bond spreads explain and mirror sovereign specific risk; and (ii) the link between CDS and bond spreads.

We decompose the CDS spread dynamics into three factors: (i) global and regional systemic risk; (ii) liquidity risk; and (iii) country specific risk. We reach the conclusion that the first two factors count the most in explaining the spreads' movements. This outcome is in line with Longstaff et al. (2007). We replicate the analysis for Romanian international bond spreads and we reach the same conclusion. Similar evidence was found in Amato and Remolona (2003) and Schuknecht et al. (2009).

The methodology behind the analysis is based on a reduced form model:

$S = (1 - RR)PD + RP + Lq$,

where RR = recovery rate, PD = probability of default, RP = risk premium, and Lq = liquidity premium.

We approximate the (1 – RR)PD using public debt to GDP, budget deficit to GDP, GDP growth, and industrial production. For RP we use implied volatility for S&P 500 and for Euro Stoxx 50 indexes (similar to Longstaff et al., 2007). We also include a regional marker like MSCI index prices for Eastern European countries, its volume and its volatility. For the interest free rate we use repo, three month Libor/Euribor, and yield curve indicators – the differences between 2-year and 10-year yields on US and German government bonds. The choice of risk free interest rate is not clear in the literature. Hull et al. (2004) find evidence for the interest swap rate and repo rate. The authors argue that most CDS models use the Treasury rate as the risk free rate, while the market practice seems to prefer the interest swap rate.

For Lq we use the bid-ask spread. As an alternative indicator we use the number of quotations per month, but it was not found significant. The liquidity component[7] for CDS spreads is highly conditioned on the global risk aversion sentiment and, to a lesser extent, on regional mood. These two factors explain over 50% of bid-ask spread variance. In the bond case, the link with risk aversion is much less important. The results are presented in Annex 4. Spreads' sensitivity to factors tested changed after November 2004 (Fitch granted Romania the investment grade), and October 2008 (Lehman Brothers went bankrupt, S&P downgraded Romania to below investment grade, and the domestic currency suffered a speculative attack).

The shifts in coefficients were detected using recursive coefficient estimations (for individual coefficients) and Chow break tests (for all coefficients). The individual tests show mild changes in the first breakpoint (November 2004), and important shifts in the second one (October 2008). The results of the aggregate tests are presented in Annex 4. The second aim of the analysis is to gain an insight into the link between the bond and CDS spreads.

[7] Brigo et al. (2010) provide an extensive overview of the estimation for the CDS liquidity premia.

Price discovery[8] is considered one of the most important CDS benefits. The method applied is similar to Dötz (2007).

We find for the Romanian case that both CDS and bond spreads count for the price discovery process, but CDS seems to matter more (Annex 5). We conduct our tests using various bond spread series: a synthetic 5-year bond spread index and singular bond spread. We re-run the tests on a monthly basis (using average monthly prices) to check the validity of the results (without heteroskedastic autoregressive profile). The outcome is alike.

Our results are similar to other studies on sovereign CDS (e.g. Ammer and Cai, 2007; Coudert and Gex, 2010). However, the evidence in literature is mixed. Ashcraft and Santos (2007), and Blanco et al. (2004) find that CDS spreads lead bond spreads, while Dötz (2007) shows vice-versa. Chan-Lau and Kim (2004), and Ammer and Cai (2007) indicate that alternations in price discovery role for CDS and bonds is due to shifts in liquidity toward CDS markets in turmoil periods. Varga (2009) investigates this relation for some Eastern European countries and finds that, for Romania, the bond market led the CDS market during 2005–2008, while an inverted relation is reached when considering the year 2008 alone.

3. Do banks pass through the changes in CDS spreads to their clients?

Changes in CDS or bond spreads might impair financial stability indirectly (altering risk perception), and directly (through the cost channel). In this second channel, banks that finance from abroad might face an additional charge. If such costs are passed on to the clients, an increasing debt service burden will put pressure on the default rate.

We ask two questions: (i) how much an adjustment in spreads affects the costs of the Romanian banks that finance from abroad; and (ii) what is the level of pass-through of such changes in the CDS spreads to the interest rates charged for the banks' clients.

From the ad-hoc survey, we discover a rather poor relation between, on the one hand, CDS and bond spread dynamics, and, on the other, the cost of financing from abroad for Romanian banks. The majority of banks declare no relation between spreads and their funding cost (from the parent bank or from other foreign lenders). However, there are some banks (especially the larger ones) indicating a strong direct link between the spreads and their cost of external financing. The CDS price matters on a larger scale than the bond spread.

We investigate if domestic banks transfer the CDS spread costs to the real economy and households. Only few banks reported in the ad-hoc survey that they use CDS spreads in computing credit margins for households. The amount at stake is very small: 0.2% of total loans granted to households (August 2009). Banks' motivation was mostly determined by requirements to increase transparency on interest rates and margins on retail contracts.

We test the link between the interest rate on new loans in euros for households and for companies and CDS spreads and CDS dynamics, to check for indirect effects. We use the

[8] The price discovery process is discussed in detail in Garbade and Silber (1983) and Hasbrouck (1995). For the purpose of this paper, the understanding of this process relies on that provided by Hasbrouck (1995). He notes that "it is generally acknowledged that it is relatively expensive for a market to provide a price discovery mechanism: balancing supply and demand in an orderly fashion requires procedural safeguards that are costly to provide. In contrast, once a price has been determined and publicized, it is relatively cheap to provide order matching or crossing functions that simply pair off buyers and sellers at that price."

monthly average figures reported by each Romanian bank during January 2007–May 2010, and run a Granger causality test[9].

We find no direct link between CDS spreads and CDS dynamics, on the one hand, and the new interest rate charged to companies, on the other hand. Both econometric results (Granger causality test at the individual and aggregate level), and the ad-hoc survey support this conclusion. In the case of households, the results are mixed. We cannot rule out such a link at the average banking sector level. We run a dynamic panel using the GMM technique on the first 20 banks (based on their assets and household and corporate portfolio). The outcome is similar. The CDS spread dynamics are not found important in the corporate case, but are significant for households. Results are displayed in Annex 6.

4. Conclusions

Anecdotic evidence exhibits a mounting role for CDS spreads in building up risk perceptions about Romania, while the similar task for sovereign bonds seems to be fading away. We adopt a macroprudential perspective to assess (i) to what extent a movement in spreads is able to signal, in a forward looking approach, an adjustment to the Romanian specific risk; and (ii) the impact on the interest rates charged by the Romanian banks to their clients due to changes in CDS spreads.

We find that markets for Romanian CDS and bond spreads display some features that would call for caution when judging their information content. The CDS market is very small, on an upward trend in terms of concentration, and with a low number of transactions. The outstanding amount of Romanian international bonds is very thin, but the number of players quoting such instruments appears to be larger as in the CDS case. Domestic banks are not involved in trading the Romanian CDS. To trade bonds issued internationally is not a widespread activity within the Romanian banking sector, being concentrated to a few banks and counting to small amounts.

The most important factors explaining Romanian spread movements are liquidity risk and regional mood. The specific factor, i.e. the Romanian stance of risk, modestly counts in spread dynamics. The link between changes in fundamentals and spreads is humble.

Both CDS and bond spreads are important for the price discovery process. Bonds are the followers during the analyzed tenure (October 2002–June 2010).

There is no direct link between CDS spreads and the new interest rate charged by banks to companies. Both econometric results and the ad-hoc survey support this conclusion. For household financing, the output is mixed. We cannot rule out such a link at the average banking sector level. However, the amount of household loans linked to CDS spreads is very small: 0.2% of the total credits granted to households (August 2009).

[9] The Granger causality test has to be read with caution. First, the test should not be interpreted as causality of CDS spreads to interest rates, but rather as the forecast capacity of CDS spreads for interest rates. Second, the results generated by Granger causality might be invalidated because: (i) during the crisis the financial variables are highly heteroskedastic (affecting the output of the test; Davidson and MacKinnon, 2003); and (ii) the test is very sensitive to number of lags and how the variables are transformed into stationary variables (Hamilton, 1994).

Annex 1:
CDS and government bond market characteristics

	CDS								International bonds and notes – amounts outstanding (bln USD)	
	Net notional value (bln USD)		Gross notional value (bln USD)		Number of contracts		Average contract value (mln USD)			
	10/31/2008	6/25/2010	10/31/2008	6/25/2010	10/31/2008	6/25/2010	10/31/2008	6/25/2010	9/2008	3/2010
BG	1.82	1.05	15.76	17.63	1,514	1,729	10.41	10.20	2.4	2.2
CZ	1.17	0.92	4.67	9.82	382	786	12.22	12.49	12.7	17.3
EE	0.65	0.42	2.18	3.23	287	393	7.59	8.23	1.6	0.4
HR	0.79	0.66	4.12	6.62	557	892	7.40	7.42	6.2	6.4
HU	4.38	3.33	32.76	57.34	3,014	4,421	10.87	12.97	38.3	37.3
LT	0.72	0.67	3.22	5.17	411	563	7.82	9.18	5.4	9.6
LV	1.13	0.71	6.28	8.39	822	956	7.64	8.78	1.7	1.3
PL	2.43	2.04	16.45	27.60	1,516	2,396	10.85	11.52	42.6	55.3
RO	1.93	1.19	11.94	16.04	1,283	1,610	9.31	9.97	4.7	5.4
RU	8.47	3.87	110.07	98.09	7,651	6,736	14.39	14.56	63.8	56.8
TR	6.98	5.81	188.63	138.35	14,093	8,027	13.38	17.24	41.6	43.7
UA	3.15	1.49	65.54	44.67	6,023	3,180	10.88	14.05	11.8	10.9
Median	1.88	1.12	13.85	16.84	1,398	1,669	10.63	10.86	9.00	10.25
Total	33.62	22.17	461.60	432.96	37,553	31,689	12.29	13.66	233.3	247.0

Source: DTCC, BIS, own calculations

Annex 2:
CDS[10] and bond spread statistics

Statistics for Romania CDS EUR and bid-ask spread

	Bloomberg		CMA (London)		CMA (New York)		Raiffeisen Austria	
	Mid price	Bid/ask	Mid price	Bid/ask	Mid price	Bid/ask	Mid price	Bid/ask
Mean	291	17	162	13	160	13	250	19
Median	272	10	62	8	82	9	197	10
Min	113	1	17	1	17	1	34	-30
Max	706	60	786	100	781	100	788	240
Std	115	16	177	15	167	14	206	21
Skewness	1.4	1.5	1.6	3.0	1.7	2.8	1.1	4.1
Kurtosis	5.2	4.5	5.0	12.4	5.6	11.4	3.2	36.3
No. obs.	634		1,475		1,687		710	
No. months*	18		69		78		38	
Period	10/2/2004–6/21/2010		10/1/2004–6/21/2010		1/1/2004–6/21/2010		2/10/2004–6/21/2010	

* number of months with more than 10 daily quotations (from a maximum of 78)

Source: Bloomberg, own calculations

[10] For extended references on various databases on CDS spreads see ISDA (2010b), Mayordomo et al. (2009)

Statistics for Romania CDS USD and bid-ask spread (cont)

	Bloomberg		CMA (London)		CMA (New York)		Raiffeisen Austria	
	Mid price	Bid/ask	Mid price	Bid/ask	Mid price	Bid/ask	Mid price	Bid/ask
Mean	181	13	160	12	158	13	211	15
Median	153	9	61	8	78	9	169	8
Min	17	1	17	1	17	1	18	-37
Max	769	100	786	100	781	100	785	240
Std	165	14	175	15	165	14	204	22
Skewness	1.3	2.8	1.6	3.1	1.7	2.8	1.1	3.9
Kurtosis	4.5	11.9	5.1	13.2	5.8	11.9	3.2	30.0
No. obs.	1,956		1,462		1,666		858	
No. months*	93		69		78		43	
Period	10/16/2002–6/21/2010		10/1/2004–6/21/2010		1/2/2004–6/21/2010		1/25/2006–6/21/2010	

* number of months with more than 10 quotations (from a maximum of 93)
Source: Bloomberg, own calculations

Statistics for Romanian bond spreads and bid-ask spreads

	Bond1 (2008)		Bond2 (2010)		Bond3 (2012)		Bond4 (2015)		Bond5 (2018)	
	Average spread	Bid/ask	Average spread	Bid/ask	Average spread	Bid/ask	Average spread	Bid/ask	Average spread	Bid/ask
Mean	104.1	4.4	164.6	4.6	193.8	5.2	359.9	5.4	422.8	7.5
Median	58.5	4.4	105.4	4.4	146.1	4.9	355.0	5.3	346.6	6.8
Min	19.3	2.7	19.3	1.3	25.3	3.2	258.2	4.8	211.8	5.4
Max	437.1	8.2	1,204.8	14.2	1,026.6	12.6	512.4	6.5	931.1	12.5
Std	88.9	1.1	187.6	1.7	182.9	1.6	88.1	0.6	190.5	1.9
Skewness	1.29	0.69	2.94	2.29	2.03	1.84	0.23	0.37	1.10	1.06
Kurtosis	0.53	0.53	9.83	8.89	4.92	4.90	8.23	8.23	2.14	2.14
No.obs.	1,473		1,798		2,007		80		525	
Period	10/1/2002–5/30/2008		6/24/2003–5/31/2010		10/1/2002–6/30/2010		2/11/2010–6/30/2010		6/12/2008–6/21/2010	

Source: Bloomberg, own calculations

Annex 3:
Data sources

Indicators	Observations	Source
Romanian CDS		
CDS USD	5Y series, monthly average	Bloomberg
CDS EUR	5Y series, monthly average	Bloomberg
Romanian bond		
BOND1 (ISIN: XS0131554700)	monthly average	Bloomberg
BOND2 (ISIN: XS0171638330)	monthly average	Bloomberg
BOND3 (ISIN: XS0147466501)	monthly average	Bloomberg
BOND4 (ISIN: XS0495980095)	monthly average	Bloomberg
BOND5 (ISIN: XS0371163600)	monthly average	Bloomberg
Risk free rate		
Euribor 3M	monthly average	Bloomberg
USD and EUR Libor 3M	monthly average	Bloomberg
USD and EUR repo rate	monthly average	Bloomberg
USD and EUR swap rate	monthly average	Bloomberg
Slope		
Government 2Y	monthly average	Bloomberg
Government 10Y	monthly average	Bloomberg
Yield slope	difference between government 10Y and government 2Y yields, monthly average	Bloomberg
Volatility		
VIX and VSTOXX	monthly average	Bloomberg
Regional factors		
MSCI Eastern European Index (MSCI EE)	monthly average	Bloomberg
MSCI Eastern European Volatility 100 days	monthly average	Bloomberg
MSCI Eastern European Volume	monthly average	Bloomberg
Macro economic factors		
Public expenses (% of public revenue)	monthly data	MFP
Budget deficit (% of GDP)	monthly data	MFP
Public debt (% of GDP)	monthly data	MFP
GDP growth rate	quarterly data, interpolated	NIS
Industrial production (2005 = 100%)	monthly data	NIS
Confidence indicator	monthly data	EC

Note: MFP stands for Minister of Public Finance, NIS for National Institute for Statistics and EC for European Commission

Annex 4:
Regression analysis for CDS spreads

All the variables (CDS and bond spreads, bid-ask spreads etc.) are in percentage points. The table displays regression coefficients and Newey-West adjusted standard errors. CDS and bond liquidity premia are calculated as residuals (see the third table below). The series were tested for unit root using Augmented Dickey-Fuller and Phillips-Perron, but the results are not included in this paper. In bold are tests significant at 5% and in italic those that are significant at 10%.

	ΔCDS		ΔCS	
	(1)		(2)	
CDS/CS Liquidity Premia	**3.5**	0.92	**19.4**	6.7
ΔPublic Deficit/GDP	0.1	0.08	-0.1	0.1
ΔPublic Debt*/GDP	**0.2**	0.06	0.1	0.1
ΔIndustrial Production	0.0	0.02	*-0.1*	0.0
ΔCurrent Account/GDP	0.0	0.06	0.0	0.1
ΔRisk Free Rate	-0.3	0.25	-0.3	0.3
ΔVIX Index	**0.04**	0.01	**0.04**	0.02
ΔMSCI EE	*-0.004*	0.00	0.0	0.0
ΔMSCI EE Volatility	*0.02*	0.01	**0.1**	0.02
constant	-0.03	0.03	0.0	0.0
Adj. R2	0.57		0.67	
Durbin-Watson statistic	1.87		2.03	
Breusch-Godfrey serial correlation LM test	F-stat: 0.22 Prob F(1,76): 0.64		F-stat: 0.02 Prob F(1,77): 0.89	
Breusch-Pagan-Godfrey heteroskedasticity test	F-stat: 2.98 Prob F(9,77): 0.00		F-stat: 4.38 Prob F(9,77): 0.00	

* domestic debt only
CS = bond spread. We conduct tests on both synthetic 5Y-spread and individual bond spread. The results are similar.
B/A = bid-ask spread (difference between ask and bid quotations)

Chow breakpoint test

		F-statistic	Probability	Log likelihood ratio	Probability
Equation on column (1) previous table	11/2004	0.9	0.51	4.7	0.45
	10/2008	**3.2**	0.01	**16.2**	0.01
Equation on column (3) previous table	11/2004	1.1	0.36	4.7	0.32
	10/2008	**10.9**	0.00	**38.5**	0.00

CDS and bond liquidity premia regression results

	ΔCDS B/A		ΔCS B/A	
	(1)		(2)	
ΔVIX	**0.006**	0.00	**0.001**	0.00
ΔMSCI EE	**-0.0006**	0.06		
Adj. R2	0.51		0.05	
Durbin-Watson statistic	1.94		1.92	
Breusch-Godfrey serial correlation LM test	F-stat: 1.47 Prob F(2,86): 0.23		F-stat: 0.66 Prob F(2,87): 0.51	
Breusch-Pagan-Godfrey heteroskedasticity test	F-stat: 15.17 Prob F(2,87): 0.00		F-stat: 0.05 Prob F(1,88): 0.83	

Annex 5:
Contributions to price discovery

We follow the procedure applied by Dötz (2007) to test the contribution of CDS and bond spreads to price discovery. We estimate the Error Correction Model:

$$EC_t = CDS_t - \upsilon - \gamma CS_t$$

$$\Delta CDS_t = \lambda_1 EC_{t-1} + \alpha_1 + \sum_{k=1}^{l} \beta_{1,k} \Delta CDS_{t-k} + \sum_{k=1}^{l} \beta_{2,k} \Delta CS_{t-k} + \varepsilon_{1,t}$$

$$\Delta CS_t = \lambda_2 EC_{t-1} + \alpha_2 + \sum_{k=1}^{l} \beta_{3,k} \Delta CDS_{t-k} + \sum_{k=1}^{l} \beta_{4,k} \Delta CS_{t-k} + \varepsilon_{2,t}$$

We compute price discovery intensity using two measures: Gonzalo Granger (GG) and Hasbrouck (HAS)[11]. A value higher than 0.5 (for GG and MID) signifies that CDS spreads lead the price discovery process.

Cointegration tests*,**

	CDS USD	CDS USD	CDS USD	CDS EUR	CDS EUR	CDS EUR
	ALL	1/3/04 – 7/31/07	8/1/07 – 6/21/10	ALL	1/3/04 – 7/31/07	8/1/07 – 6/21/10
Trace test	**37.8**	**27.5**	**18.8**	**35.5**	**31.7**	**18.8**
probability value	0.00	0.03	0.02	0.00	0.01	0.02
Maximum eigenvalue	**36.2**	**22.3**	**16.8**	**34.4**	**24.8**	**16.8**
probability value	0.00	0.02	0.02	0.00	0.01	0.02

* both test values are for H0: No cointegration relation exists

** the number of lags was determined based on Schwartz Information Criteria

Error Correction Model results

	CDS USD	CDS USD	CDS USD	CDS EUR	CDS EUR	CDS EUR
	ALL	1/3/04 – 7/31/07	8/1/07 – 6/21/10	ALL	1/3/04 – 7/31/07	8/1/07 – 6/21/10
γ	-0.83	-0.98	-0.84	-0.83	-0.97	-0.85
λ_1	**-0.016**	**-0.027**	*-0.013*	**-0.020**	*-0.022*	**-0.019**
H0 λ_1=0 t statistic	-2.9	-2.2	-1.7	-3.3	-1.7	-2.1
λ_2	**0.024**	**0.033**	**0.024**	**0.021**	**0.037**	**0.022**
H0 λ_2=0 t statistic	4.3	3.1	2.9	3.9	3.8	2.7
GG	0.6	0.5	0.6	0.5	0.6	0.5
HAS1	0.5	0.4	0.6	0.4	0.6	0.5
HAS2	0.8	0.8	0.8	0.7	0.9	0.7
MID	0.6	0.6	0.7	0.6	0.7	0.6

[11] For more details on these measures see Dötz (2007).

Annex 6:
Testing the link between CDS spreads and interest rates for new loans

Granger causality test for average new interest rates on new credit in euros

Null hypothesis (test using two lags)*:	F-test	Prob.	F-test	Prob.	F-test	Prob.
	all		period 1**		period 2***	
ΔCDS USD does not Granger Cause ΔIR CNF	2.28	0.11	0.91	0.41	1.80	0.18
ΔIR CNF does not Granger Cause ΔCDS USD	0.02	0.98	2.22	0.12	0.21	0.82
ΔCDS EUR does not Granger Cause ΔIR CNF	2.27	0.11	1.78	0.18	1.65	0.21
ΔIR CNF does not Granger Cause ΔCDS EUR	0.04	0.96	0.48	0.62	0.09	0.91
ΔCDS USD does not Granger Cause ΔIR HH	**5.03**	**0.01**	1.00	0.37	**3.65**	**0.04**
ΔIR HH does not Granger Cause ΔCDS USD	1.60	0.21	0.53	0.59	0.81	0.46
ΔCDS EUR does not Granger Cause ΔIR HH	**5.66**	**0.01**	0.37	0.69	**3.70**	**0.04**
ΔIR HH does not Granger Cause ΔCDS EUR	1.41	0.25	0.67	0.52	0.74	0.48

* IR CNF (HH) represents interest on new credit in euros granted to corporate (household) sector

**period 1: 05/2003–07/2007 (51 observations)
***period 2: 08/2007–05/2010 (34 observations)
HH = households, CNF = non-financial companies

Dynamic panel (GMM)

	01/2007 – 05/2010			
	IR CNF		IR HH	
	(1)		(2)	
ΔCDS spread	-0.40	0.56	**0.19**	0.01
Market position	**-0.04**	0.00	**-0.02**	0.02
IR (t-1)*	**0.66**	0.00	**0.84**	0.00
No of obs.	858		760	
No. of banks	20		20	
Wooldridge test for serial correlation	F-stat: 5.52 Prob F(1,19): 0.03		F-stat: 0.16 Prob F(1,19): 0.69	

*IR (t-1) represents the interest rate on new credit for companies (column 1) and households (column 3).

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