

Development, information content and regulation of the market for credit default swaps

The market for credit default swaps (CDS) has seen strong growth since the start of the millennium. The part CDS play in distributing credit risk more efficiently and, potentially, in stabilising the financial system has already been discussed in depth. Mention was also made very early on of the risks inherent to the CDS market, for example with regard to the insufficient transparency of these – primarily – over-the-counter (OTC) transactions and to its oligopolistic structure, ie the predominance of a very small number of market players. Against this backdrop, the financial crisis with the collapse of the US investment bank Lehman Brothers in the autumn of 2008 was the first serious test of the CDS market's resilience, as the default by one big CDS market player triggered fears of a systemic chain reaction. Contrary to such misgivings, however, the immediate consequences for the CDS market of the Lehman Brothers insolvency remained limited. But from the end of 2009 onwards, as worries arose over the ability of some euro-area countries to refinance their debt, debate concerning CDS and their impact on the financial system flared up anew.

This article examines a number of aspects concerning the CDS market and looks at, for instance, the market characteristics and the information content of ratios and prices in the CDS market. Particular attention is devoted to recent developments on selected European government bond markets, and the publicly debated influence of CDS transactions on the yield increases for bonds issued by those countries is empirically investigated.

Based on the results, the period under review (from 2007 to mid-October 2010) exhibited a largely stable pricing relationship between bond and CDS markets. The price leadership of CDS relatively frequently found in earlier studies on the corporate bond market is confirmed for the sovereign bonds of the so-called euro-area peripheral countries as well. In the most recent phase, however, there have also been noticeable differences in the adjustment behaviour of bond and CDS markets.

Moreover, the development of CDS spreads did not decouple from fundamentals in this phase; thus there is no support for the theory that CDS spreads have mainly been driven by speculation. The need for better data availability and greater transparency of the CDS markets is undisputed, however, and the current regulatory approaches on the market for OTC derivatives seek to achieve this goal. Various national and international regulatory approaches and measures aim at combating the risks that were highlighted by the financial crisis – especially those involved in using CDS – more effectively in the future.

Possible uses of CDS

Definition of CDS

A CDS allows a protection buyer to insure himself for a specified period of time against certain risks arising from a credit relationship; for this, the protection seller receives a premium. The risks in the form of so-called credit events are clearly defined in advance, and the corresponding contracts are based on the standards of the International Swaps and Derivatives Association (ISDA).¹ The protection seller undertakes to compensate the protection buyer if such a credit event occurs.

Factors influencing CDS market growth

Different factors have benefited the development of the CDS market since the start of the new millennium. The rising number of business insolvencies in the years 2001 to 2003 brought home at an early stage of the CDS market the need for market players to hedge credit risk. CDS are a reasonably priced alternative, particularly when compared to traditional hedges such as guarantees.

Furthermore, low transaction costs and initial efforts to standardise CDS contracts have made the CDS market more attractive.

CDS used mainly to hedge market price risk

According to market surveys, the main reason for using CDS is to protect against changes in the market value of the reference assets, to the point of the market value falling to zero, ie complete default.² Thus, CDS are a hedging instrument. Against this background, CDS spreads are also a possible source of information in estimating the probability of default expected in the market. However, the derivation of a specific probabil-

ity of default is based on a number of assumptions. This suggests the need for particular caution when interpreting such calculations (see box on page 45).

When buying CDS on sovereign bonds, the investor's foremost interest seems to be to hedge against a change in market value rather than against default.³ Portfolio considerations play an important role here; due to these, long-term oriented investors prefer to hedge an asset position against exposure using CDS rather than shift assets in response to risk assessment changes.⁴

Other important motives for the use of CDS besides purely hedging can be intermediary trading (in the sense of market making), using them as an asset class in their own right and, at least until now, as a device for saving on regulatory capital.⁵

¹ For details on the standard contracts, see the ISDA website at <http://www.isda.org/protocol/index>.

² As a rule, the actual default amount is limited by the recovery rate.

³ This explains why, for instance, CDS on AAA-rated countries such as Germany or the United States are traded although, if such a debtor really did default, the financial system would very probably suffer serious turmoil, leading to payment problems for the protection seller.

⁴ Mention should be made here of proxy hedging, which allows a creditor – in the absence of an alternative instrument – to hedge via a CDS on a reference asset whose value is assumed to be highly correlated with the liability the creditor holds. The most common examples are sovereign CDS, which are used to hedge bonds of an enterprise of the country in question if there are no CDS on that enterprise.

⁵ With regard to saving on capital, there were changes to credit risk management in banking under Basel III. The Basel rules increased the incentive to transfer credit risks to unregulated non-banks with a high credit rating, which acted as CDS issuers. In this way, it was possible to back the reference assets with less regulatory capital. The extent to which the amended capital requirements under Basel III will lead to changes remains to be seen.

Information content of CDS spreads

Owing to the CDS market's efficiency, which was postulated in particular in the pre-crisis period, the information content of CDS spreads was already of interest when this financial instrument first emerged. Empirical studies appear to indicate that the CDS market anticipates rating downgrades faster than bond markets.¹

The crisis in the euro-area peripheral countries led many observers to note an increase in the probability of default in connection with rising CDS spreads. In principle, a positive relationship can be expected to exist between the CDS spread and the market-traded (default) risk of the underlying reference asset. However, it is difficult to derive the probability of default from the CDS premiums for a number of reasons.

First of all, CDS spreads quoted in the markets put a price tag not only on the loss given default expected by investors and the additional risk of unexpected loss but also on counterparty risk and liquidity risk. In addition, whilst the two latter components as well as the risk premium can usually be presumed to be rather constant in normal market phases, they are likely to become more significant in times of crisis and subsequent uncertainty. Ultimately, however, their size is difficult to quantify due to the limited availability of data.

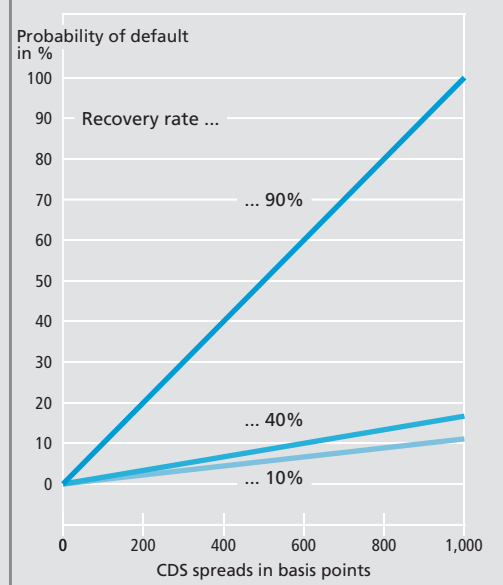
Under the simplifying assumption that these price components are constant and that the primary determinant of a change in CDS spreads is expected loss, this loss is to be divided into the expected recovery rate² and the expected probability of default.³

¹ See Deutsche Bundesbank, Credit default swaps – functions, importance and information content, Monthly Report, December 2004 — ² The recovery rate indicates the percentage share of the credit which is repaid when the credit event occurs. — ³ For the connection of the three variables, the following formula arises: $S=q*(1-R)$, where S denotes the CDS spread, q the probability of default and R the recovery rate. — ⁴ This is also consistent with the figure

In market studies on corporate defaults, a constant recovery rate of 40% is often presumed.⁴ However, for sovereign defaults, no reliable assumption can be made with regard to the rate of recovery. A study on sovereign debt restructuring in the 1998 to 2005 period written by researchers from the International Monetary Fund (IMF) arrives at a range of fluctuation of recovery rates from 10% to 90%.⁵

However, a change in this (expected) rate impacts greatly on the probability of default implied by the CDS spread. The imprecision of the probability of default increases substantially as the CDS spread rises.

Relationship between probability of default and CDS spread with given recovery rate



defined in standardised ISDA contracts on tier one reference assets. — ⁵ See: F Sturzenegger and J Zettelmeyer, Haircuts: Estimating Investor Losses in Sovereign Debt Restructurings, 1998 – 2005, IMF Working Paper, July 2005. The IMF's economists calculated the loss rate, also denoted "haircut", as the difference between the present values of the old and new instruments.

CDS also used for the risk management of market participants' portfolios

In addition, because of the separation of default and interest rate risk, CDS are an important instrument for managing the risk-return profile of a portfolio, with which a given market assessment can be turned into an investment strategy. For instance, a market participant who believes certain credit risks to be overvalued can act as protection seller on the CDS market and collect the – from his perspective, high – CDS premium without having to tie up any capital for the purchase of a bond. Thus, the global CDS market benefits from the limited short-selling opportunities for most reference assets on the bond market.⁶

When applying such trading strategies, CDS can be used to take advantage of arbitrage opportunities vis-à-vis the bond market since, in principle, a risky bond can be duplicated by an investment considered to be risk-free (eg a bond with a triple-A rating) and a CDS contract on the reference debtor of the risky bond. The prerequisite here is a sufficiently liquid CDS market for that debtor.⁷

Development of the CDS market

CDS market grew strongly from the year 2000 onwards but contracted during the financial crisis

CDS are still the most important and, in quantitative terms, the most widely used instruments in the credit derivatives market.⁸ To date, CDS are mostly traded on the OTC market, allowing for an agreement that suits the specific needs of both counterparties; the downside, however, lies in the low transparency and tradability of the contracts.

Nonetheless, the CDS market – like the market for credit derivatives as a whole – saw a rapid development from the start of the millennium until the onset of the international financial crisis. This applies both to the market volume traded (gross notional amounts) and to the open credit risk position (market values).⁹ Compared with the OTC derivatives market as a whole, with a volume of over US\$600 trillion, the CDS market is relatively small;¹⁰ but by the end of 2007, the gross notional amount outstanding on the CDS market had risen sharply to roughly US\$58 trillion (see chart on page 48). At that time, the total global volume of bonds was just short of US\$80 trillion.¹¹ The decline in gross volume since the beginning of 2008 was caused by the lower market dynamics and by a deleveraging of balance sheets in response to the financial crisis as well as by the growing use

⁶ Short selling refers to the sale of a security without owning it at the time of sale. In the case of short selling on spot markets the seller borrows the security (temporarily) from an institutional investor for a fee; “forward short selling” means that the seller stocks up on the security prior to the agreed delivery date. In each case, the seller expects to make a profit by betting that the price of the sold security will drop by the date on which he actually has to deliver it.

⁷ The gross notional values for European sovereign CDS, which are published weekly, indicate that liquidity was also available in times of crisis. There are no corresponding statistics for the sovereign bond markets. However, not until the end of April 2010 were there reports in the markets of a perceptible reduction in liquidity.

⁸ Besides CDS, total return swaps (TRS) and credit linked notes (CLN) are the two other basic types of credit derivatives. For definitions of these terms, see Deutsche Bundesbank, Monthly Report, April 2004, pp 28-31.

⁹ For definitions of gross, net and market value, see the box on p 47.

¹⁰ See Bank for International Settlements (BIS), Quarterly Review, December 2010, Table 19.

¹¹ Sum of debt securities issued internationally and nationally, published in BIS, op cit, Tables 12a and 16a.

of trade compression cycles.¹² The pronounced increase in market values, from US\$2 trillion in 2007 to US\$5 trillion in 2008, is primarily the result of the higher credit risks, which overcompensated the process described above. The subsequent decrease to below US\$2 trillion in the first half of 2010 is due, above all, to the ongoing deleveraging as well as to a temporary decline in risk premiums in the second and third quarters of 2009.

CDS market comparatively small, but heavily interconnected

Although new groups of market participants such as hedge funds and (re-)insurers have entered the CDS market as it has grown, one salient feature of the market is its oligopolistic structure.¹³ Because all large dealers act both as counterparty and as reference debtor, the interaction between counterparty risk and credit risk can be intense. In the more recent past such fears did arise, particularly when Lehman Brothers collapsed, but the interaction turned out to be less pronounced than feared.

¹² Market participants engage in trade compression cycles in order to reduce the gross notional amounts outstanding while maintaining the same risk profile. Under this procedure, market participants' offsetting claims under CDS contracts are determined and called in on a regular basis, and compensatory amounts are paid where applicable. Trade compressions are carried out, for example, by the Depository Trust & Clearing Corporation (DTCC) at the request of the industry. DTCC is a US clearing house which was created in 1999 through the merger of private companies Depository Trust Company and National Securities Clearing Corporation and, with its ten subsidiaries, is involved in the settlement of different classes of securities.

¹³ According to DTCC figures, the five largest dealers account for almost 50% of gross notional amounts outstanding, and the ten largest dealers are involved in 72% of all transactions (DTCC figures, March 2009).

Values for measuring the CDS market volume

Gross notional amount

The gross notional amount is the outstanding volume of all concluded CDS contracts. The gross notional amount is determined across all reference entities and all market participants.

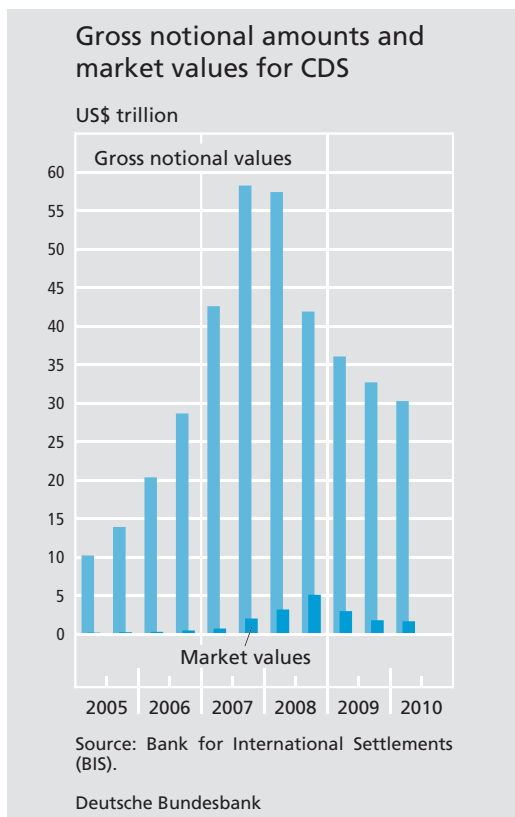
Net notional amount

The net notional amount is the sum of the net risk positions across all institutions. The net risk positions at the level of the individual institutions are calculated by netting the bought and sold CDS on each reference entity. The net risk positions of the financial sector (figures have been published by the Depository Trust & Clearing Corporation (DTCC) since 2008) amount to roughly 10% of gross notional amount outstanding.

Market value

The market value of a CDS contract reflects the replacement cost in the event of counterparty default. As a rule, when a CDS contract is concluded, the market value is close to zero as the sum of the premiums corresponds to the present value of the expected loss. If the underlying credit risk changes over the life of the contract, a positive market value results for one of the parties to the contract whereas the other has to record a negative market value in the same amount.

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Impact of Lehman insolvency on CDS market relatively small

There are two main reasons why the insolvency of Lehman Brothers had a relatively small impact. First, US government support measures stabilised the US insurer American International Group (AIG), which was an important protection seller on the CDS market and was itself facing large problems. Second, the big investment banks which usually act as market makers (ie trading entities responsible for price-smoothing operations) in general offset, by hedging, the risk positions they incur and so take on only a comparatively small part of the risk in the form of market value.¹⁴

Temporary period of relative calm followed in spring 2009

The general increase in spreads of bank and sovereign CDS in the wake of the Lehman Brothers insolvency was followed, from March 2009 onwards, by a phase of slight

easing. With the incipient problems involving the euro-area peripheral countries, the trend of falling CDS spreads was reversed for these countries. Public debate ensued, in which CDS and their supposedly destabilising impact came under heavy criticism.

This criticism was focused on the CDS market for sovereign bonds, although it accounts for a comparatively small part of the overall CDS market: with a gross notional amount of roughly US\$2 trillion, it makes up around 13% of the single-name CDS market.¹⁵ However, roughly half of this volume is accounted for by only eight countries which, in terms of gross notional amounts, currently belong to the 11 most important reference entities in the entire single-name CDS market (see table on page 51).

Overview of the sovereign CDS market

¹⁴ After the insolvency of Lehman Brothers, the other market participants succeeded, by netting, in limiting the cash settlement of the CDS contracts for which Lehman Brothers was the reference entity and which were estimated as representing a gross notional amount of US\$400 billion to US\$5.2 bn, ie to only 1.3% of the estimated gross notional amount. Moreover, the other market makers were able, apparently with relatively little fuss, to take over more than 300,000 CDS contracts involving Lehman Brothers as counterparty. See V Coudert and M Gex, The Credit Default Swap Market and the Settlement of Large Defaults, Centre d'Etudes Prospectives et d'Informations Internationales (CEPII), Working Paper 17, 2010.

¹⁵ With regard to CDS reference entities, according to the Bank for International Settlements (BIS), roughly 60% of the market is accounted for by single-name CDS, ie CDS on individual reference debtors, and 40% by multi-name CDS, ie CDS which refer to a group or an index of debtors (status as at the end of 2010 H1, BIS Quarterly Review, December 2010, Table 19). For details about the relative size of the sovereign CDS market, see BIS, Semi-annual OTC derivatives statistics, November 2010, at <http://www.bis.org/statistics/otcder/dt23.pdf>.

Pronounced growth in trading of euro-area sovereign CDS

More and more euro-area sovereign CDS have been traded since the beginning of 2009. In absolute figures, Italy has seen the sharpest increase, from US\$160 billion to around US\$250 billion (see chart on page 52). In recent months in particular, CDS on France have experienced an especially high relative growth. However, the actual willingness of the market to incur risk cannot be derived from changes in gross figures: net notional amounts are the more appropriate benchmark.

Increase in risk positions is focussed on CDS for European "core countries"

A glance at the growth rates of net volumes shows that the strongest increase is exhibited by CDS on France, followed by Germany and Italy. By contrast, net notional amounts for the euro-area peripheral countries saw comparatively moderate growth. Indeed, following a strong increase in 2009, Portugal even showed a decline between April and October 2010.

This can be explained by potential protection sellers being more willing to hold open risk positions for euro-area core countries than for peripheral countries – with knock-on effects on CDS spreads.¹⁶

Discernible connection between development of CDS spreads and risk positions

In this respect, two patterns can be discerned in the euro area. On the one hand, there are the countries whose gross-net ratio has largely remained constant and whose CDS spreads show a constant to slightly rising trend; these include Germany, France and Italy. On the other hand are countries such as Greece, Portugal, Ireland and Spain with rising CDS spreads, for which also the gross-net ratio has grown considerably.

Top five CDS dealers*

US\$ billion, purchases and sales

Dealer	Gross notional amount	Market value
JP Morgan	7,502	993
Goldman Sachs Group	6,600 ¹	392
Morgan Stanley	6,293	831
Deutsche Bank	6,191	774
Barclays Group	6,033	517

Sources: ECB (2009), US Securities and Exchange Commission (SEC). — * As at 31 March 2009, and in the case of Deutsche Bank and Barclays, as at 31 December 2008. — 1 Only sales.

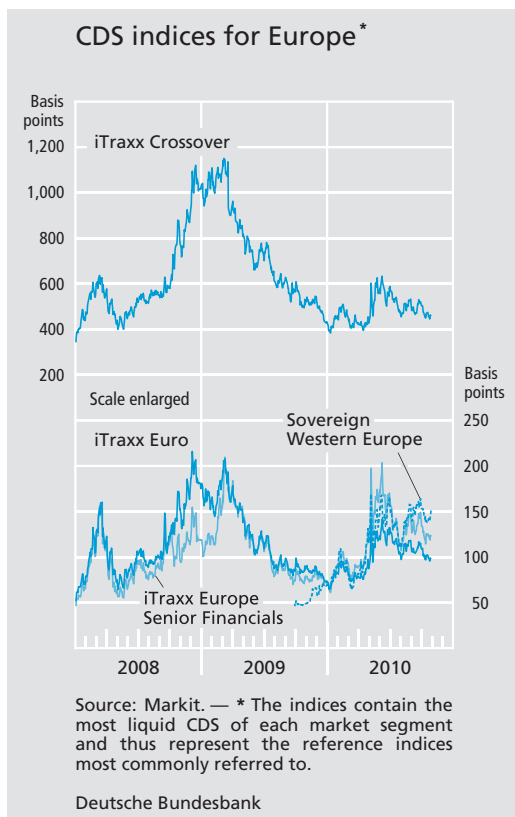
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On the criticism of speculation with CDS

The disparate developments on the European CDS markets are a comparatively new phenomenon. Up until 2007, the CDS market could largely be described as unremarkable with regard to pricing and price developments. Low key interest rates worldwide from 2002 to 2005 boosted demand for risky investments. This, in turn, contributed to a sharp decline in risk premiums on the financial markets. On the European sovereign bond market, too, the convergence of interest rates observed prior to the launch of the euro persisted at first.

CDS market pricing not in spotlight until 2009

¹⁶ This is in line with comparatively low net notional amounts in the case of emerging markets such as Brazil or Turkey, which, given very high gross notional amounts, market participants consider to be potentially at risk of restructuring.



The CDS spreads for European countries as well as the spreads between bonds of the peripheral countries and Bunds were extremely low for a considerable time, before rising on both markets – in some cases dramatically – during the financial crisis (see chart on page 56).

Rising spreads draw accusation of speculative attacks amidst worries over euro-area peripheral countries, ...

During the course of debate, the accusation has been voiced that the use of CDS on sovereign bonds of those countries fostered – or perhaps even triggered – the undesirable developments on the bond market. Critics argue that it could have been possible to use CDS to speculate, with a high leverage relative to the funds used, on the credit quality of countries deteriorating.

To validate this criticism, one must first establish that CDS do have price leadership over the respective bond markets. In theory, the two markets are linked by a long-run equilibrium relationship. This was observed for European corporate bonds – along with a certain price leadership of the CDS market – already in the initial phase of the development of the CDS markets.¹⁷ A supplementary empirical analysis conducted by the Bundesbank confirms, in principle, such a relationship as well as the leadership of CDS spreads also for selected euro-area countries from the beginning of 2007 to October 2010 (see table on page 53 and box on pages 54-55).

However, the price leadership of the CDS market merely indicates that, because of the arbitrage relationship, changes in CDS spreads are linked to corresponding changes in risk premiums on the bond market. Thus, only one prerequisite is met for the bond market to be influenced by the CDS market, but it is insufficient as a basis for alleging that certain yield movements are primarily the result of speculation on the CDS market.¹⁸

...yet price leadership of the CDS market is not sufficient to support speculation claim

¹⁷ See, for example, Deutsche Bundesbank, Credit default swaps – functions, importance and information content, Monthly Report, December 2004, and N Dötz, Time-varying contributions by the corporate bond and CDS markets to credit risk price discovery, Discussion paper by the Deutsche Bundesbank Research Centre, Series 2, No 8, 2007.

¹⁸ In this context, positions are considered to be "speculative" when there is no corresponding security in the CDS buyer's books which offsets the purchased CDS; the CDS is held to make a profit from rising spreads.

The decisive point is whether rise in CDS spreads is driven primarily by speculation...

In such a case, the CDS market would have to significantly affect risk premiums on the bond market, and largely in isolation from fundamental factors (contagion effects). This may, for instance, be triggered by herd behaviour, in which case a fundamental event or market rumours result in a sharp and disproportionate increase in CDS spreads. Such an increase causes investors to adjust their bond market positions. This produces a rise in yields of a strength and duration out of proportion to the fundamentals.

... or by fundamentals

However, a change in CDS spreads can also be caused by fundamentals. For example, rising CDS spreads may be a leading indicator for the fundamentals-driven deterioration in the credit quality of the issuer of the CDS reference asset. In this context, the CDS market responds faster if it has price leadership; market participants quickly price in the higher risk in the form of higher CDS spreads on the reference debtor's bonds.

Price leadership of CDS and "second-round effects"

However, a general price leadership of the CDS market does not rule out temporarily self-reinforcing processes on both markets. When CDS spreads have price leadership, mainly bond spreads adapt to arbitrage imbalances. Still, a corresponding, yet weaker change in CDS spreads can lead to "second-round effects" that prolong the adjustment process towards a new equilibrium.

There is some evidence that such phases in which the CDS spread also seems to have reacted to arbitrage disequilibria, and thus is likely to have heightened the need for bond yields to adjust, may have occurred at least

Most important reference entities for single-name CDS

Gross nominal values; US\$ billion

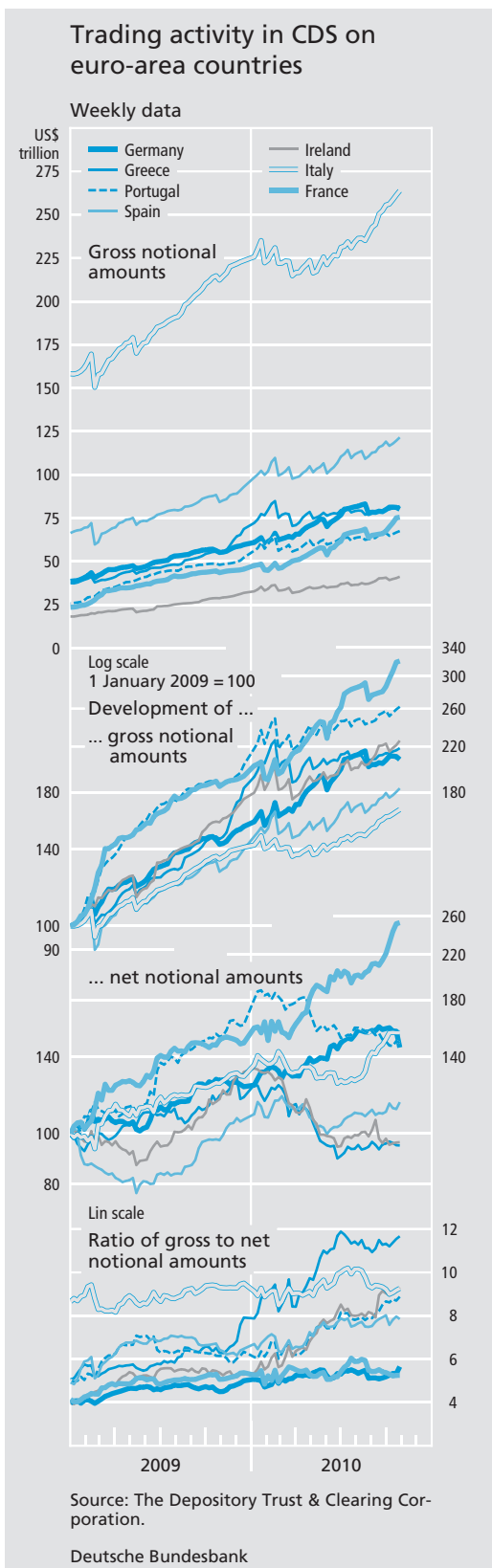
Reference entity	as at 1 Oct 2010
Italy	256
Brazil	147
Turkey	136
Spain	119
Mexico	107
Russia	95
General Electric Capital Corp	94
JP Morgan Chase	84
Greece	80
Bank of America	80
Germany	80
Memo item	
Total volume	15,147

Source: DTCC.

Deutsche Bundesbank

intermittently in the case of Greece in the crisis during the course of 2010 (see table on page 53). This is indicated by changes in the adjustment process between mid-2009 and October 2010. Nevertheless, the assessment of a general price leadership of the CDS market in Greece remains intact, even though the arbitrage relationship was at times less effective in 2010. The unusual constellation in the adjustment process coincided with a phase of increasingly negative reports regarding Greece's creditworthiness, culminating in two major rating agencies revoking its investment-grade rating.

Nor do the other euro-area peripheral countries present a homogeneous picture as regards changes in their adjustment processes when arbitrage imbalances occur. Particularly



Ireland, burdened since the end of September 2008 by the difficult situation of its banking sector, shows relatively little change. Also relatively stable in this respect, however, is Italy, one of the large euro-area countries which, furthermore, maintained a constant rating in the estimation period. The situation for Spain is somewhat less uniform over the period under review. For the analysis of the adjustment process up to mid-2009 there is only little statistical significance for a price leadership of the CDS market. Only when the database is expanded to include the period from the second half of 2009 onwards is the leadership property of the CDS market clearly confirmed. The reverse development is found for Portugal. A price leadership of the CDS market may be assumed for the period from 2007 to August 2010 as a whole, whereas there are signs of a certain weakening of the adjustment process for mid-August to mid-October 2010. However, it seems premature to interpret this finding as a more permanent structural break.

Euro-area peripheral countries during the crisis: certain heterogeneity in the development of adjustment processes...

Although the euro-area peripheral countries are, therefore, more heterogeneous in terms of these changes than the term "euro-area periphery" might suggest, a price leadership of the CDS market with regard to the arbitrage relationship with the bond market may be assumed for the period from 2007 to mid-October 2010 as a whole – even though the arbitrage relationship between the markets had, in individual cases, less of an effect at times in 2010. It should be borne in mind, moreover, that the CDS market is generally characterised by a certain lack of

...yet general price leadership of CDS market

Results of the two-stage ECM estimations*

Country	Estimation period: from 3 Jan 2007 until ...	DumIE:=	Cointegration estimation (with FMOLS) for SPRGOV_X: (estimated) cointegration coefficients of the regressors				EG test: test statistic/sign.	Estimation of the dynamic system (using GMM): estimated adjustment coeffi- cient in the equation for		GG meas- ure	Hasbrouck measures		
			SPRCDS_X	Constant	DumIE	cbreak_pt		D(SPRCDS_X)	D(SPRGOV_X)		Lower band limit	Upper band limit	Mid variable
Italy	30 Jun 2009		1.093 (41.018)	25.042 (17.743)	-	-	-4.096***	-0.004 (-0.351)	-0.065 (-4.313)	1.069	0.988	0.990	0.989
	1 Mar 2010		1.032 (32.431)	26.413 (14.995)	-	-	-3.105*	-0.005 (-0.494)	-0.043 (-4.055)	1.125	0.975	0.989	0.982
	15 Oct 2010		0.918 (34.948)	29.447 (15.803)	-	-	-3.550**	-0.002 (-0.181)	-0.043 (-3.587)	1.046	0.863	0.998	0.931
Ireland	30 Jun 2009		1.022 (47.132)	11.674 (5.559)	-	-	-5.353***	0.005 (0.399)	-0.054 (-4.493)	0.919	0.890	0.996	0.943
	1 Mar 2010		1.064 (47.886)	13.328 (5.808)	-	-	-5.779***	0.001 (0.097)	-0.050 (-5.453)	0.980	0.921	1.000	0.961
	15 Oct 2010		1.128 (60.796)	11.900 (4.877)	-	-	-6.458***	0.002 (0.162)	-0.056 (-3.866)	0.965	0.799	0.999	0.899
Greece	30 Jun 2009	dpt	0.761 (13.946)	25.862 (10.665)	0.565 (10.510)	-	-5.612***	0.000 (0.004)	-0.062 (-3.779)	0.999	0.910	1.000	0.955
	31 Dec 2009	dpt	0.755 (17.841)	24.704 (10.708)	0.542 (11.916)	-	-5.732***	-0.005 (-0.464)	-0.061 (-3.806)	1.090	0.879	0.987	0.933
	1 Mar 2010	dpt	0.863 (37.063)	22.351 (9.844)	0.437 (13.529)	-	-4.799***	-0.029 (-1.784)	-0.080 (-4.900)	1.560	0.839	0.994	0.916
	15 Oct 2010	dpt	0.968 (71.632)	16.906 (3.731)	0.407 (7.106)	-	-3.885**	-0.049 (-2.421)	-0.080 (-3.904)	2.578	0.511	0.974	0.742
Spain	30 Jun 2009	des	1	-	0.237 (19.186)	-	-4.647***	0.025 (1.809)	-0.036 (-2.303)	0.597	0.487	0.673	0.580
	1 Mar 2010	des	1	-	0.203 (14.183)	-	-4.266**	0.008 (0.717)	-0.032 (-2.683)	0.794	0.763	0.942	0.852
	15 Oct 2010	des	1	-	0.183 (12.771)	-	-4.602***	-0.018 (-1.161)	-0.060 (-4.302)	1.418	0.935	0.991	0.963
Portugal	30 Jun 2009	dpt	1.054 (15.241)	-	0.475 (17.052)	13.847 (8.219)	-4.749***	0.009 (1.068)	-0.053 (-4.018)	0.853	0.812	0.919	0.866
	1 Mar 2010	dpt	0.896 (23.987)	-	0.484 (23.185)	16.267 (9.801)	-4.442***	-0.001 (-0.168)	-0.045 (-4.228)	1.031	0.941	0.999	0.970
	15 Oct 2010	dpt	1.086 (58.935)	-	0.435 (15.395)	13.516 (5.025)	-3.529*	-0.002 (-0.102)	-0.037 (-2.054)	1.048	0.847	0.999	0.923

Sources: data from Reuters and Markit via Reuters; Bundesbank estimates and calculations. — * Results of two-stage ECM estimations using Eviews (t-statistics given under the estimated coefficients (in brackets), based on (Newey-West) heteroscedasticity and autocorrelation-consistent standard errors). SPRGOV_X stands for the relative yield spread of ten-year sovereign bonds, SPRCDS_X for the relative CDS spread (for five years, in EUR) of a country X vis-à-vis Germany, in each case in basis points. Country abbreviations (X): IT (Italy), IE (Ireland), GR (Greece), ES (Spain), PT (Portugal). The DumIE proxy variable dpt (des) corresponds to the difference between the relative CDS spreads of Ireland and Portugal (Spain) when SPRCDS_IE is greater than SPRCDS_PT (SPRCDS_ES), and is otherwise zero. The dummy variable cbreak_pt for modelling a structural break of the constant in the long-term relationship for Portugal has the value one until 30 September 2008

and zero thereafter. In the cointegration regression for Spain, the SPRCDS coefficient has been restricted to one. Approximate critical values for EG tests for cointegration calculated for the period of January 2007 to mid-October 2010 based on MacKinnon (2010) (specification without trend) at 1%(***)/5%(**)/10%(*) levels of significance: for the case without DumIE (ie for two integrated time series, n=2) approximately -3.91/-3.34/-3.05; for the case with DumIE (treated as n=3) approximately -4.31/-3.75/-3.46. See also J G MacKinnon (2010), Critical Values for Cointegration Tests, Queen's University, Queen's Economics Department Working Paper No 1227, January 2010. EG test statistics obtained from EG test regressions with lag lengths selected according to the Akaike information criterion (with a maximum lag length of 11). D(Y_X) stands for the change of the variable Y_X.

Empirical evidence on the relative price leadership in CDS and bond markets for selected euro-area countries during the financial crisis

Credit risks are priced in both the CDS and bond markets. This suggests a close relationship between the prices developing on the respective markets, as otherwise there would be profitable arbitrage opportunities. However, even where such a long-term arbitrage relationship exists, it is not clear at the outset which market price tends to adjust and which one “leads” in it. For European corporate bonds, previous empirical studies imply a certain dominance of the CDS market in the price discovery process.¹ The following analysis examines the question of price leadership for selected euro-area countries from 2007 to mid-October 2010.² The spread between the yields on the ten-year government bonds of a particular country and Germany is taken as the risk premium in the bond market (p_{CS}). Due to a higher liquidity of the relevant maturity segment, the difference between the particular country’s five-year CDS spread and that of Germany was selected as a risk premium on the CDS market (p_{CDS}), however.³ First, the existence of a long-term equilibrium relationship between risk premiums (spreads) of a country in both markets is tested for; the analysis subsequently tries to clarify which is more likely to adjust. For each pair of country risk premiums⁴ for which a cointegrating relationship is found to exist, an error correction model (ECM) is estimated (with $\Delta x_t = x_t - x_{t-1}$ as the change of x in t compared with $t-1$):⁵

$$\Delta p_{CDS,t} = \alpha_1 * (p_{CS,t-1} - \beta \cdot p_{CDS,t-1} - c) + \sum_{i=1}^{lq} \delta_{1,i} * \Delta p_{CDS,t-i} + \sum_{i=1}^{lq} \gamma_{1,i} * \Delta p_{CS,t-i} + \varepsilon_{1,t}$$

$$\Delta p_{CS,t} = \alpha_2 * (p_{CS,t-1} - \beta \cdot p_{CDS,t-1} - c) + \sum_{i=1}^{lq} \delta_{2,i} * \Delta p_{CDS,t-i} + \sum_{i=1}^{lq} \gamma_{2,i} * \Delta p_{CS,t-i} + \varepsilon_{2,t}$$

These dynamic ECM equations model the current changes in the spread variables as depending on their own lagged changes and the lagged changes of the other variables, and, conditional on the size of the estimated adjustment coefficients α_1 and α_2 , also from the deviation from an equilibrium relationship in the previous period.⁶ The ECM coefficients were estimated with a two-step procedure.⁷ The main estimation results⁸ are contained in the table on page 53. The estimation periods were recursively extended from the original January 2007 to mid-2009 period in two steps: first up to 1 March 2010 and then until mid-October 2010. Therefore, up to this point, trends during/after periods of particular euro sovereign debt crisis stress can also be analysed – though caution is warranted given the short estimation periods.

The existence of a long-term arbitrage relationship (cointegrating relationship) between the CDS and bond market can be established for all countries.

1 See also: Deutsche Bundesbank, Credit default swaps – functions, importance and information content, Monthly Report, December 2004, pp 43-56; N Dötzt, Time-varying contributions by the corporate bond and CDS markets to credit risk price discovery, Discussion Paper, Deutsche Bundesbank Research Centre, Series 2, No 08/2007; as well as R Blanco, S Brennan and I W Marsh (2005), An Empirical Analysis of the Dynamic Relation between Investment-Grade Bonds and Credit Default Swaps, The Journal of Finance, Vol 60, No 5, pp 2255-2281. — 2 For an analysis in which the group of selected countries is considered as a whole (albeit only until 18 March 2010), see eg V Coudert and M Gex, Credit default swaps and bond markets: which leads the other?, in: Banque de France Financial Stability Review, No 14, Derivatives – Financial innovation and stability, July 2010, pp 161-167. — 3 Daily data for ten-year government bond yields were taken from

Reuters and for CDS spreads (for five years, denominated in euro) from Markit via Reuters. For the use of relative variables, see also N Dötzt and C Fischer, What can EMU countries’ sovereign bond spreads tell us about market perceptions of default probabilities during the recent financial crisis? Discussion Paper, Deutsche Bundesbank Research Centre, Series 1, No 11/2010. — 4 ADF tests indicated non-stationarity (I(1)) of the relative spread time series between 2007 and mid-October 2010. — 5 Depending on the specifications preferred for the individual countries, the respective cointegrating relationships might deviate somewhat for particular cases. — 6 If an equilibrium relationship exists, deviations from it must be dynamically reduced again over time (as long as no further disruptions occur). If such a reduction is effected in the ECM above (with $\beta > 0$) by changing only one variable, α_2 must be significantly negative or α_1

The question of the price leadership role can be investigated by applying various empirical approaches. Firstly, the estimated adjustment coefficients (α_1 and α_2) and their significance provide important information. In addition, special measurement techniques are used in the literature. The Gonzalo-Granger measure is calculated as $GG = \alpha_2 / (\alpha_2 - \alpha_1)$, based solely on the adjustment coefficients. A value greater than 0.5 suggests that the CDS premium is "leading", while a value of less than 0.5 is interpreted as the opposite. A method going back to Hasbrouck (1995) also takes into account the variances (σ_1^2, σ_2^2) and covariance (σ_{12}) of the dynamic ECM equations' residuals as information, with HAS1 and HAS2 providing a range for the possible contribution of the CDS market to price discovery:⁹

$$HAS1 = \frac{\alpha_2^2 \left(\sigma_1^2 - \frac{\sigma_{12}^2}{\sigma_2^2} \right)}{\alpha_2^2 \sigma_1^2 - 2\alpha_1 \alpha_2 \sigma_{12} + \alpha_1^2 \sigma_2^2},$$

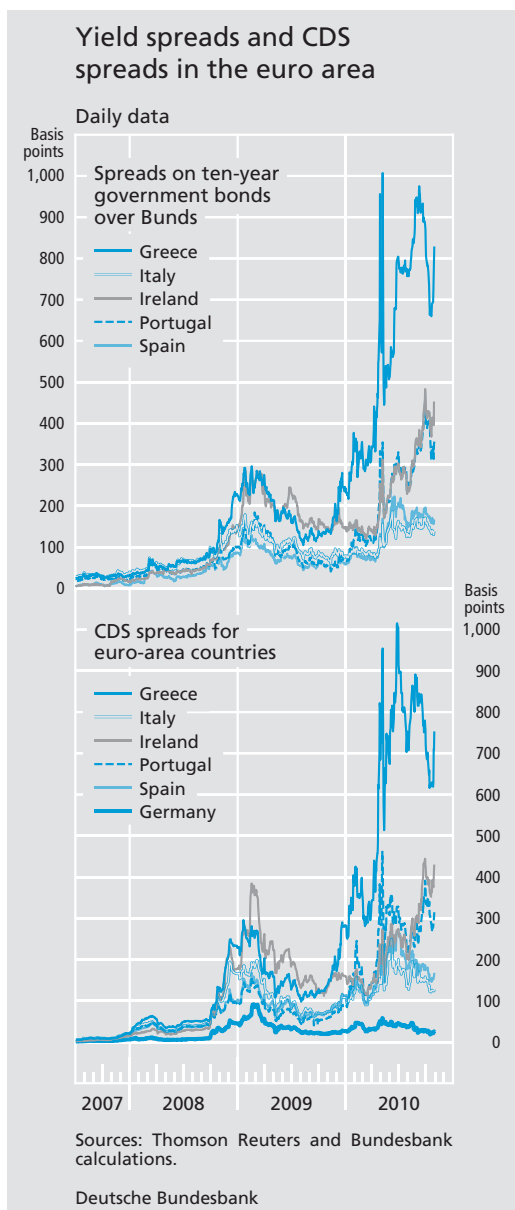
$$HAS2 = \frac{\alpha_2^2 \sigma_1^2 - 2\alpha_1 \alpha_2 \sigma_{12} + \alpha_1^2 \frac{\sigma_{12}^2}{\sigma_1^2}}{\alpha_2^2 \sigma_1^2 - 2\alpha_1 \alpha_2 \sigma_{12} + \alpha_1^2 \sigma_2^2}$$

The literature often also refers to the simple average of the two, the MID variable $MID = 0.5 \cdot (HAS1 + HAS2)$.

positive. — 7 In line with the Engle-Granger two-step approach, after an EG test for cointegration the lagged residuals ecm_{t-1} of the estimated first-step equation $p_{CDS,t} = \beta \cdot p_{CDS,t} + c + ecm_t$ appeared in place of the bracketed term as regressors when estimating the dynamic equations. For the derivation of critical values for the EG test, see J G MacKinnon (2010), Critical Values for Cointegration Tests, Queen's University, Queen's Economics Department Working Paper No 1227, January 2010. — 8 The FM OLS estimations in the first step and the GMM estimations of the dynamic equation system in the second step were carried out under Eviews calculating Newey-West heteroscedasticity and autocorrelation-consistent standard errors. — 9 See eg N Dötz (2007), Blanco et al (2005), and also additionally J Hasbrouck (1995), One Security, Many Markets: Determining the

The corresponding results of the empirical analyses confirm overall price leadership of the respective CDS markets for the selected EMU countries, too. However, the pattern at the individual country level is not always homogeneous. The combination of significantly negative bond spread and insignificant CDS spread adjustment coefficients implies a dominance of the CDS market for Italy and Ireland. In the case of Spain, there was a more mixed picture for the 2007 to mid-2009 estimation period, as the estimated adjustment coefficient for the bond spread is negative, but only relatively weakly significant, while it is insignificant for the CDS spread, but clearly positive. In this situation, the GG measure additionally considered still indicates a dominance of the CDS spread, but the Hasbrouck range includes the value 0.5 and thus no longer provides a clear decision. For the periods extended until 1 March 2010 and October 2010, however, the combination of significantly negative bond spread and insignificant CDS spread adjustment coefficients suggest a price leadership of the CDS spread for Spain. The Portuguese estimation results indicate, overall, a price leadership of the CDS market, especially until about mid-August 2010.¹⁰ For Greece, the results also imply, overall, a relative dominance of the CDS spread,¹¹ but the lower bound of the Hasbrouck range for the estimate until mid-October 2010 is just over 0.5.

Contributions to Price Discovery, in The Journal of Finance, Vol 50, No 4 (Sep 1995), pp 1175-1199. — 10 Like the EG test, the small t-statistic (in absolute terms) of the bond spread adjustment coefficient indicates a certain weakening of the cointegrating relationship for the regression up to mid-October 2010. An extended recursive analysis suggests, however, that this problem is relevant only from mid-/late August 2010. This means that, at least until then, price leadership of the CDS spread over the bond spread may be regarded as being the case for Portugal as well. — 11 In view of Greece's announcement of 5 November 2009 concerning the need for a fundamental revision of the estimated 2009 budget deficit, for Greece the table on p 53 contains additional estimation results for the period from 2007 to late 2009.



transparency and a somewhat oligopolistic market structure.

However, the observed CDS spread movements can be linked fundamentally to country-specific events in the respective time period. On the whole, this tends to argue against market exaggerations, regardless of whether they might be triggered by speculation or by supposedly irrational risk aversion.

Development of CDS spreads primarily attributable to fundamentals

The limited data available make it difficult to conduct a more extensive analysis, however. This lends weight to calls for greater transparency on the CDS market – including disaggregated data on the positions held by market players.

Improved data situation would be beneficial

Change in regulation of CDS in response to the financial crisis

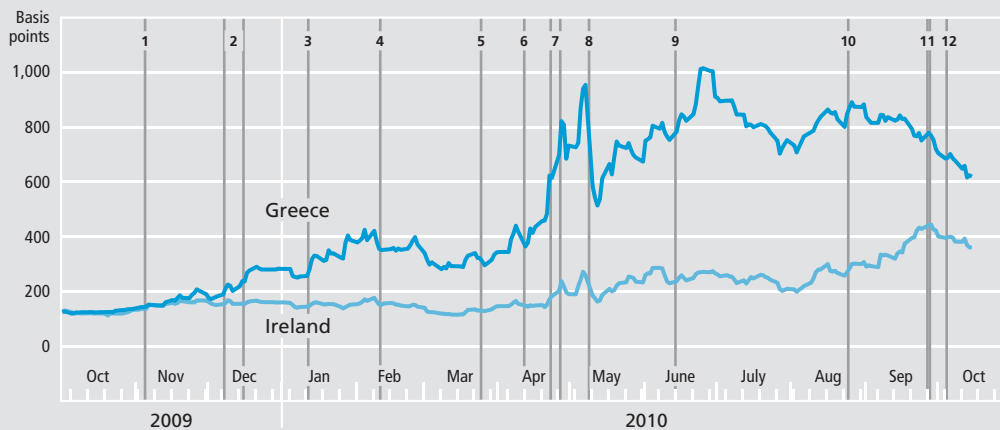
The financial crisis, in particular the collapse of Lehman Brothers as a major market player, brought to light shortcomings in market infrastructure and credit derivatives market oversight. For this reason, policy-makers and market players themselves have since been pushing for an improved transparency and settlement of credit derivatives (see box on pages 58-59).

Financial crisis revealed weaknesses in supervision of credit derivatives market

On the whole, the focus with regard to regulating the CDS market ought to be placed on measures to enhance transparency – initially towards supervisors – and to reduce counterparty credit risk and settlement risk. The extensive requirements to report to trade repositories and the obligation to clear via central counterparties are well suited to this purpose and are explicitly to be welcomed. On the other hand, imposing a permanent blanket ban on certain types of transaction may impair the smooth functioning and efficiency of the financial markets – above all, the price discovery mechanism. The most problematic aspect here lies in differentiating between hedging and speculation. At the same time, however, it cannot be ruled out that uncovered CDS in particular, which are

Improved market transparency the prime objective of regulation

How CDS spreads of selected euro-area countries responded to major events



Source: Markit. — 1 5 November 2009: New Greek government revises substantially its data on the 2009 deficit. — 2 8 and 16 December 2009: S&P and Fitch downgrade Greece rating to BBB+. — 3 12 January 2010: European Commission publishes report criticising the Greek deficit. — 4 11 February 2010: At a special summit meeting, the EU heads of state or government pledge full support for Greece. — 5 25 March 2010: The euro-area heads of state or government resolve to support Greece, if necessary with a rescue package with the involvement of the International Monetary Fund (IMF). — 6 12 April 2010: ECOFIN Council spells out the Greek financial support package, specifying volume and interest rate. It can be activated at any time by a formal request from Greece. — 7 23 April 2010: Greece formally requests EU and IMF support. 27 April 2010: Greece loses S&P investment-grade rating. — 8 9 May 2010: EU finance ministers agree on credit line totalling €500 bn to stabilise the euro area. The IMF is to provide a further \$250 bn. The ECB sets up the Securities Markets Programme to safeguard liquidity in "dysfunctional" market segments. — 9 14 June 2010: Moody's downgrades Greece from A3 to Ba1; Greece is dropped from major indices for investment-grade bonds as at the end of the month. — 10 25 August 2010: S&P lowers Ireland rating from AA to AA-, citing the costs of bank rescues. — 11 27 September 2010: Moody's lowers rating for Anglo Irish Bank. 28 September 2010: S&P announces it will downgrade Ireland's rating if the government has to invest more than €35 bn in Anglo Irish Bank. — 12 5 October 2010: Moody's lowers Ireland's rating outlook to negative.

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not used to hedge risk, may accelerate undesirable market developments. Transparency requirements, notably towards supervisors, are therefore suitable as a regulatory instrument for identifying the causes of destabilising price developments or the accumulation of risks. Moreover, increased transparency would be beneficial to market players themselves. For example, the publication of positions aggregated by derivative class and the measures currently under debate to

heighten trading transparency could afford them a clearer picture of the situation on the OTC derivatives market.

In addition to the above measures, consideration needs to be given to granting supervisors powers of intervention as a means of countering, on an *ad hoc* basis and in the interests of financial stability, undesirable developments on the CDS market.

CDS market regulation measures

Given the lessons learned from the financial crisis, the stricter regulation of the OTC market in general and the CDS market in particular is currently being debated. In this context, governments have essentially favoured two approaches. One avenue is the reform of OTC derivatives markets initiated by the G20 Heads of State or Government, particularly the introduction of a mandatory requirement to effect clearing via central counterparties (CCPs) and report all OTC derivatives; this will put the CDS market on a more solid footing. Another is that certain forms of CDS transactions have, in some instances, been prohibited on account of associated risks for financial stability, and special reporting requirements for non-prohibited CDS positions are under consideration. In addition, in the past few years, market participants have strived to achieve greater standardisation by means of self-regulation. This development, in turn, is being closely monitored and encouraged by regulators, mainly central banks and the Financial Stability Board (FSB).

An important element of the communiqué adopted by the Pittsburgh G20 summit in September 2009 was the requirement that all standardised OTC derivative contracts should be traded on exchanges or electronic trading platforms, where appropriate, and cleared through central counterparties by end-2012 at the latest. It was further stated that OTC derivatives contracts should be reported to trade repositories. The European Commission delivered on these G20 goals by presenting a draft regulation in mid-September 2010. European financial counterparties would be subject to a mandatory requirement to clear OTC derivatives contracts through CCPs and to report these contracts to trade repositories. In addition, under the envisaged new European regulatory regime for banking supervision, incentives would be put in place to encourage the use of CCPs in the derivatives segment. The draft regulation also provides for European non-financial corporations to be

come subject to a reporting requirement and mandatory clearing via a CCP should they exceed certain thresholds. The increased systemic importance of CCPs resulting from their mandatory use would be complemented by the introduction of a set of minimum prudential standards for CCPs throughout the EU. Under the draft EU regulation, trade repositories would be assigned the important task of enhancing transparency towards supervisory authorities and be subject to harmonised minimum requirements, mainly with respect to operational reliability and protecting confidentiality. According to the European Commission, CCPs and trade repositories located outside the EU would not be allowed to operate in Europe until after their prudential equivalence has been recognised.

In its efforts to enhance transparency towards market participants and the general public, the European Commission is also considering extending the trade transparency requirements contained in the Markets in Financial Instruments Directive (MiFID) to cover OTC derivatives as well, with a particular emphasis on credit derivatives. At present, these requirements apply solely to shares that are admitted to trading on a regulated market. The European Commission is expected to issue concrete proposals in spring 2011.

It was also in mid-September 2010 that the European Commission published a draft regulation which *inter alia* requires notification of uncovered CDS positions on the debt of EU sovereigns or the EU itself. Furthermore, it is envisaged that national supervisory authorities or the European Securities and Markets Authority (ESMA) should be able to prohibit natural or legal persons from entering into such CDS transactions or impose CDS position limits in cases where financial stability or market confidence is threatened. The proposed "Regulation on Short Selling and certain aspects of Credit Default Swaps" is currently being negotiated with member states and the European Parliament and is

¹ Owing to country-specific differences, the ISDA defined the following trading regions: America, Japan, Asia (excluding Japan), Australia

and EMEA (Europe, the Middle East, Africa). For more information on the new rules see <http://www.isda.org/protocol/index.html>.

due to enter into force on 1 July 2012, provided it is adopted on schedule.

Germany already introduced regulation of CDS in 2010. In May 2010, against the backdrop of extraordinary volatility in euro-area debt instruments and a widening of CDS spreads for several euro-area countries, temporary restrictions on certain CDS transactions were imposed in the form of a General Decree issued by the Federal Financial Supervisory Authority (*Bundesanstalt für Finanzdienstleistungsaufsicht, or BaFin*). In concrete terms, protection buyers were temporarily prohibited from concluding CDS on euro-area member states with the exception of hedging transactions. With the entry into force of the Act on the Prevention of Improper Securities and Derivatives Transactions (*Gesetz zur Vorbeugung gegen missbräuchliche Wertpapier- und Derivategeschäfte*) on 27 July 2010, this temporary ban was replaced by a permanent legal regulation (section 30j of the German Securities Trading Act (*Wertpapierhandelsgesetz – WpHG*)). This legislation forbids protection buyers from entering into CDS transactions in Germany in cases where at least one debt instrument issued by a euro-area central or regional government or local authority is also functioning as a reference obligation. The ban does not apply to hedging transactions or transactions in connection with market-making activities.

These sovereign regulatory initiatives have been buttressed by a range of activities on the part of market participants who, in the past few years, have applied self-regulation to develop and enhance framework agreements and other standards in order to facilitate the clearing and settlement of OTC products. Written self-commitments by the 14 leading market participants and associations commonly referred to as the G14 towards a group of supervisory bodies that includes BaFin and is coordinated by the Federal Reserve Bank of New York have meant that the industry's declarations of

intent have taken on a more binding nature of late. The most significant measures implemented to date and geared at increasing product standardisation apply, in particular, to the CDS market. Most notable among these is the Big Bang Protocol which was initiated by the International Swaps and Derivatives Association (ISDA) in March 2009. This ushered in regional Determinations Committees, with the authority to decide in cases of dispute, for example regarding when a credit event is deemed to have occurred.¹

By concluding an ISDA standard contract, the parties accept in advance that any decisions made by the aforementioned committees are final. This increases legal certainty and effectively precludes the need to conclude individual supplementary agreements. Moreover, as a means of determining the final settlement price, an auction mechanism was introduced as a further settlement method. A second Small Bang Protocol served to additionally harmonise the modalities for the occurrence of a "restructuring" credit event. This is of particular significance for European CDS as the standard contracts for this region generally mention such a credit event, whereas US CDS usually exclude it. In the course of 2009, initiated and coordinated by the ISDA, standard trading practices underwent a number of changes with respect to CDS trading. The most significant of these has been that CDS are now traded on the basis of a fixed coupon, in each case with upfront payments due at the beginning of the contractual relationship. The changes were not implemented simultaneously across the globe but on a region-by-region basis throughout the year.

Not least in the light of the desired migration of OTC trading and clearing activity to regulated trading platforms and central counterparties, the FSB is both keenly monitoring and actively driving the ongoing standardisation process, as this form of trading and settlement requires at least a modicum of standardisation.