Credit default swaps – functions, importance and information content

The market for credit default swaps (CDS) has experienced explosive growth in the past few years. CDS allow credit risks to be separated from the underlying credit relationship and to be traded separately.

It is essential for central banks to ascertain the extent to which developments in the markets for credit derivatives affect financial stability. A broader distribution of credit risks improves the financial system's overall ability to absorb shocks. On the other hand, developments in the CDS markets may also pose risks, for example, if new contagion channels increase the threat of systemic crises.

Although CDS markets are still in a nascent stage, several studies indicate that, owing to faster processing of new market information, CDS markets have price leadership over bond markets and act as a clear indicator of upcoming credit downgrades by rating agencies. On the whole, the results show that CDS prices contain information which is useful for the early detection of potential critical developments in the financial system.

Evolution of the CDS market

Market participants are focusing more and more on the possibilities of using CDS, which allow the separation of credit risk from the

Credit derivatives becoming increasingly important

43

underlying credit relationship. The ability to trade these default risks separately extends the range of options available for the systematic management of risk and income. This is of particular significance to banks. Furthermore, CDS even allow for greater risk distribution in those sectors which cannot function as a direct creditor in credit operations.

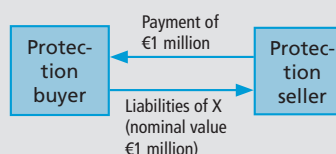*Distinctive features and types of credit default swaps*

In quantitative terms, credit default swaps are the most important and widely used instruments in the credit derivatives market. A CDS allows a risk shedder (protection buyer) to protect himself for a specified period of time against certain risks arising from a credit relationship by paying the risk taker (protection seller) a premium. These predefined risks (called *credit events*) are based on the standards of the International Swaps and Derivatives Association (ISDA). Credit events generally include late payment or default, filing for insolvency protection or the restructuring of liabilities to the detriment of the creditors. The risk taker undertakes to compensate the risk shedder if a credit event occurs. If the CDS is based on a credit relationship with only one borrower (single-name CDS), the risk shedder transfers the reference asset (eg bonds or loans) to the risk taker. If this is done by the physical delivery of securities (physical settlement is the market standard), the risk shedder usually has the choice between securities of the same kind (cheapest to deliver option). Cash settlement is another option. This involves an agreement to pay the difference between the nominal value of the reference asset and its market value following a credit event. This is particularly favoured when a CDS backs a loan portfolio from

Characteristics of credit default swaps (CDS)

Example
Conclusion of a single-name CDS contract to insure €1 million in liabilities (nominal value) of enterprise X against payment of an annual premium of 150 basis points.

Protection buyer — Premium 150 BP = €15,000 per year for five years → Protection seller

If a credit event occurs during that time:

Payment of €1 million → Protection buyer ← Liabilities of X (nominal value €1 million) → Protection seller

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which individual loans are more difficult to separate. Credit default swaps are traded over the counter (OTC market), allowing for an agreement which better suits the more specific, non-standardised needs of both counterparties. The drawback is less liquidity.

Evolution of the credit derivatives market with respect to growth ...

The market for credit derivatives is a global market in which particularly banks, credit insurers, reinsurers, hedge funds, mutual funds and major non-financial enterprises operate. The liabilities of non-financial enterprises comprise the largest share of the reference obligations. Worldwide, the market for credit derivatives has grown to approximately US$5.5 trillion. Hence, although this market is still relatively small compared to the market for interest-rate-related derivatives, its significance vis-à-vis other derivatives markets is in-
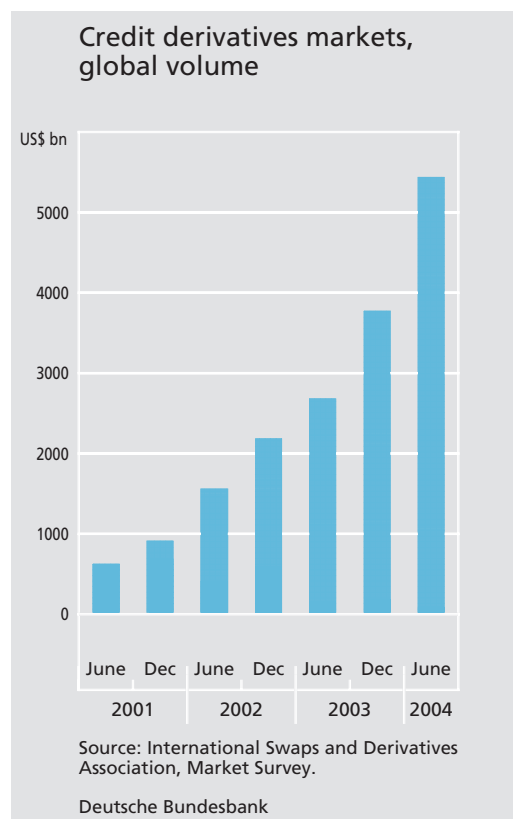
creasing steadily owing to its extremely dynamic evolution. The volume of outstanding credit derivatives contracts has already surpassed that of the markets for equity derivatives and commodity derivatives.[1]

A survey conducted by the Bundesbank in the second half of 2003 of the ten German banks most active in the market for credit derivatives indicates that these institutions acted as risk shedders in the CDS market for approximately €270 billion (of which €220 billion in single-name CDS) and as risk taker for approximately €235 billion (of which €210 billion in single-name CDS).[2]

... and structure According to the British Bankers' Association, single-name CDS account for approximately 51% of the global market for credit derivatives. Much like the overall market for credit derivatives, the CDS market is dominated by internationally operating financial institutions which act as market makers in over-the-counter trading and as end users, conducting transactions for their own trading book. One of the reasons for the high market concentration lies in the fact that the use of CDS requires a disciplined analytical management of risks as well as a sophisticated technical infrastructure. High fixed costs often make it unaffordable for small and medium-sized players to build up such capacity.

Even so, there has been a marked increase in the activity of hedge funds and pension funds in the CDS market, both as protection buyers and protection sellers. According to several market observers, the increase in the trading activities of hedge funds, in particular, has at

Credit derivatives markets, global volume

US$ bn

Source: International Swaps and Derivatives Association, Market Survey.

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times led to sharp movements in CDS spreads.[3] By contrast, pension funds and bond-based funds focus on CDS indices and collateralised debt obligations (CDO).[4]

CDS indices

CDS indices, which track movements in CDS spreads in various sub-segments of the single-name CDS market, have recently gained con-
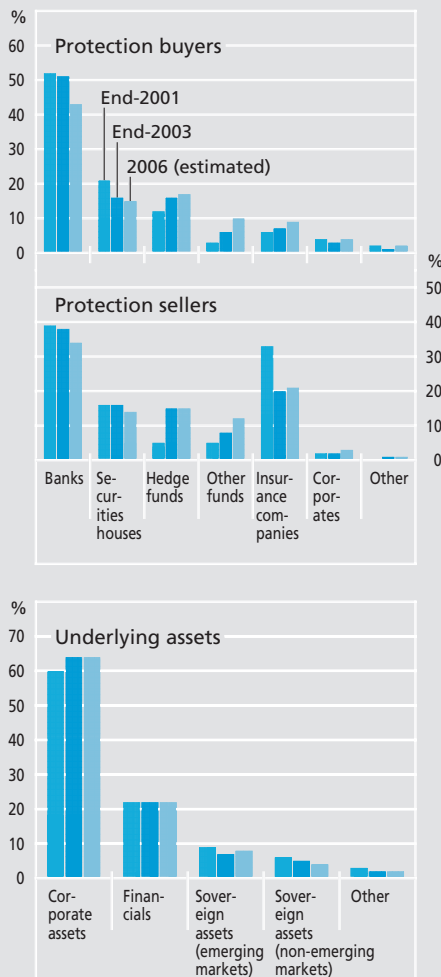
CDS indices becoming more important

1 See International Swaps and Derivatives Association (ISDA), *2004 Mid-Year Market Survey* and F Fornari and S Jeanneau, Derivatives markets, *BIS Quarterly Review,* June 2004. — 2 See Deutsche Bundesbank, Credit risk transfer instruments: their use by German banks and aspects of financial stability, *Monthly Report,* April 2004, pp 27-44. — 3 See C Horwood, Hedge funds' swift exit, *Risk Magazine,* March 2004. — 4 Synthetic collateralised debt obligations are securitised debt instruments backed by credit default swaps.

Structure of the credit derivatives markets

%

Protection buyers

60
50
40
30
20
10
0

End-2001
End-2003
2006 (estimated)

%

Protection sellers

50
40
30
20
10
0

Banks | Se-cur-ities houses | Hedge funds | Other funds | Insur-ance com-panies | Cor-por-ates | Other

%

Underlying assets

70
60
50
40
30
20
10
0

Cor-porate assets | Finan-cials | Sover-eign assets (emerging markets) | Sover-eign assets (non-emerging markets) | Other

Source: British Bankers' Association, Credit Derivatives Report 2003-04

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siderably in importance. The merger of Trac-x and Dow Jones iBoxx, the two largest providers of CDS indices, to form Dow Jones iTraxx in mid-2004, created a group of indices, which in future are to also serve as underlying assets for the trade of options and futures. The iTraxx group of indices comprises regional and sector subindices, which are derived from the market data on liquid CDS currently provided by 19 traders.[5]

Creating the index has facilitated entry into the CDS market – until now essentially an interbank market – for investors who want to build up an exposure to the general market trend. The tradable CDS indices are characterised by high market liquidity and relatively low bid/ask spreads. The iTraxx Europe index, for example, carries a spread of 1 basis point. In future, the importance of CDS indices is likely to increase considerably, also vis-à-vis single-name CDS.[6]

After having peaked in October 2002, the CDS spreads of European enterprises have declined considerably. The narrower CDS spreads also reflect the fact that numerous enterprises were able to improve their credit rating by reducing their level of debt.[7]

Movements in CDS spreads

Reasons for the advance of CDS

The evolution of the CDS markets is being buoyed by various factors. The growing number of bankruptcies and particularly the rising frequency of insolvencies of large enterprises in the period from 2001 to 2003 heightened market participants' sensitivity to credit risks at an early stage in the markets' development. Moreover, low transaction costs, which

CDS trading buoyed by low transaction costs, ...

5 The DJ iTraxx Europe index, whose composition is adapted bi-annually to reflect market changes, contains the 125 most liquid securities (measured by trading volume) in the European credit market. The DJ iTraxx Europe Corporate index comprises a duration weighted basket of CDS issued by non-financial enterprises.
6 The British Bankers' Association predicts an increase in the share of index-linked transactions in the overall market for credit derivatives from 11% in 2003 to 17% in 2006.
7 See Deutsche Bundesbank, Recent developments in the corporate bond market, *Monthly Report,* April 2004, pp 15-25.
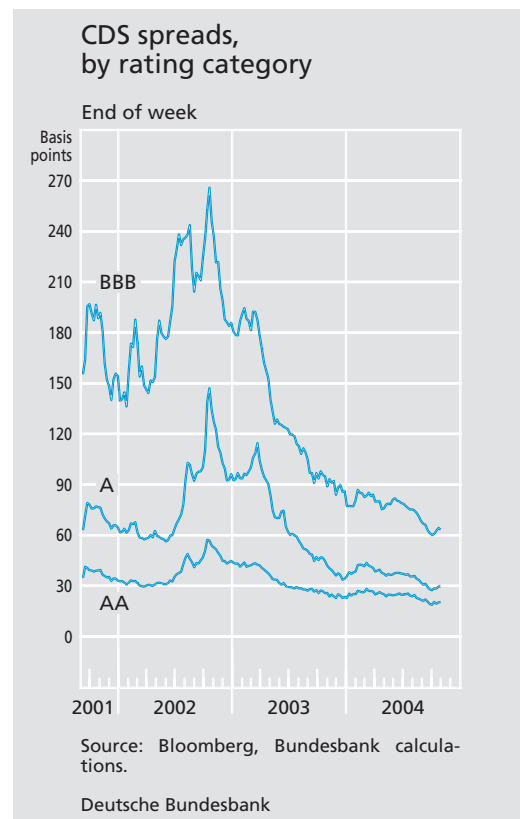
fell further as the bid/ask spreads narrowed, as well as the standardisation by the ISDA of contract terms and conditions, enhanced the attractiveness of the CDS market. It is precisely in comparison to conventional methods of credit risk transfer that CDS prove to be a cost-effective alternative. For example, in the case of CDS, only the credit risk is transferred; the underlying relationship between the borrower and lender remains intact.

... their use in structured products, ...

Moreover, CDS can also be combined to create new financial instruments, to better satisfy the needs of the risk shedder and risk taker. For instance, CDS contracts can form the basis for complex structured credit products such as collateralised debt obligations. Using such structured products, credit risk can also be reduced by credit enhancements, which, for example, cover any non-covered residual risk that a risk taker may have.

... the incentives for banks to transfer risks and ...

Changes to credit risk management in the banking sector are an additional factor contributing to greater use of CDS. As part of their credit risk management, banks are viewing CDS more and more often as tradable products, which can be transferred to third parties before the maturity date. In this respect, the new supervisory rules provided for by Basel II are also increasing the incentives for banks to use CDS in the long term.[8] For example, Basel II raises the incentive to transfer credit risks to unregulated non-banks with a good credit rating as the core capital backing of the counterparty risk focuses only on default risk in general and does not differentiate between banks and non-banks. The regulatory capital freed up through the transfer of

CDS spreads, by rating category

End of week

Source: Bloomberg, Bundesbank calculations.

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risks can be used to back other risks. In addition, banks are now gearing their risk management more towards their overall loan portfolio instead of towards individual risks.

Furthermore, CDS represent an important instrument for managing the risk-return profile of a portfolio by separating default and interest rate risk. Hence, CDS also offer new possibilities of turning a given market opinion into an investment strategy. Instead of purchasing a specific bond, a market participant who considers certain credit risks to be overvalued can earn an attractive CDS premium as a protection seller in the CDS market. On the other hand, market participants who consider risks

... the potential improvement of the risk-return profile of portfolios ...

8 See Deutsche Bundesbank, Credit risk transfer instruments: their use by German banks and aspects of financial stability, *Monthly Report,* April 2004, loc cit.

to be undervalued can purchase protection by paying a premium. Owing to the limited possibilities for short sales in the bond market, hedge funds are increasingly entering into positions in the CDS market to implement their investment strategies.

From the protection seller's point of view, the income received from payment of the CDS premiums – apart from managing the risks of a loan portfolio – is one of the main reasons for using CDS. CDS premiums are generated without having to tie up any capital for the purchase of a bond issue (at least as long as no credit event occurs). In an environment of falling interest rates, investors' search for attractive investment opportunities has boosted demand for credit risk and provided additional impetus to the CDS market.

CDS allow participants to take advantage of arbitrage opportunities vis-à-vis the bond market since, in principle, a risky bond can be duplicated through a risk-free investment or a CDS contract taken out on a suitable reference debtor. As a rule, however, CDS trade is limited to liquid credit positions, which means that any operations in the CDS market are possible for only a limited number of debt securities.

Impact on financial stability

Effects of CDS trade on financial stability both positive ...

The rise of CDS can make a positive contribution towards greater financial stability. Negative shocks to the financial system tend to be absorbed better through a greater distribution of risks to various market players. For ex-

ample, there are indications that the markets for credit derivatives helped to soften at least part of the burden on the financial system stemming from the large number of corporate insolvencies in 2001 and 2002. Even so, at that time market liquidity was concentrated on only a relatively low number of debt securities.

Market studies have shown that the reallocation of credit risks, which goes hand in hand with tradability, occurs primarily within the banking system. A broader diversification of credit risks in banks' portfolios enhances the ability to handle shocks both in the financial markets and in the real economy. This could, for example, curb the risk of credit scarcity on the supply side. However, from the perspective of financial stability, the real question is how the use of CDS impacts the financial system as a whole. This is closely linked to the ultimate allocation of credit risks arising through their use. At the moment, there is not yet enough information available to assess the overall risk situation.

... and negative

On the other hand, CDS can also contribute to instability in the financial system. Owing to competitive pressure, for example, banks might use their newly gained leeway to enter into new risks. The transfer of risks to market players outside of the banking system which do not have a suitable risk management system in place and are subject to less supervision would lead to an increase in the accumulated risks in the financial system as a whole.

Moreover, further risks arise from the trade of CDS which, in the event of major shocks,

could possibly exacerbate the risk of systemic crises. The CDS market remains characterised by a large concentration of trading at a few large banks. Apart from their own direct operations as risk shedder or risk taker, banks are also active in the CDS markets as intermediaries. Hence, the withdrawal of one large intermediary from the market could impair the smooth functioning of trading in CDS.

Given asymmetric information, an opportunistic streak (moral hazard) could stand in the way of efficient CDS trading. It is therefore conceivable that banks, in their capacity as lenders, could use their information advantage regarding individual loans to pass on mainly bad risks. Furthermore, for the protection buyer, there might be less incentive to continue monitoring the creditworthiness of the reference entity with the same intensity. This would result in market participants being less willing to assume credit risks and in the market charging an additional risk premium for this structural risk. Any such additional risk premium would then also distort the information content of the CDS spreads. The threat of a tarnished reputation to the risk shedder could, however, mitigate the moral hazard problem. This problem should not have any impact on highly liquid bonds in particular.

Information content of CDS

A non-distorted reflection of debtor-specific information in CDS spreads is of importance to both market participants and to overall financial stability. With a view to financial stability it is important to have as wide as possible a range of indicators which deliver reliable early warning signals of any looming risks. CDS markets may exhibit different pricing behaviour from that of conventional financial markets. CDS can therefore be a potential source of important additional information.

The reliability of CDS spreads as an indicator for conducting a stability analysis depends to a large degree on how closely they are linked to default probabilities and to what extent they are appropriate to identify changes in debtors' creditworthiness. An examination of the potential leading indicator property of market prices prior to rating changes can contribute to an assessment of those changes. In this context, it is also relevant to ascertain whether the CDS markets act as a leading price indicator for the bond markets in terms of time and hence, as a source of information.

The correlation between CDS and bond spreads

Based on the arbitrage-related integration of both markets, CDS prices and bond risk premia should actually be closely linked. However, a number of factors weaken the price link between CDS and bond markets. These include liquidity restrictions, tax treatments, limited short-selling opportunities, callable bonds and an additional counterparty default risk in the case of CDS.

Liquidity plays a major role

According to a study conducted by Zhu, the available liquidity in the CDS and bond markets plays a major role in explaining existing

price differences in both markets.[9] In the corporate bond market, many participants hold their securities until maturity. Liquidity in the secondary markets is too low to permit extensive dealing in major credit risks at relatively low transaction costs.

A recent study of the CDS market by Fitch comes to the conclusion that in normal market situations, there are sufficient liquidity and tightening bid/ask spreads.[10] This same study points out, though, that in certain market phases, CDS prices were not always able to reconcile supply and demand. This was the case, for example, during the WorldCom crisis in the summer of 2002, when the demand for protection in the bond markets rose and only a few market participants were willing to act as protection sellers. However, non-market-clearing CDS prices naturally lose much of their information content.

Price discovery in the CDS market and bond market

Compared to the bond market, the CDS market is still likely to be the easiest way to trade credit risk without any major restrictions. Real-time processing of information provided by well-informed market participants is essential for an accurate assessment of credit risk. In this respect, price discovery represents a key function of secondary markets. The results of a study by Zhu, which are based on market data from 1999 to 2002, suggest price leadership of the CDS market vis-à-vis the bond markets for the United States but not for other regions.

Bundesbank studies come to the conclusion that in Europe, too, the CDS market has a lead over the bond market with respect to the reaction to new data and that, in the short term, marked – albeit temporary – price differences occur. One additional important reason for this could be that the CDS market provides a specialised platform for the trade of debtor-specific credit risks, whereas in the bond market, the features of the individual bonds also determine pricing.

Empirical evidence on price discovery

The correlation between market prices and ratings

The efficiency of CDS and bond spreads in the price discovery process can also be examined in connection with the movements in credit ratings. Risk models and early warning systems, which take account of the prices in various markets as well as macroeconomic variables, are already widely used by risk managers to assess credit risks. Rating agencies, too, are increasingly using market-price-based risk models, such as the KMV model,[11] which augments Robert Merton's equity value model and which Moody's uses to evaluate default probabilities.

In contrast to market prices, which react very quickly to new information, ratings tend to

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9 See H Zhu (2004), *An empirical comparison of credit spreads between the bond market and the credit default swap market,* BIS Working Paper No 160.
10 See FitchRatings, *CDS Market Liquidity: Show Me the Money,* November 2004.
11 The KMV model is an economic model based on the option pricing theory. The key factors used to determine changes in default probabilities are: share price volatility, degree of indebtedness and the volatility of enterprise value.

Empirical evidence of price discovery in the European CDS and bond markets

Price discovery is the efficient, real-time processing of information factored into market prices. As credit risks are traded in the bond market and in the CDS market, price discovery can take place in both markets. In this context, price leadership in one market means that price discovery in that market occurs based exclusively on new market-relevant information and not on price changes in the other market. In terms of prices, the equilibrium between CDS and bond spreads can be affected temporarily if, in the market with price leadership, prices change owing to new market-relevant information. The other market adapts to these price changes until a new equilibrium is found between the two markets.

A Bundesbank empirical study focuses on the correlation between the markets for CDS and bonds issued by European enterprises. The study was based on daily market prices (in euro) provided by Bloomberg on bonds and CDS contracts with a maturity of five years during the observation period of October 2001 to August 2004. To calculate matching bond yields with a constant residual maturity of five years, for each point in time a weighted interpolation of the yields of several bonds of one issuer was conducted. For each trading day, at least one bond issue with a residual maturity of less than five years and at least one bond issue with a residual maturity of more than five years was required. This sharply reduced the number of reference enterprises included in the estimates. The bond spreads were then calculated from the interpolated bond yields minus the five-year euro swap rate.

In the event of a unique long-term correlation (cointegration relationship) between CDS and bond spreads of the reference enterprises, the following vector error correction model has been estimated.

$$\Delta p_{CDS,t} = \lambda_1 (p_{CDS,t-1} - c - \alpha p_{CS,t-1}) +$$

$$\sum_{i=1}^{q} \beta_{1i} \Delta p_{CDS,t-i} + \sum_{i=1}^{q} \delta_{1i} \Delta p_{CS,t-i} + \varepsilon_{1t} \qquad (1)$$

$$\Delta p_{CS,t} = \lambda_2 (p_{CDS,t-1} - c - \alpha p_{CS,t-1}) +$$

$$\sum_{i=1}^{q} \beta_{2i} \Delta p_{CDS,t-i} + \sum_{i=1}^{q} \delta_{2i} \Delta p_{CS,t-i} + \varepsilon_{2t} \qquad (2)$$

where p_{CDS} denotes CDS spreads and p_{CS} denotes bond spreads. α, β_1, β_2, c, δ_1, δ_2, λ_1 and λ_2 are the coefficients to be estimated.

This model assesses the long-term correlation between CDS spreads and bond spreads (the equation in par-

Estimations results

Sector	Number of enterprises	Average number of observed market prices per enterprise (trading days)	Average GG measure
Banks	6	579	1.062
Telecommunications	5	515	0.708
Automobile	5	481	0.409
Consumer enterprises and conglomerates	4	455	0.231
Energy and utilities	4	445	0.951

entheses) as well as the influence of past spread changes on current spread changes. The coefficients λ_1 and λ_2 measure the velocity at which the CDS and bond spreads move back to equilibrium following a deviation from the long-term relationship between the two markets. A significantly negative coefficient λ_1 suggests that CDS spreads move later than bond spreads in order to re-establish the equilibrium relationship between the two markets. Conversely, a significantly positive coefficient λ_2 suggests that an adjustment of the bond spreads takes place to re-establish the equilibrium relationship.

The Granger and Gonzalo measure $GG = \lambda_2 / (\lambda_2 - \lambda_1)$ can be used to better illustrate the contribution of both markets to price discovery. It indicates to what extent price leadership occurs in the CDS or the bond market. If $GG > 0.5$, the CDS market leads in terms of price discovery. A GG of < 0.5 indicates that price discovery occurs mainly in the bond market. An assessment based on this measure shows that in 59% of the cases studied, the CDS market leads in price discovery whereas price leadership occurs in the bond market in 29%. In 12% of the estimates there was no clear evidence of price leadership in either of the two markets.

The results are in line with those of Blanco et al,[1] who suggest that the CDS market dominates price discovery in the market for corporate credit, although the bond market also plays a discernible role.

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[1] See R Blanco, S Brennan and I W Marsh (2004), *An empirical analysis of the dynamic relationship between investment-grade bonds and credit default swaps,* Bank of England, Working Paper No 211; also published in The Journal of Finance.

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be more stable in nature (less volatile). This is because rating agencies do not adjust their ratings every time new information appears regarding the financial situation of an issuer or if there is a model-induced change in the default probabilities. A rating is usually only changed when the new outlook is supported by a sustainable change in the information base and the change in the issuer's creditworthiness is due to profound structural changes rather than merely to the cyclical situation. This is intended to ensure a certain degree of rating stability throughout the economic cycle and to prevent having to revise rating changes again shortly thereafter. This suggests that the changes in default probabilities are reflected more quickly in market prices than in ratings.

On the other hand, rating agencies base their credit ratings on a wide range of information which is not necessarily available in the public domain and which supplements market price data. Hence, rating changes are indeed of importance to the markets.

CDS as a potential leading indicator of upcoming rating changes

CDS are of particular interest with respect to their ability to predict rating changes since they – as mentioned – have the potential to process information on creditworthiness more quickly than bond prices can.

Initial empirical analyses[12] suggest that CDS markets anticipate rating downgrades. CDS spreads have the tendency to not only anticipate rating downgrades, but they also react more quickly to a review for downgrade than the equity markets.[13] CDS spreads widen in line with rating downgrades.

The following analysis of market price movements before and after a rating change is based on the CDS and bond spreads of European enterprises and information on rating changes conducted by Moody's, Standard & Poor's (S&P) and FitchRatings between 2001 and 2004. CDS and bond spreads were adjusted for market effects to measure issuer-specific influences on market prices. To obtain this information, the difference was calculated between the changes in CDS spreads and the changes in CDS indices, which comprise single-name CDS of debtors with the same rating. The Merrill Lynch indices of European corporate bonds with equal creditworthiness and a residual maturity of five years were used for individual bond issues.

Bundesbank study suggests that ...

The index-adjusted CDS and bond spreads reflect the changes in issuers' creditworthiness even weeks before a rating change occurs. When a review for downgrade is announced, the spreads widen even more than when an actual downgrade occurs. This may be due to the fact that a negative outlook often precedes a rating downgrade.

... market prices tend to anticipate ratings changes ...

A rating upgrade is usually accompanied by a narrowing of CDS and bond spreads. Compared to an actual upgrade, a review for upgrade by the same rating agency results in a greater narrowing of spreads.

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12 J Hull, M Predescu and A White (2004), The relationship between credit default swap spreads, bond yields, and credit rating announcements, *Journal of Banking and Finance,* 28, pp 2789-2811.
13 L Norden und M Weber (2004), *Informational Efficiency of Credit Default Swap and Stock Markets: The impact of Credit Rating Announcements,* Centre for Economic Policy Research, No 4250.
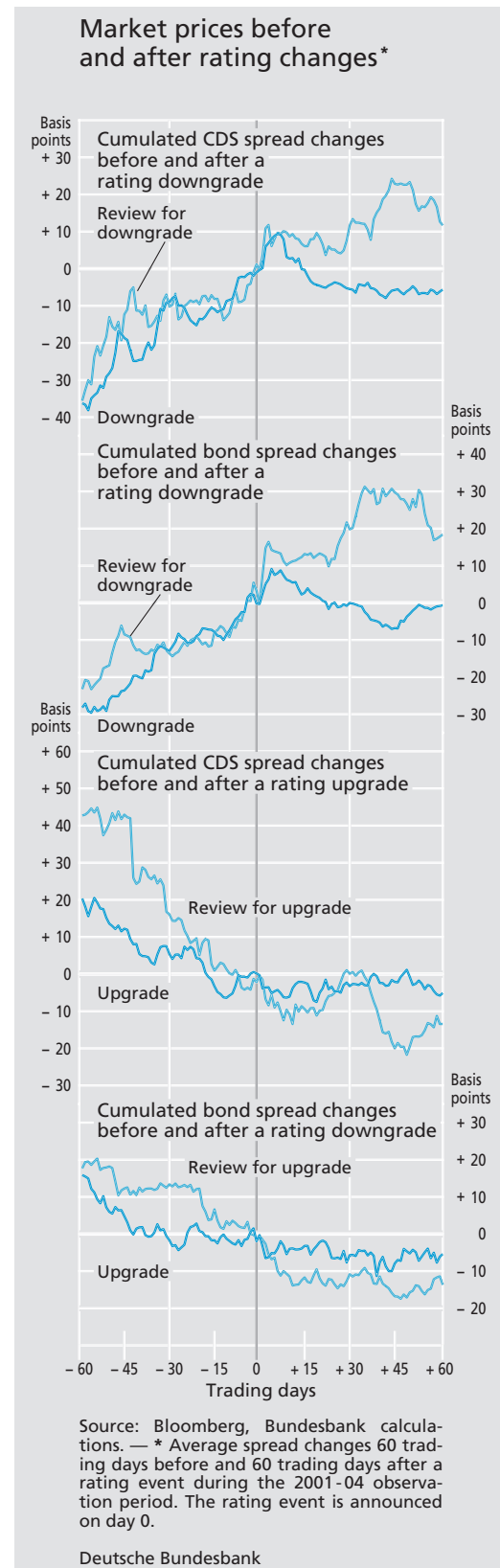
... rather than react to rating changes

On the day before a rating downgrade or a review for downgrade, the CDS spreads (bond spreads) have, on average, already widened by 68% (56%) of the maximum widening occurring during the overall observation period of 60 trading days before and 60 trading days after a rating event. In the case of an upgrade or a review for upgrade, on the day before an announcement is made the CDS spreads (bond spreads) narrow by an average of 62% (54%) of the maximum narrowing during the observation period. Therefore, the rating change is already anticipated to a large degree by the market, although market prices also show a significant reaction directly following a rating change.

On balance, these results show that, first, market price movements do have a leading indicator property prior to a change to an issuer's credit rating. The observed widening of CDS spreads before a rating downgrade is particularly well substantiated in statistical terms. Furthermore, the fact that CDS spreads react more strongly than bond spreads before the announcement of a rating change confirms the price leadership property of the CDS market.

Determinants of CDS spreads

The leading indicator property of CDS spreads prior to rating changes suggests that CDS spreads contain information which is significant for estimating the probabilities of the occurrence of credit events. The more risk premia depend on determinants which have a strong correlation to default probabilities, the

Market prices before and after rating changes*

Source: Bloomberg, Bundesbank calculations. — * Average spread changes 60 trading days before and 60 trading days after a rating event during the 2001-04 observation period. The rating event is announced on day 0.

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greater the information content for assessing credit risks. Determinants of risk premia may comprise both enterprise-specific and macro-economic variables and will be examined in greater detail below.

The impact of interest rate developments

Portfolio theory would expect to see a positive correlation between interest rates and risk premia. If interest rates rise, investors tend to shift away from riskier investments to safe instruments with attractive interest rates. The attendant lower demand for riskier investments leads to rising risk premia on these issues. Conversely, the marked fall in interest rates since the end of 2002 has buoyed demand for higher-interest-bearing instruments as many investors no longer find the low rate of interest on risk-free investments attractive (search for yield). This increased demand for risky investments has contributed to a sharp drop in the risk premia. The fact that enterprise value also depends on expected future income, which is more heavily discounted when interest rates are rising, also suggests a positive correlation between interest rates and risk premia. Furthermore, rising interest rates push up the cost of financing.

Bearing the aforementioned arguments in mind, risk premia are also influenced by expectations about future interest rate movements and cyclical developments, which are reflected in the yield curve.

Enterprise-specific determinants

The financial soundness of an enterprise, which hinges to a large degree on the level of indebtedness and profitability, is a significant enterprise-specific determinant of risk premia. Both of these factors are approximated

in the estimating approach presented here through equity price movements as there are no informative weekly data available on the level of indebtedness.

The probability of default owing to overindebtedness increases with the volatility of the firm's equity. This is factored into the estimating approach by taking account of the implied volatility of the share price which is calculated using option prices.

Non-restricted tradability directly influences the attractiveness of an investment. In the case of low liquidity, which is expressed as a rule in a widening of the bid/ask spread, the market demands a liquidity premium.

The results of an empirical study carried out by the Bundesbank on the sensitivity of CDS spreads in relation to the aforementioned determinants are based on panel estimates, using weekly data of 37 European enterprises over a period from May 2002 to October 2004. The results of ordinary least square estimates are robust and are confirmed by a panel cointegration approach using instrument variables.[14]

Results of the Bundesbank's empirical study

The significantly positive correlation between the changes in the year-on-year interest rate and the changes in the CDS premia is compatible with the aforementioned portfolio

14 It is possible that the determinants of CDS spreads (exogenous variables) used in the estimating approach depend on the CDS spreads (endogenous variable). This potential endogeneity problem can be mitigated through the use of instrument variables which are correlated with the exogenous variables (determinants) without depending on the endogenous variable or the residuals of the estimating approach.

theory argumentation and reflects the phenomenon of the search for yield during the observation period. The improvement in the financing conditions which accompanies falling interest rates has also strengthened enterprises' financial situation during the estimation period. The positive correlation between the slope of the yield curve (difference between the 10-year and 2-year yield) and the CDS spreads also suggests an interlinkage.

A rising share price leads to narrowing CDS spreads. Conversely, as expected, rising volatility and a widening of the bid/ask spread lead to an increase in the CDS premia.

Relatively large share of determinants cannot be explained statistically …

Despite the statistically significant influence of the examined variables on CDS spreads, on balance the estimates can explain only a relatively small share (approximately 12%) of the variability of the CDS spreads. One reason for this may be the fact that certain enterprise-specific determinants such as the financing structure cannot be adequately factored into the panel approach selected here with high frequency time series.

… can be put down to common market-wide factor

The phenomenon of a large proportion of unexplainable determinants was also identified in other studies on the determinants of risk premia. These studies show that approximately three-quarters of the changes can be accounted for by a systemic factor which is not captured by the usual models.[15] Furthermore, a principal component analysis of the results presented here shows that the non-explanatory variance of the CDS spread changes are mainly driven by a common factor.

Estimated sensitivity of CDS spreads

Item	Coefficient	t-value
Change in annual interest rate	0.0606*	1.9946
Change in yield curve	0.1437**	3.5106
Change in share price	– 0.4938**	– 13.2780
Change in volatility of share price	0.0465**	3.7607
Change in bid/ask spread	0.0692**	6.8701
R square	0.1222	
Adjusted R square	0.1202	

* Significant at the 5% level. — ** Significant at the 1% level.

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This suggests that risk premia are determined to a large extent by supply and demand factors which affect the entire market. The Bundesbank's empirical analysis was unable to identify which factors are at play; it can at best limit them in qualitative terms, requiring an examination of both macroeconomic and market structure determinants.

The development of the market is embedded in the macroeconomic and monetary framework. It can therefore be assumed that the CDS premia are determined to a large extent by cyclical developments. However, the sharp rise in default rates during recessions cannot be captured fully by the selected estimating

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15 See P Collin-Dufresne, R S Goldstein und J S Martin (2001), The Determinants of Credit Spread Changes, *The Journal of Finance,* Vol LVI, No 6, pp 2177- 2207.

approach. Moreover, the financial environment during the estimation period was characterised by factors which had a considerable overall influence on the credit markets. These include extraordinarily low interest rates, high liquidity in the financial markets and changes in enterprises' financing structures. In addition, the changes in risk propensity and risk aversion are also likely to affect demand for acquiring and the willingness to sell protection against credit risks.

From a more technical market perspective it should be pointed out that the CDS markets, much like other credit derivatives markets, are still in a nascent stage. Experience has shown that during such stages, structural factors, such as the growing number of market participants, do have an overall impact on price discovery in the CDS market.

Outlook

In future, the explosive development of the CDS market will play an increasingly important role as an indicator of credit risk developments. CDS are already fulfilling an important function with regard to price discovery in the credit markets. This fact is also expressed in their ability to clearly anticipate changes in rating agencies' assessments before they occur. Apart from additional indicators such as risk models for assessing default probabilities, CDS therefore make an important contribution to the early detection of financial risks.

For this reason, ongoing monitoring of the credit risk transfer market is indispensable for gaining new insights into the stability of the financial markets.