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Risk aversion and risk premia in the CDS market[1]

Credit default swap (CDS) spreads compensate investors for expected loss, but they also contain risk premia because of investors' aversion to default risk. We estimate CDS risk premia and default risk aversion to have been highly volatile during 2002–2005. Both measures appear to be related to fundamental macroeconomic factors, such as the stance of monetary policy, and technical market factors, such as issuance of collateralised debt obligations.

JEL classification: G120, G130, G140.

One of the more difficult tasks in the analysis of financial markets is sorting out what portion of changes in asset prices are due to changes in economic factors affecting payoffs versus changes in risk premia. Credit markets are no exception. Was the large widening of credit spreads in the summer of 2002 the result of the rapid deterioration in the outlook or did investors suddenly become more risk-averse? Has the narrowing of corporate spreads to historically low levels since then been driven mainly by improving corporate balance sheets or a steady increase in risk appetite? And what of the spike in spreads in the spring of 2005 after downgrades in the US auto sector? The answers to these questions have implications for the signals policymakers take from credit markets, both during normal periods and in times of market stress. The answers should also interest academics for what they tell us about asset pricing models, as well as market participants searching for relative value opportunities across credit instruments and asset classes.

This article constructs measures of risk premia and risk aversion in credit markets using data from the fast growing credit default swap (CDS) market covering the period 2002–05. Spreads on default swaps should reflect expected losses from default and risk premia as compensation for bearing default risk. We find estimated premia to be highly volatile over time, consistent with the view of many market practitioners that changing attitudes towards risk can explain a good deal of the movements in asset prices. We also seek to identify the main determinants of risk premia in credit markets. Our findings

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[1] The author thanks JPMorgan Chase for providing data on synthetic CDO issuance, Claudio Borio, Frank Packer and Philip Wooldridge for helpful comments, and Jhuvesh Sobrun for research assistance. The views expressed in this article are those of the author and do not necessarily reflect those of the BIS.

suggest that default risk premia and risk aversion are strongly related to fundamental factors, such as indicators of real economic activity and the stance of monetary policy, and technical market factors, such as issuance of collateralised debt obligations (CDOs).

Our study begins by providing background on the CDS and CDS index markets that are the core of the empirical investigation. We then briefly discuss related literature and the data used in the analysis before turning to the construction of measures of CDS risk premia and default risk aversion. After analysing the determinants of these measures, we conclude with a summary and suggestions for future work.

The CDS market

CDS market has grown rapidly …

Our study focuses on the CDS market, one of the fastest growing segments of the global financial system in recent years. A CDS is an insurance contract that protects the buyer against losses from a credit event associated with an underlying reference entity. In exchange for credit protection, the buyer of a default swap pays a regular premium to the seller of protection ("investor") for the duration of the contract.[2] Most of the initial development in the CDS market was in single-name contracts. However, since late 2003 there has also been increasing activity in contracts related to CDS indices, which are the main objects of our analysis. BIS statistics indicate that the total notional amount outstanding of single- and multi-name default swaps was $10.2 trillion as of June 2005.[3]

… and is suitable for examining credit spreads

There are several reasons to focus on the CDS market instead of the cash market. One is that default swaps now play a central role in credit markets: a broad range of investors use default swaps to express credit views; banks use them for hedging purposes; and default swaps are a basic building block in synthetic credit structures. Another is that the relatively high liquidity in the default swap market means that CDS spreads are presumably a fairly clean measure of default and recovery risk compared to spreads on most corporate bonds. This facilitates the identification of credit risk premia.[4]

CDS indices now underlie other important credit derivatives

There are also benefits to be gained by focusing on CDS indices. Swap contracts and notes based on CDS indices are traded in the market, unlike in the case of corporate bonds, and so our results could be used directly to analyse market index spreads. Our findings may also be useful in studies of

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2 Several sources contain descriptions of CDS contracts and their features (eg O'Kane, Naldi et al (2003)). Most contracts cover four types of credit event: bankruptcy, failure to pay, repudiation and material restructuring of debt (including acceleration). Hereafter, the term default will be synonymous with credit event.

3 While the net value of exposures is much smaller ($267 billion as of June 2005), trading volumes are estimated to be significantly greater than in the underlying bond markets.

4 CDS contracts may be more liquid than bonds for several reasons. For instance, most default swaps benefit from having standardised contracts, where the credit events that trigger payment to the protection buyer are defined in the ISDA credit derivatives definitions (ISDA (2003)). Default swaps also allow market participants to short credit risk with less difficulty and at lower cost than with corporate bonds. See Longstaff et al (2005) for further discussion.

derivatives based on the indices, such as index tranches or default swaptions. Index tranches, which give investors the opportunity to take on exposures to specific segments of the CDS index default loss distribution, are priced and hedged partly based on the behaviour of index spreads.[5] Similarly, the valuation of options on the index depends upon the dynamics of index spreads.

Related literature

Few studies have examined CDS risk premia

The results in this article add to a small but growing literature on the empirical properties of CDS spreads and the risk aversion of credit investors. The most closely related study is the paper by Berndt et al (2005), who estimate risk premia using CDS data on a set of 67 US firms in three industries and Moody's KMV's Expected Default Frequencies (EDFs™) as measures of default probabilities. They identify default risk premia by estimating fully specified dynamic credit risk models for each entity. We adopt a simpler approach to measuring risk premia, though we consider a broader set of firms – the constituents in the main US investment grade CDS index – and we analyse the relationships of these measures with macroeconomic and credit market activity variables.

Past work has estimated large risk premia in bond spreads

Given the relatively short life of the CDS market, most research on spreads has been conducted using bond data. Elton et al (2001) examine how much of the variation over time in spreads (less expected loss and taxes) can be explained by the Fama-French factors, and then calculate a risk premium based on these contributions. Driessen (2005) estimates a dynamic term structure model by dividing spreads into several components. He finds evidence of large and time-varying default risk premia, as well as liquidity premia. Amato and Luisi (2005) estimate risk premia in a model that includes macroeconomic variables as determinants of the term structure of corporate bond spreads.

Data

Our analysis utilises a synthetic CDS index …

Given our methodology for estimating risk premia (see next section), we require data on CDS index spreads and default probabilities on the index constituents. We construct a historical synthetic time series of spreads for a fixed set of firms using data from Markit. This is done for two reasons. First, we focus on a fixed group of firms to achieve consistency in the series across time. The composition of the leading market indices has changed over time due to mergers and rolls in the indices every six months.[6] Second, we wish to analyse data over the longest period possible. Daily time series can be constructed for most of the firms in our sample beginning in May 2002. Since index contracts

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5 See Amato and Gyntelberg (2005) for a general discussion of CDS indices and index tranches, and of some of the issues involved in pricing these instruments.

6 The index market began with a set of competing indices, which then merged in the spring of 2004 to form the CDX and iTraxx families. The constituents in these indices are chosen every six months based on a dealer poll.

started trading in mid-2003, we could, in principle, use market quotes at the index level; but this would leave us with a short sample and a non-homogeneous set of firms due to changes in the “on-the-run” index.

… based on the DJ CDX series 4 constituents

The group of firms we consider are the members of the DJ CDX North America investment grade series 4 index (CDX.NA.IG.4).[7] Contracts on this version of the index were on-the-run from 21 March to 20 September 2005. There are 125 entities in the index; most have a credit rating in the range A+/A1 to BBB–/Baa3. We are mainly interested in the aggregate index, though we also analyse five sectors to determine to what extent sector patterns match up to aggregate behaviour. The sectors considered are: consumer, energy, financial, industrial and TMT. Synthetic series of index and sector spreads are constructed as equal-weighted averages of spreads on single-name contracts.

Synthetic spreads can differ from market spreads

The synthetic series we construct may differ from market quotes on the index for at least two reasons.[8] First, while in principle the mark to market index spread should equal the average of spreads on the 125 reference entities, in practice there have been discrepancies (a non-zero “basis”). This is probably due, in part, to the convenience of using index contracts for hedging macroeconomic risk. As such, caution should be exercised when interpreting our results directly in the context of market index spreads. Second, index contracts restrict the eligible types of credit event to bankruptcy or failure to pay. This corresponds to the no-restructuring documentation clause in single-name CDS contracts.[9] However, most single-name contracts in the United States are traded with a modified restructuring clause. To maximise the sample size, for each day and each firm we construct a weighted average, expressed on a no-restructuring basis, of the quotes available across clauses in the Markit database. It is probable that the value of the cheapest-to-deliver option on contracts allowing restructuring varies systematically with the credit cycle. Any such variation would introduce an error in our (fixed) weighting scheme, but it is likely to be small.[10]

Daily time series of CDS spreads for the aggregate index at maturities of one, five and 10 years are plotted in Graph 1. A few features of the series are worth noting. First, the term structure of spreads is upward sloping at lower spread levels; in particular, there have been large differences over the past couple of years between one-year and five-year CDS rates. This means that care must be taken in choosing the maturity in our subsequent analysis. Second, spreads are highly persistent and much of their variation occurs over

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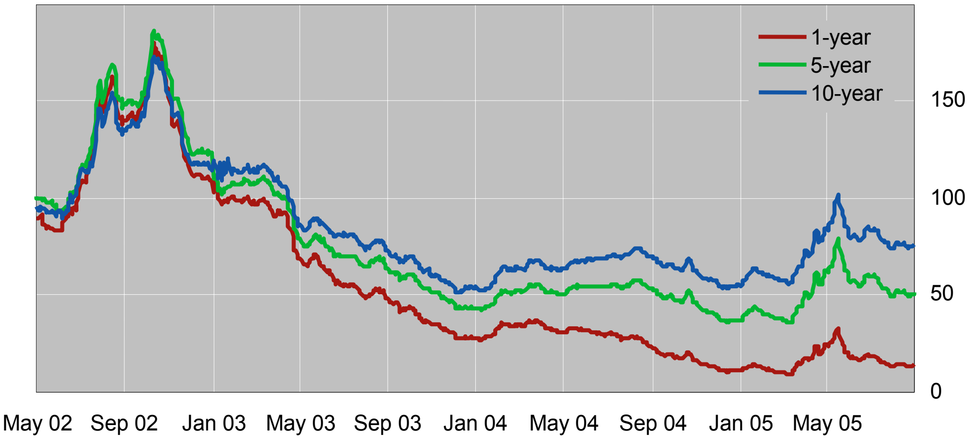
[7] The constituents of this index can be found on Markit’s website at http://www.markit.com.

[8] We can compare our synthetic series to official index spreads from Markit. For the difference in daily five-year spreads over the period 21 March to 31 August 2005, the mean is 0.6 basis points, the mean absolute value is 1.9 basis points and the standard deviation is 2.6 basis points.

[9] See ISDA (2003) for a description of documentation clauses.

[10] The weights reflect observed patterns in spreads across clauses in a sample where quotes for more than one type of contract exist for an entity on a given day. See also O’Kane, Pedersen and Turnbull (2003) and Packer and Zhu (2005) for analysis of restructuring clauses.

CDS spreads[1]



[1] Based on the aggregate index, in basis points.

Sources: Markit; BIS calculations. Graph 1

lower frequencies, such as a month or more. Thus, even though we must aggregate CDS rates on a monthly basis for most of our analysis (to accord with the availability of other data series), there is a good deal of variation in spreads at this frequency.

EDFs™ proxy for default probabilities

To proxy for default probabilities, we use one-year EDFs™ as in the study by Berndt et al (2005). EDFs™ are constructed using balance sheet and equity price data under the principles of a Merton-type model for gauging the likelihood of default.[11] Our data on EDFs™ are available at a monthly frequency for all but two firms in the CDX.NA.IG.4 index. Aggregate and sector EDFs™ are constructed as simple arithmetic averages of existing data on the constituents.

Measuring default risk premia

In this section, we provide estimates of CDS risk premia and default risk aversion using the synthetic CDS index data introduced above.

In order to see how we obtain measures of risk premia and risk aversion, note that CDS spreads can be roughly decomposed as follows:

$$\text{CDS spread} \cong \text{expected loss} + \text{risk premium}$$
$$= \text{expected loss} \times \text{risk adjustment}$$

where

$$\text{risk adjustment} = 1 + \text{price of default risk}$$

CDS spreads are risk-adjusted expected loss

The first equation above says that the CDS spread is approximately equal to expected loss plus a risk premium, where the latter is compensation paid to investors for enduring exposure to default risk. In the second equation, the spread is re-expressed in terms of risk-adjusted expected loss, where the risk adjustment varies proportionally with the price of default risk. The price of default risk has the interpretation as the compensation per unit of expected

[11] See Kealhofer (2003) for further details.

loss. It is an indicator of investors' aversion to default risk: a positive price of risk means that investors demand that they be paid more than actuarial losses. Hereafter, we will use the terms "price of default risk" and "indicator of default risk aversion" interchangeably.

While the formulations of spreads above isolate a "risk premium" and a "price of risk", in principle there are two distinct types of default risk that may command a premium. One is cyclical variation in expected loss, which usually rises during economic downturns, when overall income growth is low. The other is the actual default of an entity and its impact on investors' wealth due to an inability to perfectly diversify credit portfolios. In the literature, these are generally referred to as systematic and jump-at-default risk, respectively.[12] In the following, we will construct measures of CDS risk premia and the price of default risk that implicitly incorporate both of these types of risk.[13] See the box for a more precise description of CDS pricing and the components of spreads.

Premium is estimated as spread minus expected loss …

Our method for estimating risk premia and risk aversion is straightforward. First, we construct a measure of the risk premium by subtracting an estimate of expected loss from CDS spreads. Expected loss is estimated using observable EDF™ data as a proxy for the probability of default and assuming that loss-given-default is constant and equal to 60%. This figure is based on historical loss rates on US senior unsecured bonds using data from Moody's.[14] Since our EDF™ data attempt to measure default probabilities over a one-year horizon, we mainly concentrate on the risk premium in one-year CDS rates. Second, the price of default risk is estimated as the ratio of CDS spread to expected loss.

… and price of risk as spread over expected loss

Summary statistics[1]

	One-year CDS	Five-year CDS	EDF™	Risk premium[2]	Price of default risk[2]
Mean	55.33	75.07	35.40	34.09	1.42
Median	33.82	56.20	22.84	21.11	1.30
Standard deviation	44.62	37.01	22.88	31.95	0.66
Skewness	1.00	1.21	0.70	1.24	0.26
Kurtosis	2.81	3.35	2.01	3.57	2.51
Minimum	11.15	37.31	9.09	2.64	0.31
Maximum	167.81	175.70	81.43	121.95	2.92

[1] Based on the aggregate index, in basis points (except price of default risk). [2] Based on a one-year horizon.

Sources: Markit; Moody's KMV; BIS calculations. Table 1

[12] This terminology is somewhat misleading, for the inability to perfectly diversify against single-name defaults is a "systematic" risk as well.

[13] Our formulation of the price of default risk is also non-standard. More specifically, in the literature, the price(s) of systematic risk is (are) typically identified as the compensation per unit of *volatility* of the risk factor(s); the price of jump-at-default risk is the compensation per unit of expected loss.

[14] Thus, we do not allow loss rates to vary systematically across the credit cycle. A growing body of evidence suggests that loss rates covary positively with default probabilities (eg Altman et al (2004)); however, the strength of the relationship depends on whether losses are measured by market prices shortly after default or by ultimate recovery rates.

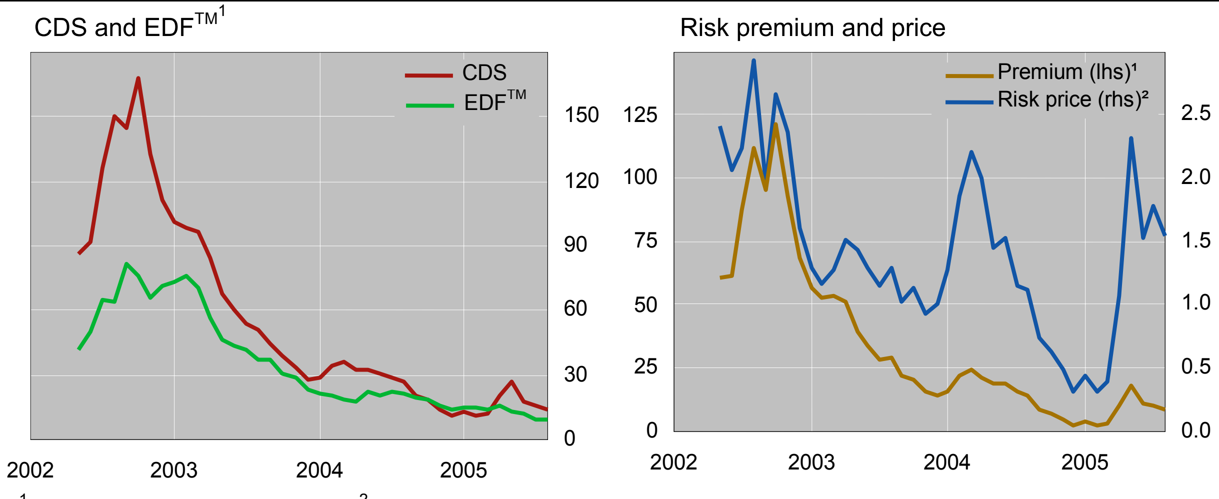
Risk-adjusted default probabilities are 140% larger than actual probabilities

Table 1 reports summary statistics on monthly time series of the main variables of interest for the aggregate index.[15] As shown in the table, CDS rates are higher than EDFs™ on average and more volatile; they are also more skewed. The one-year risk premium is positive on average, and its distribution (over time) is positively skewed and has fat tails. The average one-year price of default risk is 1.42. Under the assumption that loss-given-default is constant, this means that risk-adjusted default probabilities have been roughly 140% higher than actual default probabilities. The price of default risk also varies significantly, reaching a minimum of 0.31 and a maximum of 2.92.

Spreads and default risk aversion jumped in mid-2002 and in May 2005

Graph 2 shows the time variation in the variables. The left-hand panel plots time series of CDS spreads with a one-year maturity against EDFs™, and the right-hand panel shows estimates of the risk premium and price of default risk. The graph illustrates four key features of the series. First, it is evident that the largest changes in CDS spreads occurred in 2002.[16] This is true both on the upside, when one-year CDS rates widened by over 10 basis points in each of three weeks in July of that year, and on the downside, when spreads sharply narrowed in November. It was in July 2002 that WorldCom filed for bankruptcy with assets of $107 billion, and this appears to have had a market-wide contagion effect on CDS spreads. Default probabilities on the aggregate index also rose during this period, but by much less, indicating that WorldCom's default mainly affected market risk premia. Second, starting in early 2003, both spreads and expected default frequencies declined and have since remained relatively stable, with spreads widening only briefly in the spring of 2005

CDS risk premium and price of default risk



[1] One-year horizon, in basis points. [2] One-year price of default risk.

Sources: Markit; Moody's KMV; BIS calculations. Graph 2

[15] Monthly CDS spreads are constructed as averages of daily values.

[16] This is also evident at a higher frequency in Graph 1. For instance, nine of the 10 largest weekly changes in one-year CDS rates (in absolute value, measured on a Friday-to-Friday basis) occurred in 2002.

The components of CDS spreads

This box illustrates how to obtain the (approximate) decomposition of CDS spreads used in this article as a basis for constructing measures of risk premia and the price of default risk. For concreteness, we model credit events ("default") using an intensity-based framework.[1] This model assumes that defaults occur randomly, where the probability of default over a short time interval (eg a day or a month) is equal to the intensity, denoted by h^P. In principle, h^P may be a stochastic variable that varies in accordance with macroeconomic, sector-specific or firm-specific conditions. Other key inputs to the model include: loss-given-default (L); risk-free interest rates for discounting cash flows (r); and the prices of systematic risk and jump-at-default risk (Γ). Each of these elements may also vary with economic conditions.

In general, the risk-adjusted intensity (denoted h^Q) that is relevant for pricing CDS contracts will differ from the actual intensity h^P. This adjustment depends upon the price of jump-at-default risk, namely $h^Q = h^P (1 + \Gamma)$. If investors do not demand a premium for jump-at-default risk, then risk-adjusted and actual intensities are equal; otherwise, we would generally expect that $\Gamma > 0$, so that $h^Q > h^P$.

The spread on a CDS contract is obtained by solving for the quarterly premium that equates the expected present value of payments made by the protection buyer ("premium leg") to the expected present value of default costs to be borne by the protection seller ("protection leg"). CDS contracts specify M quarterly payment dates, $t = t_1, t_2, \ldots, t_M$, on which the premium is to be paid.[2] At origination of a contract at time t, the expected present value of the premium leg is equal to the expected sum of discounted premium payments, where the *effective* discount rate, $r + h$, is the risk-free rate adjusted for the possibility of default:

$$\mathrm{V}_{\text{prem}}(t) = E_t^Q\left[\sum_{i=1}^{M} \exp\left(-\int_t^{t_i}\left[r(s)+h^Q(s)\right]ds\right)\cdot CDS(t)\right]$$

$CDS(t)$ is the quarterly premium and $E_t^Q(.)$ denotes expectations adjusted for systematic risk.

The expected present value of the protection leg is the discounted value of the expected loss at possible default dates:[3]

$$\mathrm{V}_{\text{prot}}(t) = E_t^Q\left[\sum_{i=1}^{M} h^Q(t_i)\cdot L(t_i)\cdot \exp\left(-\int_t^{t_i}\left[r(s)+h^Q(s)\right]ds\right)\right]$$

The premium is found by setting $\mathrm{V}_{\text{prem}} = \mathrm{V}_{\text{prot}}$ and solving for $CDS(t)$:

$$CDS(t) = \frac{\sum_{i=1}^{M} E_t^Q\left[h^Q(t_i)\cdot L(t_i)\cdot \exp\left(-\int_t^{t_i}\left[r(s)+h^Q(s)\right]ds\right)\right]}{\sum_{i=1}^{M} E_t^Q\left[\exp\left(-\int_t^{t_i}\left[r(s)+h^Q(s)\right]ds\right)\right]}$$

The above equation implies that CDS spreads are weighted averages of risk-adjusted expected losses, $E_t^Q\ (h^Q L)$; in other words, $CDS(t) \cong E_t^Q\ (h^Q L)$.

There are potentially two differences between $E_t^Q\ (h^Q L)$ and actual expected loss, $E_t^P\ (h^P L)$, where $E_t^P(.)$ denotes expectations based on actual real-world probabilities. First, as noted above, h^Q may differ from h^P if investors demand compensation for jump-at-default risk ($\Gamma > 0$). Second, expectations of $h^Q L$ are evaluated using probabilities adjusted to take account of investors' aversion to systematic risk. This implies that CDS spreads are approximately equal to the sum of actual expected loss ($h^P L$), a jump-at-default risk premium ($h^P L\ \Gamma$) and a systematic risk premium.

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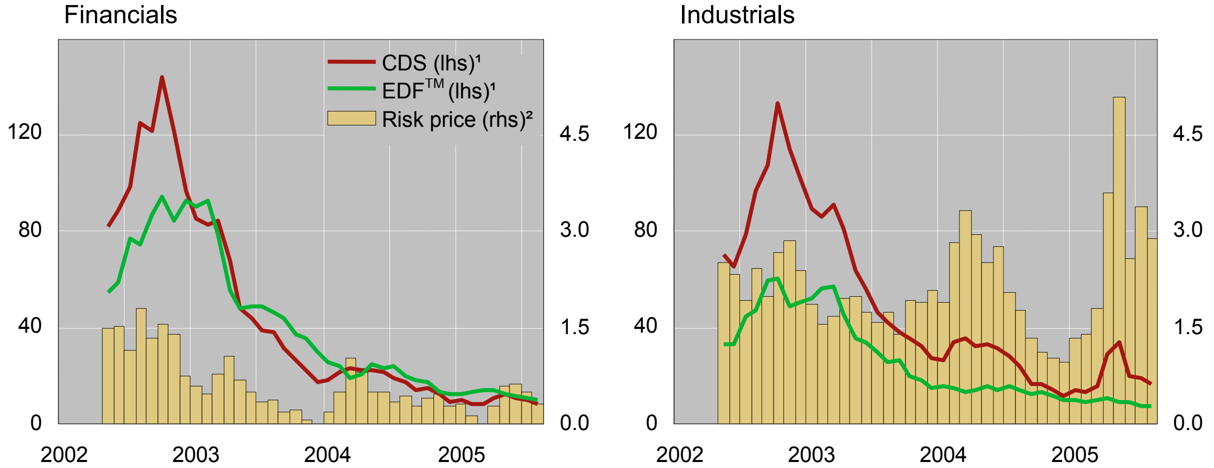
[1] Previous studies of CDS spreads using intensity models include Berndt et al (2005), Longstaff et al (2005) and Pan and Singleton (2005). [2] Payment is made only as long as the reference entity has not already defaulted. [3] For simplicity, this assumes that default can only occur on premium payment dates. In practice, when default occurs between premium payment dates, sellers of protection receive an accrual payment.

Selected CDS index sectors



[1] One-year horizon, in basis points. [2] One-year price of default risk.

Sources: Markit; Moody's KMV; BIS calculations.

Graph 3

around the events related to General Motors and Ford. Third, risk premia have largely followed the same path as spreads. Fourth, the price of default risk has experienced more ups and downs than risk premia, reaching its maximum value in mid-2002, but also rising to high levels in early 2004 when the slope of the Treasury curve steepened significantly, and again in May 2005 during the turbulence surrounding the auto sector downgrades.

Large differences across sectors

Turning to data at the sector level, Graph 3 plots one-year CDS rates and EDFs™ against the implied estimates of the price of default risk for two sectors.[17] Trend movements in both CDS spreads and EDFs™ are similar across sectors, and hence with the aggregate index. Nonetheless, the implied level and volatility of the price of default risk have varied significantly across these two sectors. For example, the level averaged 2.18 for industrial firms but only 0.62 for financial firms. Moreover, it rose precipitously on industrial firms in April-May 2005, whereas it hardly changed on financial firms during this tumultuous period.[18]

What drives CDS risk premia?

Which variables are the main drivers of movements in CDS risk premia and our indicators of default risk aversion? Earlier we identified a few key episodes when these measures were at elevated levels. In this section, we use regression analysis to estimate possible relationships with macroeconomic and

[17] The other sectors are not shown to conserve space. Broadly put, the trends in CDS spreads and estimates of default risk aversion are similar across sectors. The estimated level of default risk aversion in the consumer sector is similar to industrials, whereas it has been much lower in the TMT sector since the beginning of 2003.

[18] Amato and Remolona (2005) find that the price of default risk is higher for firms with higher credit ratings. In the CDX index, however, financial firms have higher ratings on average than those in other sectors. This suggests that a different explanation, other than credit quality, is needed to explain sector differences in our estimates. Further examination of sector differences is a subject for future research.

credit market activity variables. Due to space considerations, we focus solely on the aggregate index.[19]

Choice of variables

Impact of macroeconomy and monetary policy is examined …

To the extent that the state of the macroeconomy affects the risk preferences of investors in the CDS market, we would expect to find statistically significant relationships between macroeconomic variables and CDS risk premia measures.[20] In our analysis we consider several series, including measures of inflation, real economic activity, consumer confidence, risk-free interest rates and the stance of monetary policy.

… as well as default rates and issuance amounts

We also include measures of credit market activity in the regressions. The high-yield default rate is used as a monthly indicator for a host of other fundamental variables that would be expected to affect default risk premia. In addition, we consider the impact of straight bond and note issuance by US non-financial corporations, and global funded and unfunded issuance of synthetic CDOs. This latter variable is especially relevant for the CDS market, as CDO arrangers typically hedge deals by selling protection on single-name or index default swap contracts. There has been considerable speculation among market participants that this type of activity, known as the "structured credit bid", has had a dampening effect on CDS spreads over the past two years.

Regression results

CDS risk premia have a strong link to real economic activity

Table 2 reports results of selected univariate and multiple regressions for the CDS risk premium (top panel) and price of default risk (bottom panel).[21] The univariate regressions (columns 1–5 in each panel) indicate that the CDS measures have strong links to macroeconomic and credit variables. First, it is evident that real activity, as captured by housing starts or the change in non-farm payrolls, has a negative and statistically significant relationship with the risk premium and, to a lesser extent, the indicator of default risk aversion. This is consistent with results in Amato and Luisi (2005), who find that real activity has a large impact on risk premia in corporate bonds over a longer sample period.

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[19] Regressions were also computed for each of the sectors and the estimates are broadly similar to those for the aggregate index. These and other unreported results discussed below are available from the author upon request.

[20] Similarly, measures of economic activity should account for systematic movements in the probability of default (EDFs™ in our study). Indeed, in results not reported, we find that EDFs™ have a negative and statistically significant relationship with several real activity variables. In addition, EDFs™ are positively related to default rates.

[21] We also found evidence of economically and statistically significant relationships with several other real economic activity indicators. In most cases, inflation measures and bond issuance generally have statistically insignificant coefficients.

Regressions of CDS risk premium and price of default risk[1]

Dependent variable: Risk premium							
Variable[2]	1	2	3	4	5	6	7
HS	–0.140* (0.023)					–0.096* (0.030)	–0.102* (0.029)
NP		–0.120* (0.036)				–0.015 (0.035)	–0.019 (0.034)
RG			0.276* (0.071)			0.162* (0.059)	0.155* (0.059)
DEF				0.629* (0.198)		0.184 (0.168)	
CDO					–0.911* (0.439)		–0.355 (0.312)
R-squared	0.51	0.24	0.30	0.22	0.11	0.62	0.62
Dependent variable: Price of default risk							
Variable[2]	1	2	3	4	5	6	7
HS	–0.002* (0.001)					–0.002* (0.001)	–0.002* (0.001)
NP		–0.001 (0.001)				0.001 (0.001)	0.001 (0.001)
RG			0.006* (0.001)			0.004* (0.001)	0.004* (0.001)
DEF				0.009* (0.004)		0.004 (0.004)	
CDO					–0.025* (0.009)		–0.018* (0.007)
R-squared	0.24	0.04	0.32	0.11	0.20	0.44	0.51

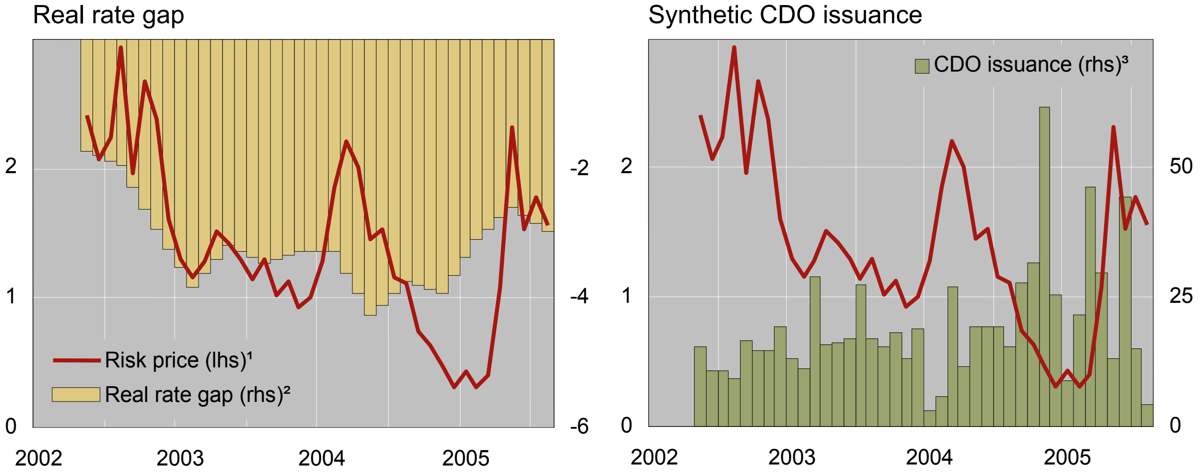
[1] Based on aggregate index measures at one-year horizon, in basis points. * indicates significance at 5% level. Standard errors are in parentheses. [2] HS: housing starts (in thousands); NP: non-farm payrolls (change, in thousands); RG: real policy rate gap (in basis points); DEF: high-yield default rate (in basis points); CDO: global funded and unfunded synthetic CDO issuance (in billions of US dollars). RG is defined as the real federal funds rate less the natural rate of interest, where the real rate is the nominal rate adjusted for four-quarter consumer price inflation and the natural rate is defined as the average real rate (1985–2003) plus four-quarter growth in potential output less its long-term average. Monthly values are linearly interpolated from quarterly averages. See BIS (2004, Chapter IV).

Sources: Bloomberg; JPMorgan Chase; Markit; Moody's; Moody's KMV; BIS calculations. Table 2

Risk aversion is closely related to the stance of monetary policy …

Second, there is a strong relationship between the real interest rate gap and default risk aversion, as illustrated in Graph 4 (left-hand panel). The real interest rate gap is an indicator of economy-wide demand conditions, but even more directly it is a measure of the stance of monetary policy. The real rate gap is constructed as the difference between estimates of the real federal funds rate and the natural rate of interest, where the latter is a proxy for the equilibrium real interest rate consistent with stable consumer price inflation (see Table 2 footnotes for more details). During the period under review, monetary policy was highly accommodative by this measure, and our results suggest that default risk aversion declined as the real federal funds rate fell further below the natural rate. As an inverse indicator of aggregate output, it is perhaps not surprising that the real rate gap varies positively with the price of

Macro liquidity, CDO issuance and default risk aversion



[1] One-year price of default risk on aggregate CDS index. [2] US real policy rate gap (RG), in per cent. RG is defined as the real federal funds rate less the natural rate of interest, where the real rate is the nominal rate adjusted for four-quarter consumer price inflation and the natural rate is defined as the average real rate (1985–2003) plus four-quarter growth in potential output less its long-term average. Monthly values are linearly interpolated from quarterly averages. See BIS (2004, Chapter IV). [3] Global funded and unfunded synthetic CDO issuance, in billions of US dollars.

Sources: JPMorgan Chase; Markit; Moody's KMV; BIS calculations. Graph 4

default risk, since aversion to risk tends to decline during good times. Alternatively, the regression evidence is consistent with easy monetary policy having facilitated greater risk-taking, as investors took more highly leveraged positions that could be financed (relatively) cheaply.[22]

To be sure, a word of caution is in order when interpreting these results. The estimates imply that when the real rate gap was below its *sample* mean, risk appetite was abnormally high. Yet the real interest rate gap was *negative* during our entire sample period. By contrast, from a longer-term perspective, default risk aversion was relatively high in mid-2002 and again in May 2005. Thus, whether or not the estimated relationships with the real rate gap hold over a full business cycle has not yet been tested and is open to debate.

… and synthetic CDO issuance

A third striking result is that months of relatively high synthetic CDO issuance coincide with a lower price of default risk (Graph 4, right-hand panel). This suggests that greater demand to sell protection in the single-name CDS market due to increased CDO issuance has a negative impact on measured risk aversion. However, these results might also be influenced by reverse causation; namely, that greater appetite for risk might lead to increased demand for, and hence greater issuance of, exotic credit products such as synthetic CDOs.

These relationships are robust to conditioning on the state of the economy

The statistical significance of default rates and synthetic CDO issuance in the univariate regressions may reflect correlations of these series with more fundamental macroeconomic variables. To control for this possibility, in Table 2 we also report results from multiple regressions that include the macroeconomic variables along with the default rate or CDO issuance. These regressions have much higher explanatory power as indicated by higher R^2

[22] See BIS (2005, Chapter VI) for further discussion.

statistics. In the case of the risk premium, housing starts and the real interest rate gap appear to be the most significant variables, while the coefficients on the high-yield default rate and CDO issuance are no longer significant. By contrast, CDO issuance remains statistically significant in the equation for the price of default risk, though its marginal impact is somewhat weaker when variables proxying for the state of the economy are included. This is further evidence that the degree of activity in the structured credit market – the so-called "structured credit bid" – may have lowered the effective degree of risk aversion in recent years.

Summary and future work

Evidence points to links to macroeconomic variables …

This article has provided estimates of CDS risk premia and default risk aversion over the period 2002–05. Both measures have been very volatile, implying that investor risk aversion changes frequently. Our measures are similar to and complement those obtained by Berndt et al (2005). Large spikes in the estimated series occurred following the default of WorldCom in 2002 and the turmoil surrounding the auto sector in April–May 2005. Furthermore, regression analysis indicates that changes in risk aversion are related to both macroeconomic factors and technical market factors. However, our conclusions should be qualified. We have made several strong simplifying assumptions to construct measures of risk premia and risk aversion. Moreover, the sample period spans just over three years, which does not cover a full credit cycle.

… but further work is needed to improve estimation and test robustness

There are several avenues to explore in future research. First, a more careful analysis would require building a model along the lines of Berndt et al (2005). Estimates obtained in this way would need to be tested for robustness to model specification. Recent work by Pan and Singleton (2005) on sovereign CDS spreads, for instance, indicates that estimates of risk aversion can be sensitive to the form of the model. Second, it would be desirable to relate measures of risk aversion and risk premia estimated using CDS data to those obtained from other credit instruments or asset classes, such as equities and government bonds. This would help further our understanding of the extent to which prices on assets in different markets are driven by common forces.

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