E SOME LESSONS FROM THE FINANCIAL MARKET TURMOIL FOR THE USE OF MARKET INDICATORS IN FINANCIAL STABILITY ANALYSIS

This special feature discusses some of the market-based indicators that are used regularly in the Financial Stability Review (FSR), focusing in particular on indicators whose information content was distorted by the financial crisis owing to factors such as extreme risk aversion, impaired market liquidity and high uncertainty about the intrinsic values of assets traded on some markets. The analysis shows that, particularly during times of crisis, great analytical efforts are required for an appropriate interpretation of developments in these indicators. This is due to the fact that credit default swap (CDS) spreads, interest rates and equity prices all include a range of risk premia, so that it is important to be aware how much and in what ways these premia are driving asset prices. If these factors are properly taken into account, market-based indicators still provide a very rich source of up-to-date information for financial stability analysis.

INTRODUCTION

Indicators based on asset prices can provide important information for financial stability analysis for two main reasons. First, since such indicators are based on market prices or other types of asset valuations, they should reflect market participants' expectations about future developments in the fundamental factors that drive them. For instance, in principle, asset prices represent the discounted expected returns to investors from holding such assets. If markets are efficient, this means that asset prices should incorporate all currently available information that is relevant for their pricing. In other words, market-based indicators can provide forward-looking information which can be used in a comprehensive financial stability assessment to complement information from backward-looking indicators such as the information found in balance sheets. A second reason why market-based indicators are an important source of information relates to their availability at high frequency, with the vast majority of them being available daily. This can make them especially useful in situations where the financial stability outlook may be changing significantly within very short periods of time. Nevertheless, market-based indicators also have some shortcomings, which must be taken into account when forming financial stability assessments. In particular, during the recent financial crisis, such indicators have been affected, among other things, by extreme risk aversion, impaired market liquidity and additional risk premia on top of those, which predominate during normal times. Such elements can distort their information content.

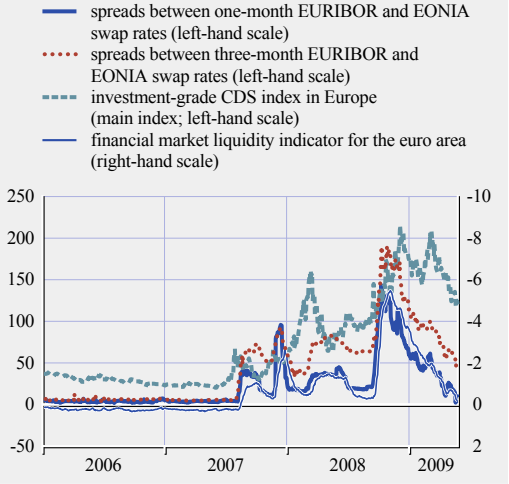
IMPACT OF THE FINANCIAL MARKET STRESSES ON MARKET-BASED INDICATORS

CREDIT DEFAULT SWAP-BASED INDICATORS

One of the most distinctive features of the current financial crisis is that it has been associated with a chronic lack of liquidity in a number of financial markets (see Chart E.1). The drying-up of market liquidity was initially felt in the market for the most complex structured

Chart E.1 Financial market liquidity indicator and money market spreads for the euro area and the CDS index in Europe

(Jan. 2006 – May 2009)



Sources: ECB, Bank of England, Bloomberg, JP Morgan Chase & Co., Moody's KMV and ECB calculations.
Note: The financial market liquidity indicator is presented in inverted scale.

credit securities, namely collateralised debt obligations (CDOs). However, it quickly spread to the other parts of the market for asset-backed securities (ABSs). Finally, vanishing liquidity also affected the corporate debt market, as well as the usually very liquid interbank money market and the CDS market. Investors will normally demand higher returns from assets that are traded in illiquid markets and this liquidity premium is an important component of asset prices. In the early stages of the crisis, the drying-up of market liquidity was an important, if not the main, driver of some asset prices and it was reflected in the widening of spreads across a range of markets including the interbank money market and the CDS market (see Chart E.1).

An important indicator of aggregate credit risk that has been used extensively in this FSR and elsewhere is the CDS spread. This is because, in principle, CDS spreads should provide a pure measure of default risk, since they represent the price that investors who wish to protect themselves against the risk of the default of an underlying entity are prepared to pay sellers of credit protection. As such, CDS spreads should predominantly reflect market participants' assumptions about the probability of default of the underlying entity. In the most basic approach to the valuation of CDS spreads, they can be seen as a function of the probability of default (PD) and the recovery rate (RR):

$$CDS = PD \times (1-RR)$$

Even using this basic model for pricing CDSs, it is clear that the probability of default is not the only driving factor of the spread but that assumptions that are made about the recovery rate are also important in determining its level. In many pricing models, the recovery rate is assumed to be fixed, but some authors suggest that the probability of default and the loss given default (LGD = 1-RR) may be cyclically interdependent. For instance, Altman suggests that there is a negative correlation between default rate and recovery rate over the cycle.[1] The corollary of this is that the correlation between the losses given default and the probabilities of default should be positive. This means that it can usually be expected that before economic downturns CDS spreads will increase in anticipation of the downturn by more than the underlying probabilities of default. This is because the rise in probabilities of default will most likely be accompanied by rising losses given default, which will amplify the overall loss to the investor who is exposed to the underlying credit risk. If losses given default are changing over time, this makes it difficult to interpret movements in CDS spreads in a straightforward manner unless a view is also taken of the likely losses that will occur in the event of default. In this vein, one feature of the current turmoil has been growing expectations that LGD rates will be higher than in the recent past.

During the recent period of financial market strains, apart from a heightened liquidity risk premium and expectations of higher LGD rates, CDS spreads may also have been affected by other risk premia related to jump-to-default risk – i.e. the risk of a sudden default occurring before the market has had time to factor the increased default risk into current spreads – or systemic risk. In normal times, premia related to these risks tend to have a negligible impact on the level of CDS spreads, but the default of Lehman Brothers, which was a classic example of jump-to-default risk materialising, clearly illustrated the importance of this risk (see Chart E.2). On the other hand, systemic risk, i.e. the risk of simultaneous failure of a number of institutions, or of the entire financial system, as a result of interlinkages that exist in the system, may be particularly significant for the pricing of CDS on debt issued by banks or insurance companies, which tend to have much higher degrees of interconnectedness than is the case for non-financial sectors. These risk factors should be taken into account when drawing conclusions either from the levels of, or changes in, the CDS spreads of large and complex banking groups (LCBGs) and other financial institutions.

1 See E. I. Altman, "Credit Risk and the Link between Default and Recovery Rates", *CFA Institute publication*, No 1, December 2006.

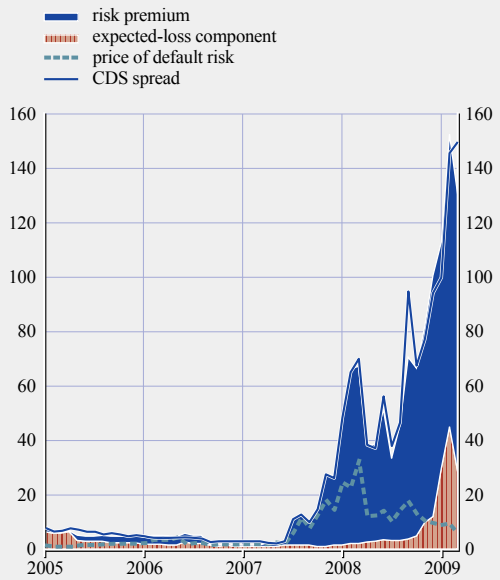
Chart E.2 Materialisation of jump-to-default risk during the default of Lehman Brothers

(CDS spread; basis points; senior debt; five-year maturity)

Source: Bloomberg.

Chart E.3 Decomposition of the CDS spreads of euro area large and complex banking groups

(Jan. 2005 – Mar. 2009; basis points)



Sources: Bloomberg, Moody's KMV and ECB calculations.
Notes: Since expected-loss components and risk premia were calculated for each LCBG individually, their medians do not necessarily sum up to the median CDS spread. See the box entitled "Price of default risk as a measure of aversion to credit risk" in ECB, *Financial Stability Review*, December 2008, for a description of how the price of default indicator was constructed.

To illustrate the impact of jump-to-default risk and systematic risk premia, an indicator of the price of default risk was calculated, as demonstrated by Amato.[2] According to intensity-based CDS pricing models, the CDS premium can be decomposed into an expected-loss component and a default risk premium. The latter is composed of a jump-to-default risk premium and a systematic risk premium, which compensates for the volatility of risk factors that affect the default probability. Thus, the default risk premium can be measured as the difference between the CDS spread and the expected-loss component. Alternatively, the decomposition can also be done using a product of risk premium components, whereby the risk adjustment ratio compensates for a unit of expected loss and is usually reflected as the price of default risk. Using this approach, both the price of default risk and the risk adjustment ratio may be approximated by the quotient of the CDS premium to the expected loss component. This ratio is a measure of investors' aversion to default risk.

The significant widening observed after August 2007 in the CDS spreads of euro area LCBGs was driven mainly by the default risk premium (see Chart E.3). Between 2005 and mid-2007, by contrast, the largest proportion of CDS spreads was explained by patterns in the compensation demanded by investors for expected losses.

After the eruption of the market turmoil, the expected-loss component increased only moderately in comparison with the default risk premium. From April 2008 onwards, aversion to credit risk, as measured by the price of default risk, fell. In particular, it declined from the beginning of 2009, even though CDS spreads increased at that time. The rise in the CDS spreads was due to an increase in the expected loss component, which rose steadily after the end of 2007, and surged in the fourth quarter of 2008. This suggests that CDS spreads were

2 See J. D. Amato, "Risk aversion and risk premia in the CDS market", *BIS Quarterly Review*, Bank for International Settlements, December 2005.

increasingly driven by rising probabilities of default of individual LCBGs.

A simple VAR (vector autoregression) model-based decomposition of the variance of the total risk premium in CDS spreads revealed that as much as 46% of the variance may be explained by systemic risk, as measured by a systemic risk indicator, and another 25% by liquidity, as measured by a market liquidity risk indicator (see also Chart E.3). This suggests that the high levels of aversion among investors regarding LCBGs' credit risk were driven mainly by fears related to jump-to-default risk – owing to the possibility of a systemic spill-over – and, to a lesser extent, by vanishing liquidity in the broader financial markets.

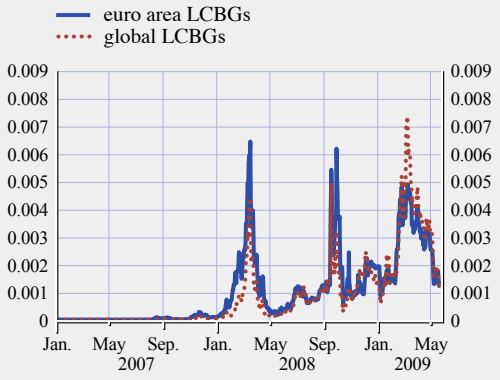
It is important to note that one of the systemic risk indicators regularly used in this FSR may have been affected by changes in all default risk premia, since CDS spreads are the most important input into the model (see Chart E.4).[3]

Apart from the risk premia discussed above, there is a further reason for interpreting patterns in this indicator with caution. In particular, the increase in the indicator up to mid-March 2009 may have been related to increasing concerns among market participants that the only possible solution to the problems faced by some banks was to nationalise them, most likely temporarily. In ISDA Master Agreements, under which most CDS trades are executed, nationalisation is considered to be a credit event, triggering the payoffs to protection buyers that they would have received had the institution defaulted.[4] This risk can be clearly distinguished from default risk and should be seen as an additional risk premium in the CDS spreads of banks. The existence of this risk makes the interpretation of patterns in the CDS-based indicator of systemic risk difficult because market participants would have viewed the nationalisation of a LCBG as a step designed to avoid possible systemic consequences, thereby decreasing systemic risk in the banking system, contrary to what the indicator suggested on the surface.

Another example of how dislocations in financial markets may have affected the pricing of assets is to be found in the recent developments in the "bond-CDS basis", i.e. the difference between the CDS spread and the spread implied from the bond price on the same underlying company. In principle, both CDS spreads and bond spreads should represent the price of the same underlying credit risk. Thus, any difference between the two spreads should be transitory, i.e. should disappear in the long run. In particular, if a negative basis emerges, an investor can profit by buying a bond (long position in credit risk) and, at the same time, purchasing protection on the same underlying name in the CDS market (short position in credit risk). Such an arbitrage opportunity could be exploited by the investors without any risk, so that it should force the two

Chart E.4 Joint probability of distress for euro area and global large and complex banking groups

(Jan. 2007 – May 2009)



Sources: Bloomberg and ECB calculations.
Note: The samples of euro area and global LCBGs include 14 and 12 banks respectively. The difference between the two series in terms of scale is related to the sample size, i.e. more banks in the sample lower the probability of joint default.

3 See Section 4.3 for more details on the systemic risk indicator depicted in Chart E.4.

4 The ISDA (International Swaps and Derivatives Association) was chartered in 1985, and today has over 830 member institutions from 57 countries on six continents. These members include most of the world's major institutions that deal in privately negotiated derivatives, as well as many of the businesses, governmental entities and other end users that rely on over-the-counter derivatives to manage efficiently the financial market risks inherent in their core economic activities.

spreads to converge. However, in the months following the default of Lehman Brothers, corporate bond market liquidity all but dried up. This added significant additional liquidity risk premia to the spreads of corporate bonds, while the CDS market remained relatively liquid at that time. As a consequence, the bond-CDS basis entered negative territory, with the average difference between the spreads implied from bonds and CDSs amounting to as much as 100 basis points for the European investment-grade companies and even 300 basis points for US investment-grade companies. The wide bond-CDS basis proved to be persistent on account of a lack of funding, overall pressure towards deleveraging and marking-to-market risk embedded in basis trades.[5]

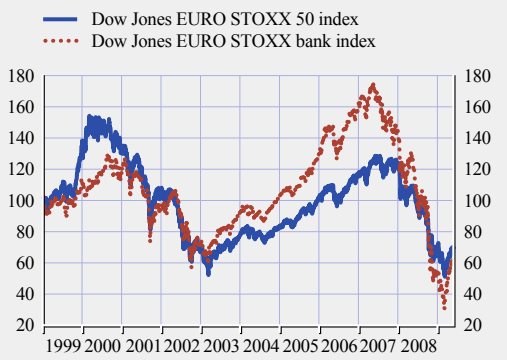
Spreads implied from bonds of LCBGs, rather than from CDS spreads, may be used to calculate, for instance, a similar systemic risk indicator, as illustrated in Chart E.4. Since bond-implied spreads have remained higher than CDS spreads, such a bond-based systemic risk indicator would suggest a much higher probability of systemic risk than that calculated using CDS spreads. However, the level of systemic risk indicated by this indicator would be an obvious overestimation and would not represent the actual level of systemic risk to which the financial system is exposed.

EQUITY PRICE-BASED INDICATORS

Indicators based on equity prices, in particular share prices of banks and insurance companies, are also frequently used in this FSR and elsewhere. These are analysed to assess banks' earnings capacities, capital positions and loss absorption capacities, as perceived by market participants. Although the equity prices of LCBGs have been in constant decline since the start of the crisis (see Chart E.5), the reasons for declining shareholder value have varied over time. In the early stages of the crisis, potential losses on sub-prime exposures and uncertainty surrounding the magnitude of these losses were the major drivers of falls in banks' stocks equity in mid-2007.

Chart E.5 Dow Jones EURO STOXX total market and bank indices

(Jan. 1999 – May 2009; index: Jan. 1999 = 100)



Source: Bloomberg.

Following the collapse of the originate-to-distribute model and the spread of losses beyond CDO markets in autumn 2007, there were fears about the ability of banks to withstand funding constraints and possible further marking-to-market losses on non-sub-prime securities. In 2008 fears that some banks might not withstand further losses and that the worsening economic situation might have adverse feedback effects on the real side of the economy were further aggravated by the possibility of systemic collapses of a few financial institutions. These fears temporarily decreased after the bailout of Bear Stearns, which fuelled expectations that none of the systemically important institutions would be allowed to fail by the authorities. However, these fears rematerialised in the aftermath of the default of Lehman Brothers. This was followed by further losses on structured credit securities, problems with the recapitalisation of some banks using private equity capital and a significant deterioration in the economic outlook, which increased the probability of feedback effects hitting banks' banking books. In the most recent episode of falls in banks' equity prices, investors became increasingly fearful of having their claims on the dividend cashflows of banks diluted as result of the possibility of injections of capital by governments into a more senior part of

5 See Box 9, entitled "The Bond-CDS basis and the functioning of the corporate bond market", in this issue of the FSR.

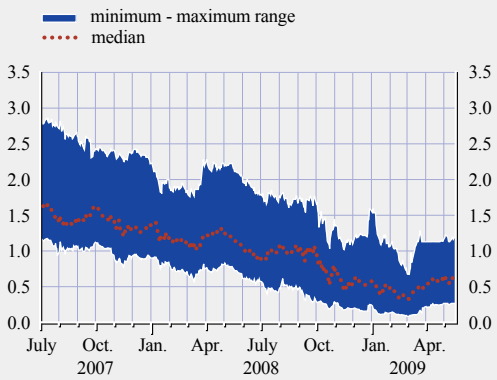
the capital structure such as through the creation of preferred shares.

The importance of this factor in driving bank equity price movements can be seen by examining patterns in the price-to-book value ratio (see Chart E.6).

This ratio is a valuation metric that can be seen as a floor for stock prices in a worst-case scenario. For instance, when a bank is liquidated, the book value is what may be left over for the owners after all the debts have been paid. A high price-to-book value ratio (in excess of unity) is often seen as an indication that an investor can expect to retrieve his investment in full, assuming that the assets on the balance sheet of the bank can be resold at their book value. During the recent market turmoil, government capital support increased the book value of equity, i.e. the denominator, but equity prices, i.e. the numerator, simultaneously fell as a result of the dilution effect. Overall, this indicator decreased significantly, even though the prospects of institutions receiving the capital injections should have improved. On the face of it, the drop in equity prices might have been interpreted as a bad signal. This illustrates the importance of complementing information extracted from asset prices with information on the underlying fundamentals.

Chart E.6 Dispersion of price-to-book value ratios for euro area large and complex banking groups

(July 2007 – May 2009)



Sources: Bloomberg and ECB calculations.

CONCLUDING REMARKS

All in all, market-based indicators have proved to be useful in financial stability analysis. However, particularly during times of crisis, great analytical efforts are required to ensure that developments in these indicators are appropriately interpreted. This is due to the fact that asset prices such as CDS spreads, interest rates and equity prices all incorporate a range of risk premia, so that it is important to be aware of how much and in what ways these premia, are driving asset prices. This holds particularly true because the importance of these premia can change over time, sometimes abruptly and significantly during episodes of market stress. That said, taking these factors properly into account and applying a careful analysis of the drivers of the movements of the indicators, market-based indicators should still provide a rich source of up-to-date information for financial stability analysis.