

Box 8

SYSTEMIC RISK MEASURE – A PORTFOLIO PROBABILISTIC PERSPECTIVE ON MEASURING DEFAULT RISK

The risk of banking institutions defaulting – and in particular those with a systemic dimension – is at the heart of financial stability analysis. One approach to modelling such default risk which has gained considerable prominence in recent years concerns the probability of simultaneous failures of multiple financial institutions. While such extreme events are highly unlikely to actually materialise in practice, such methodologies provide a succinct means of conceptually viewing the financial system as a joint distribution of its constituent financial institutions. Moreover, such a methodology can take publicly available data to assess the likelihood of such an extreme systemic event. This box presents a methodology based on clear, flexible and reproducible estimation methods to measure such joint default risk, applied to euro area large and complex banking groups (LCBGs) – and compares it with results from selected existing methodologies.

The measure is derived on the basis of a three-step procedure.¹ First, credit default swap (CDS) contracts of different maturities are used to extract the perceived individual default risk of euro area LCBGs. To recover individual probabilities of default from CDS spreads, a standard cumulative probability model that incorporates recovery rates, refinancing rates and continuous compounding is employed.² The second step involves recovering the joint probability density of the banks concerned defaulting. Since joint credit events are rarely traded in the default insurance market, assumptions are needed to generate a synthetic structure to measure the joint default probability density within the system, thus allowing a mapping from marginal to joint probabilities of default. There are numerous procedures readily available in the literature, one which is particularly suitable being the Consistent Information Multivariate Density Optimization (CIMDO) Procedure.³ This methodology relies on the market beliefs of an institution's performance, rather than a direct investigation of its capital structure. On the basis of the banking system's multivariate probability density so far obtained, a third and final step involves deriving an indicator for the perceived joint probability of at least two LCBGs defaulting.

The resulting systemic risk measure (SRM) is closely related to the systemic risk indicator (SRI) first presented in the December 2007 FSR (see Chart A). While both aim to capture the interdependence of default risk of a set of euro area LCBGs, their evolution has been somewhat divergent in recent years. Most importantly, the estimated rise in perceived systemic fragility during the sub-prime crisis from mid-2007 to mid-2009 is less accentuated in the SRM compared with the SRI. The subsequent dynamics are similar across both indicators to a large extent: after a period of decline and stabilisation in 2009, the indicators rose again from April 2010 onwards, reaching peaks in late November and early December 2011, then declining in early 2012 and rising again in April and May 2012.

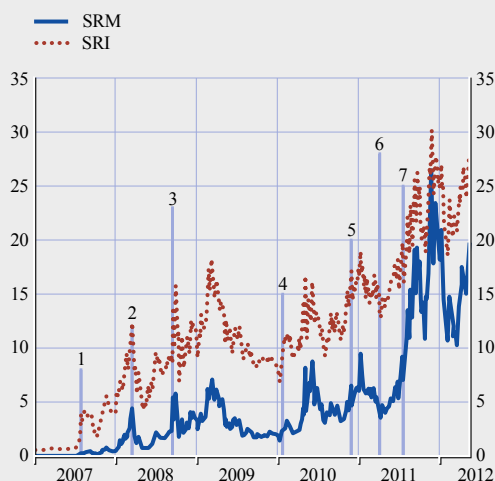
1 The methodology presented in this box is based on the procedure outlined in D. Radev, "Assessing Systemic Fragility – A Probabilistic Perspective", Working Paper, GSEFM Frankfurt-Mainz-Darmstadt and Johannes Gutenberg University Mainz, 2012.

2 This model is known as CDS bootstrapping. For further details, see e.g. D. O'Kane and S. Turnbull, "Valuation of Credit Default Swaps", Fixed Income Quantitative Credit Research, Lehman Brothers, April 2003, and M. Adelson, M. van Bemmelen and M. Whetten, "Credit Default Swap (CDS) Primer", Nomura Fixed Income Research, May 2004, and further references therein. It conservatively implies risk-neutral probabilities that are higher than actual probabilities.

3 See M. Segoviano, "The Consistent Information Multivariate Density Optimizing Methodology", Financial Markets Group, Discussion Paper 557, London School of Economics, 2006.

Chart A Probability of a simultaneous default by two or more large and complex banking groups as measured by previous (SRI) and new (SRM) methodologies

(Jan. 2007 – May 2012; probability; percentages)

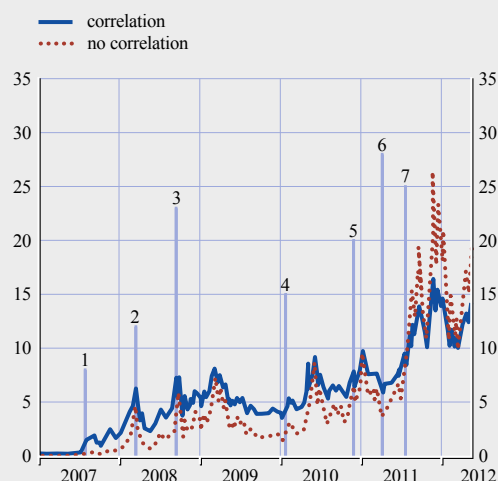


- 1 Turmoil begins
- 2 Bear Stearns rescue takeover
- 3 Lehman Brothers defaults
- 4 Greek fiscal problems gain media attention
- 5 Programme for Ireland signed
- 6 Portuguese government asks for financial assistance
- 7 EU summit 21 July

Sources: Bloomberg and ECB calculations.
Note: The SRM has a sample of 15 banks, compared with a sample of 11 banks used in the SRI, and uses a one-year horizon instead of two.

Chart B Probability of a simultaneous default of two or more large and complex banking groups, with and without multivariate model correlation (SRM)

(Jan. 2007 – May 2012; probability; percentages)



- 1 Turmoil begins
- 2 Bear Stearns rescue takeover
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Sources: Bloomberg and ECB calculations.
Note: Model correlation is estimated by the overall sample correlation of the marginal probability measures.

In addition, the inclusion of model-specific correlation (see Chart B) in the multivariate probability distribution itself alters the notion of risk of joint default. Prior to mid-2011, in a period that could be characterised as having been driven by global factors, the model with correlation (in the probability function itself) depicts higher levels of fragility. By contrast, since 2011 the model without correlation shows a higher level of fragility. This illustrates the impact of such “structural” forms of model correlation.

All in all, the new measure updates the methodological underpinnings of a multivariate perspective of default risk modelling for euro area banks. While not free of caveats – notably the model’s dependence on estimates – this measure provides a robust, flexible, succinct and widespread means of illustrating systemic stress within the banking sector.