

## Box 12

### MEASURING THE TIME-VARYING RISK TO BANKING SECTOR STABILITY

To further expand the market-based framework for monitoring systemic risk in the Financial Stability Review, this box introduces a new method for estimating joint probabilities of default (PoDs) for euro area and global LCBGs.<sup>1</sup>

The first step in constructing the indicator is to collect data on alternative market-based PoDs for the individual banks to be included in the sample, such as Merton-type PoDs or PoDs inferred from credit default swaps (CDS-PoDs). Visual analysis of historical time series reveals that the latter appear to be more responsive to news affecting the banking sector. In the topical context, the CDS-PoDs have also captured the recent financial market stresses better. In addition, being a market-based measure, the CDS-PoDs may provide real-time information on changes in those individual banks' default probabilities for which CDSs exist, although words of caution should be added since PoDs based on CDS spreads may be biased upwards in periods of market stress. To move from individual bank PoDs to the joint probability of default (JPoD), this box follows a framework which conceptualises the banking system as a "portfolio of banks". Using a novel non-parametric copula approach and CDS-PoDs as inputs, the banking system's JPoD can be derived. The JPoD embeds both linear and non-linear dependence and allows for these to change throughout the economic cycle, reflecting the fact that dependencies typically increase in periods of distress. These are relevant technical improvements over most risk models, which usually account only for linear dependence (correlation), which is also assumed to remain constant over the cycle. From the JPoD estimate, it is possible to further derive a measure for banking system stability, a banking system stability index (BSI). The BSI represents the expected number of bank defaults in the portfolio of banks, given that at least one bank defaults. The advantage

<sup>1</sup> For a similar methodology previously used for an assessment of systemic risk assessment in this context, see Box 16 in ECB, *Financial Stability Review*, December 2007. The methodology applied in this box draws heavily on M. Segoviano and C. Goodhart, "Banking Stability Measures", *IMF Working Paper*, forthcoming, M. Segoviano, "The Conditional Probability of Default Methodology", Discussion Paper No 558, Financial Markets Group, London School of Economics, 2006, and M. Segoviano, "The Consistent Information Multivariate Density Optimizing Methodology", Discussion Paper No 557, Financial Markets Group, London School of Economics, 2006.

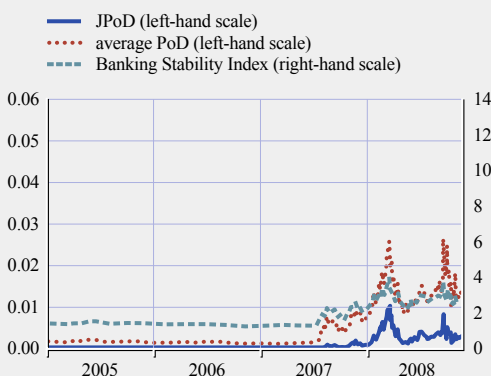
of this derived indicator is that it transfers the movements in the JPoD to an ordinal measure that is comparable across different sub-samples since a larger sample generally decreases the probability of default.

The comparison of changes in an unweighted average of CDS-PoDs with changes in the JPoD (the level of which is much lower due to the measurement of the probability of a multiple default, instead of the averaged probability of single-entity defaults) reveals the importance of incorporating default inter-dependence into the analysis. Charts A and B illustrate, for instance, that the change in the JPoD between 1 June 2007 and 15 November 2007 (this is the time horizon of the first JPoD pick-up) was stronger (it increased by a factor of 14160.7 for euro area LCBGs, and by one of 5554.3 for global LCBGs) than the change in the average CDS-PoD (which increased by a factor of 3.7 for euro area LCBGs, and by one of 3.3 for global LCBGs in the same period). This divergence can be explained by an increase in banks' default interdependence, which is taken into account in the JPoD. Notably, between the beginning of May and mid-September 2008 (the episode of the Lehman Brothers default), the average CDS-PoD increased by a factor of 8.0 for the global LCBGs and by a factor of 4.0 for the euro area LCBGs. In contrast to this result, the JPoD for the global LCBGs picked up by a factor of 2.4 within the same time horizon, while it increased by a factor of 1.4 for the euro area LCBGs. This discrepancy in developments across groups of banks suggests that the CDS market saw relatively larger increases in systemic risk for global LCBGs at the time.

Finally, Charts A and B also show that, for euro area and global LCBGs up to the summer of 2007, the BSI has been moving in the range of two banks out of the sample defaulting, given that at least one bank out of the sample defaults. From mid-2007 onwards, the BSI went up to four banks defaulting, given one bank defaults, for both euro area and global LCBGs. This is in line with the movement of the JPoD. However, the BSI shows a less strong momentum in periods of distress (e.g. mid-September 2008). Consequently, it seems that while the JPoD is a suitable tool for short-term monitoring of systemic risk, the BSI conveys information about more medium-term developments.

**Chart A Average CDS-PoD, joint probability of default (JPoD) and Banking Stability Index (BSI) for euro area large and complex banking groups**

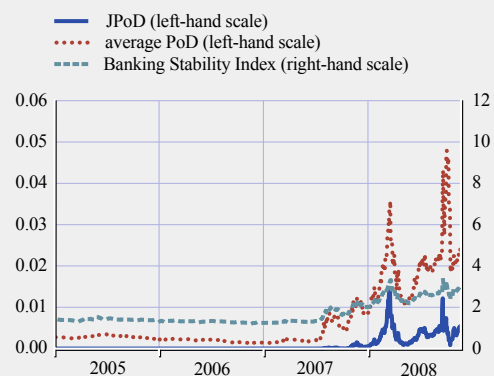
(percentage probability; number of banks for the BSI)



Sources: Bloomberg and ECB calculations.  
Note: The sample of euro area LCBGs includes 14 banks. The scale of the euro area JPoD series has been adjusted to allow for visual comparison with the average CDS-PoD series. Therefore, a comparison in terms of changes, instead of levels, has to be made.

**Chart B Average CDS-PoD, joint probability of default (JPoD) and Banking Stability Index (BSI) for global large and complex banking groups**

(percentage probability; number of banks for the BSI)



Sources: Bloomberg and ECB calculations.  
Note: The sample of global LCBGs includes 12 banks. The scale of the global JPoD series has been adjusted to allow for visual comparison with the average CDS-PoD series. Therefore, a comparison in terms of changes, instead of levels, has to be made.