

## Box 6

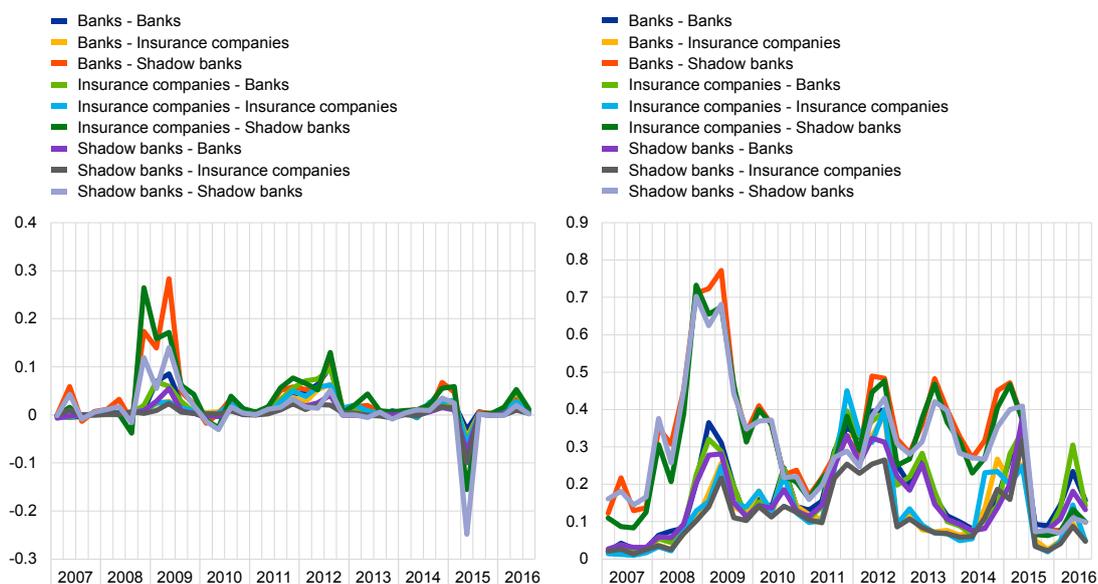
### Assessing the spillover potential between banks, shadow banks and insurance companies in Europe

Financial distress in the non-bank financial sector can be transmitted to the banking sector through a number of direct and indirect transmission channels. First, the banking sector may be directly exposed to non-bank financial institutions through equity investment or credit claims. Credit claims often arise in connection with prime brokerage services through which non-bank financial firms increase their leverage. In addition, the liquidity credit lines that provide non-financial firms with a backstop against an outflow of their short-term liabilities could also give rise to a significant exposure. Second, non-bank financial institutions play an important role in the funding of the banking sector by investing in bank debt securities and providing liquidity through secured money markets, as well as through the provision of collateral. Third, banks and non-bank financial institutions are also indirectly interconnected through common exposures to assets. Distress in one of these sectors may give rise to asset fire sales, which would depress the prices of assets held by the other sector and, through mark-to-market accounting, adversely impact the profits and capital of that sector.

#### Chart A

##### dCoES estimates for a significant sample of banks, shadow banks and insurance companies

(dCoES measured in PD percentage points)



Sources: ECB and ECB calculations.

Notes: The weighted aggregate dCoES estimates are total asset-weighted averages of the underlying institution-to-institution level dCoES estimates linking all pairs of institutions from a sample of 1,911 firms. The chart on the right shows the 95th percentile of the institution-to-institution level estimates per sector combination instead of a weighted aggregate.

Against this backdrop, assessing the potential for contagion among different kinds of financial institutions is an important element to understand the systemic dimension of financial stability risks in the European financial sector as a whole. To this end, a time-varying measure of the interconnectedness of shadow banks, banks and insurance companies has been developed. The analysis relies on the delta-Conditional Expected Shortfall (dCoES) methodology which is a non-parametric variant of the parametric CoVaR/CoES method developed by Adrian and Brunnermeier

(2014)<sup>52</sup>. Using the expected shortfall (ES) concept, one can measure the marginal contribution of an institution  $i$  to  $j$ 's (tail) risk, as the difference between the conditional ES, which attempts to measure risk in the tail, and the median conditional ES, reflecting conditions for institution  $i$  during normal, non-stressed market conditions:

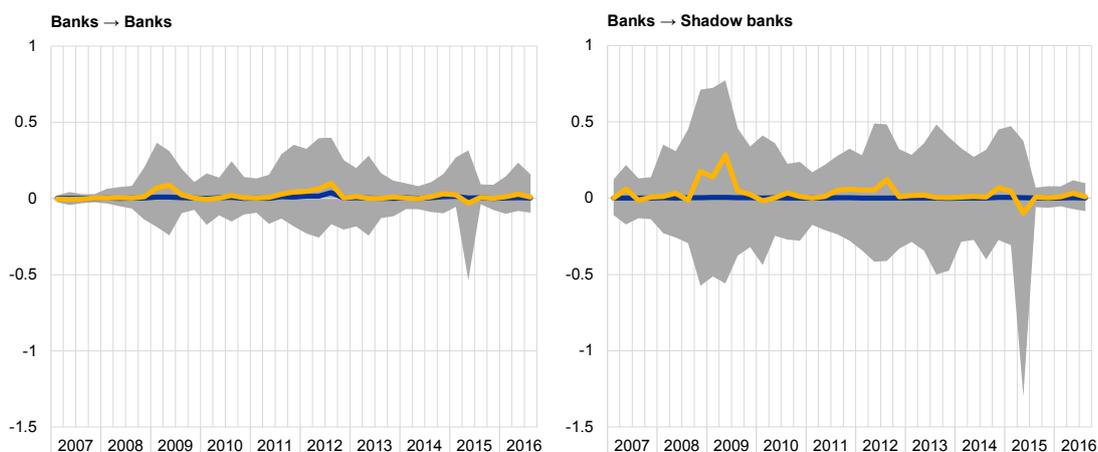
$$dCoES_q^{ji} = CoES_q^{ji} - CoES_{50}^{ji}$$

This measure is computed for all pairs of institutions in a combined sample of 1,911 firms from Europe, based on one-quarter non-overlapping windows of daily data for their probabilities of default (PDs) over the period from January 2007 to September 2016.<sup>53</sup> The time-varying institution-to-institution level dCoES estimates are grouped into three sectors to subsequently compute asset-weighted aggregates linking the three sectors. The results are shown in Chart A. They suggest that there are two periods during which significant rises in spillover potential could be observed: Q4 2008-Q2 2009 and Q3 2011-Q3 2012. The two periods correspond to: (i) the aftermath of the collapse of Lehman Brothers that marked the beginning of the global financial crisis; and (ii) the ensuing euro area sovereign debt crisis that reached its apogee between the third quarter of 2011 and the third quarter of 2012.

### Chart B

#### dCoES estimates over the Q1 2007-Q3 2016 period

(dCoES measured in PD percentage points)



Sources: ECB and ECB calculations.

Note: The weighted aggregate dCoES estimates (yellow line) are total asset-weighted averages of the underlying institution-to-institution level dCoES estimates linking all pairs of institutions belonging to the two sectors indicated in the header of the chart.

Chart B presents as an example out of the nine possible sector combinations the evolution of the cross-institution distribution of the dCoES weighted aggregates (in this case along with the whole cross-institution distribution) for the bank-bank and bank-shadow bank combinations to provide an additional illustration of the results. The weighted aggregate dCoES from Chart A (left panel) for these two sector combinations correspond to the yellow lines in Chart B, while the 95th percentile

<sup>52</sup> Adrian, T. and Brunnermeier, M. K., "CoVaR", Federal Reserve Bank of New York Staff Report No 348, September 2008 (revised September 2014).

<sup>53</sup> This measure is calculated using expected default frequencies provided by Moody's KMV for a sample of 1,911 financial institutions from 20 EU countries. The data cover 39 quarters of daily data (2,534 daily observations) over the Q1 2007-Q3 2016 period. Of the 1,911 total, 14% are banks. The remainder of the sample includes insurance companies, finance companies, investment management companies, and security brokers and dealers.

evolution from Chart A (right panel) corresponds to the upper end of the shaded area in Chart B. The visualisation helps reveal again the wider distribution of the potential for contagion including the shadow banking system over the considered time period.

Overall, tail risk-based measures such as the dCoES are useful as a contemporaneous monitoring tool, which in addition to an aggregate measurement of spillover strength across specific financial market segments can also be used to identify the most influential or most vulnerable firms (over time) or those firms that are both influential and vulnerable at the same time (not presented here). Such tail-risk measurement remains a reduced-form measurement, however, and warrants a deeper structural investigation with a view to identifying changes in exposure structures, for instance, to seek answers as to why spillover potential changes over time.

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