Box 3

THE NETWORK STRUCTURE OF THE CREDIT DEFAULT SWAP MARKET AND ITS DETERMINANTS

Despite considerable growth in the credit default swap (CDS) market over the last decade, it remains opaque in many respects. In particular, the over-the-counter (OTC) nature of the trades implies a high potential for counterparty risk, which may embed externalities that reverberate well beyond a bilateral structure of exposures. A more detailed understanding of the network structure is thus essential to identify potential sources of financial stability risks that may emanate from this financial market segment. Indeed, while such questions have already been at the centre of attention in the context of interbank markets for some time now, derivative markets have been analysed less deeply to date, mainly on account of an unavailability of data.

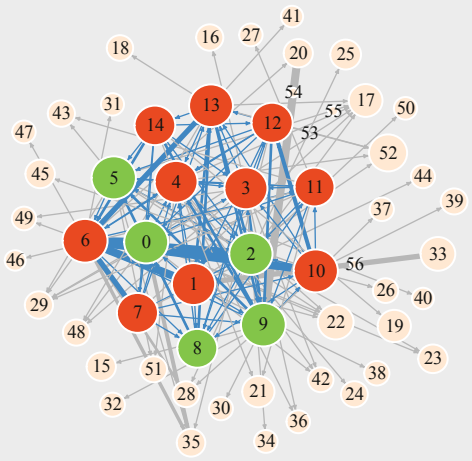
This box analyses the CDS market structure using a large and novel dataset, focusing on the network structure and the analysis of the determinants of some key network properties at a

reference entity level.[1] The dataset, obtained from the Trade Information Warehouse (TIW)[2] of the Depository Trust and Clearing Corporation (DTCC), comprises virtually all gross and net exposures on 642 reference entities worldwide, including 40 sovereigns (18 G20 sovereigns and 22 European sovereigns) and 602 financial reference entities as at the end of 2011.[3]

The resulting map of the market structure of the CDS exposure network shows that it shares many features with other financial networks such as networks for interbank loans. The chart illustrates the structure of the aggregated CDS network for key sovereign and financial CDS reference entities. The analysis shows that, on aggregate, active traders sell and less active traders buy (net) CDS protection, which is in line with the finding that smaller banks tend to lend to larger, "money centre" banks.[4] The analysis shows that the interconnectedness on the CDS market does not arise from the large number of bilateral links between any two counterparties, but rather as a result of the fact that all traders are close to one another due to the existence of a few key intermediary traders. There is also a high(er) concentration among counterparties (i.e. buyers and sellers of protection) than among CDS reference entities (i.e. the underlying entity being hedged).[5] In terms of stability and contagion, scale-free networks, such as the CDS network, have been shown to be more robust than random networks to the disappearance of

The structure of the aggregated CDS network for key sovereign and financial CDS reference entities

(as at end-2011)



Sources: T. Peltonen, M. Scheicher and G. Vuillemey, "The Network Structure of the CDS market and its Determinants", *ECB Working Paper Series*, forthcoming. The dataset of this paper is obtained from the Trade Information Warehouse (TIW) of the Depository Trust and Clearing Corporation (DTCC).
Notes: The chart is constructed as follows: in order to isolate the net behaviour of systemically important institutions in the network, the top 15 counterparties and their top ten exposures are depicted. Hence, the coloured nodes at the centre are the 15 largest counterparties in the CDS market, when counterparties are ranked by their total notional exposure. Among them, the red nodes represent net sellers and the green nodes overall net buyers. For each of these 15 traders, the ten largest bilateral net sell exposures are shown. The size of each node is proportional to the log of the underlying gross exposure. The size of each link is proportional to the log of the net exposure it represents. Large net exposures between the top 15 traders are in blue.

1 For further details, see T. Peltonen, M. Scheicher and G. Vuillemey, "The Network Structure of the CDS market and its Determinants", *ECB Working Paper Series*, forthcoming.
2 The TIW is a global trade repository, i.e. a database of transactions covering the vast majority of CDS trades worldwide, and virtually all recent CDS trades. It has several interesting features. First, it covers both centrally cleared and bilateral OTC transactions. Second, not only banks or dealers report their trades to DTCC, but all types of counterparties, so that the dataset encompasses all main non-bank institutions such as hedge funds, insurance companies, central counterparties (CCPs) and, potentially, some industrial corporations. Third, this dataset is a legal record of party-to-party transactions, as the Warehouse Trust Company (a subsidiary of DTCC which operates the Trade Information Warehouse) is supervised by US regulatory authorities.
3 The amount of the total gross notional value in the analysis sample equals €4.28 trillion. Therefore, the sample represents around one-third of the global single-name CDS market and around one-fifth of the total CDS market (including multi-name instruments) at that point in time. For each reference entity, the dataset contains gross and net bilateral exposures between any two counterparties. The overall network consists of 57,642 bilateral exposures of individual reference entities. As any bilateral exposure may result from several separate transactions, the number of transactions covered by the dataset is 592,083.
4 See, for example, S. Markose, S. Giansante and A.R. Shaghaghi, "Too Interconnected To Fail' Financial Network of US CDS Market: Topological Fragility and Systemic Risk", *Journal of Economic Behavior & Organization*, No 83(3), forthcoming; and B. Craig and G. von Peter, "Interbank tiering and money center banks", *BIS Working Paper Series*, No 322, 2010.
5 The top ten most active traders account for 73% of the gross protection bought or sold, and are active in more than 55% of the sovereign and financial reference entities.

one node, but also to be highly vulnerable in the event of one of the few highly connected nodes (i.e. key intermediary traders) disappearing from the network.[6]

An econometric analysis – using a generalised linear model of the determinants of the properties of the CDS network for individual reference entities – yields some insight into the relationship between features of the networks of individual reference entities and the characteristics of the underlying reference entity. First, a higher pool of underlying bonds outstanding, together with a higher proportion of unsecured funding, increases both the size and the activity on the CDS market. Second, higher debt maturity decreases both the CDS network size and its activity, indicating potentially that roll-over risk by underlying reference entities is an important concern for CDS traders. Third, regarding the risk characteristics, CDS volatility and "beta" are found to have a greater influence on the size and activity than the absolute level of the CDS spread. Traders are more numerous and more active in reference entities whose perceived changes in creditworthiness can be larger and whose systematic component is higher. Fourth, two key determinants of concentration are the level of activity in a reference entity and its market beta. Therefore, fewer traders are willing to bear a large share of systematic risk when it is relatively higher. Finally, with regard to differences due to the type of reference entity and its location, the distinction between sovereign and financial reference entities has an effect on the network structure, but there are almost no significant differences in structural properties between European and non-European reference entities.

The analysis has shown that the CDS market is highly interconnected through a few key intermediary traders. Thus, monitoring their solvency and liquidity positions is essential for assessing the stability of this market segment. However, less regulatory information is available for other types of financial institutions (e.g. hedge funds and investment funds) that are also highly active in this market, which complicates the analysis from a financial stability perspective. Moreover, given the multi-dimensionality and richness of the interconnections between counterparties in the CDS market, a deeper understanding of risk-sharing and the ultimate holder of credit risk is warranted from systemic risk analysis perspective.

6 W. Duan, Z. Chen, Z. Liu and W. Jin, "Efficient target strategies for contagion in scale-free networks", *Phys Rev E Stat Nonlin Soft Matter Phys*, No 72(2 Pt 2), 2005.