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Stability Implications of Financial Interconnectedness under the Capital Markets Union

Justus Inhoffen

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Justus Inhoffen | jinhoffen@diw.de | Department of Macroeconomics at DIW Berlin
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In the run-up to the European elections in May 2019, the European Commission is trying to advance the initiatives laid out in its action plan for a European Capital Markets Union (CMU). In order to diversify financing sources and to increase private risk sharing, the CMU aims at deepening the integration of European equity and debt markets. While there are benefits associated with more cross-border investments, the intensification of connectedness between financial market participants in the Eurozone and beyond can also engender systemic risks. This article reviews the debate about the link between capital market integration and financial stability from the perspective of interconnectedness.

The Growth of the Non-Bank Sector and Interconnectedness

In recent years, the sector of financial institutions that provide bank-like financial services despite the lack of a full banking license (non-banks for short) has grown in size: The sectoral balance sheet has doubled within a decade and was worth EUR 32 trillion in 2017, representing 55% of the total euro area financial sector, up from 43% in 2008 (European Central Bank (2017), chart 4.1).

This is partly due to non-banks increasingly taking on economic functions, e.g. credit intermediation as well as maturity and liquidity transformation, previously fulfilled exclusively by Monetary Financial Institutions (MFI, or banks for short). ECB calculations show that the net flow of finance from MFIs to Non-Financial Corporations (NFC) experienced a negative trend and even declined in the five years following the Great Financial Crisis 2007 – 2008 (GFC) while the flow from non-banks remained positive throughout (ibid., chart 1.4).

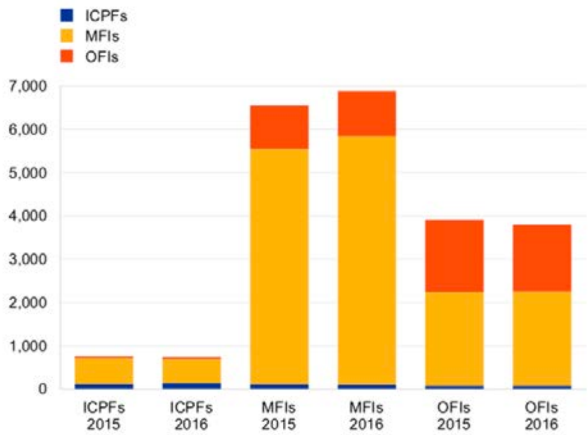
To facilitate this new business, wholesale funding is becoming increasingly important to the non-bank sector (see Financial Stability Board (2019)). This induces sectoral cross-exposures which were already non-negligible in 2016: Figure 1 shows that more than 10% of the loan volume issued by MFIs were held by Other Financial Intermediaries (OFIs, a broad classification of financial institutions to capture non-banks) while MFIs held more than 50% of the loan volume issued by OFIs. For debt securities, around 45% of MFI holdings were issued by OFIs and around 35% of OFI holdings were issued by MFIs (European Central Bank (2017), chart 1.8). From a country-sector perspective, the report reveals for example that OFIs from Austria, Malta and Luxembourg combined as well as Germany each have an exposure of slightly more than 50% to both OFIs and MFIs from other euro area countries (ibid., chart 1.13).

The CMU, as envisioned in the Action Plan laid out in European Commission (2015), seeks to diversify financing sources and cross-border risk sharing. It can be expected that these measures will intensify the development of cross-sectoral and cross-country contractual obligations in the European financial system.

While a large body of literature deals with the advantages and disadvantages of capital market openness (for an overview, see e.g. Bremus and Stelten (2017)), *financial networks* have become a subject of growing academic (see for example Rogers and Veraart (2013), Elliott, Golub, and Jackson (2014), Acemoglu, Ozdaglar, and Tahbaz-Salehi (2015), Duarte and Eisenbach (2018)) and policy debate (see for example European Central Bank (2017), Financial Stability Board (2019)). This literature attempts to find mechanisms that can, for example, explain how potential losses from outstanding US subprime mortgages that were small relative to the size of the global financial market could supposedly trigger the tremendous global financial turmoil in the GFC (see Bernanke (2010)). The central hypothesis is that the structure channeling the interaction of market participants drives amplifications of small local shocks to system wide effects.

This article reviews theoretical and empirical studies analyzing whether more connections amplify or dampen systemic shocks, and whether the structure of the network matters for financial stability.

Figure 1: Cross-exposures among sectors of the euro area financial system: loans



Source: European Central Bank (2017), chart 1.7. Numbers are given in billion EUR and refer to the fourth quarter of a given year. The lender sector is reported on the horizontal axis while the borrower is reported on the vertical axis. The data include intra-group positions. OFIs refer to non-monetary financial corporations excluding insurance corporations and pension funds (ICPF) and non-money market investment funds (i.e. financial vehicle corporations (FVC) and the remaining OFIs are included).

Liquidity Risk Sharing and Funding Runs in Networks of Linked Balance Sheets

A seminal contribution to the debate of contagion in financial networks goes back to Allen and Gale (2000). They consider banks in different regions that collect deposits from consumers and invest in liquid (short-term) and illiquid (long-term) assets. If consumers withdraw early - essentially a liquidity shock to banks that is not observable at the time of investment - the bank can liquidate short-term assets to satisfy the demand or liquidate long-term assets at a cost which will make it impossible to pay out consumers who do not withdraw. The authors show that if liquidity shocks are negatively correlated across regions, then the problem is solely the sub-optimal allocation of liquidity because there is no shortage in the aggregate. In a decentralized financial market, this can be solved by banks holding assets in all other regions that they can redeem if exposed to a shock: interconnectedness increases financial stability, as risks are insured across regions.

However, interconnectedness becomes a problem if the demand for liquidity exceeds the system's supply. Then, interbank lending cannot solve the problem and the region with the largest shock has to liquidate some of its long-term assets. If the shock is large enough, the affected bank cannot fully repay the depositors. This drives down the value of liabilities and other banks withdraw their deposits at a discount: the mechanism of risk sharing becomes one of contagion.

In their study of risk properties of networks, Allen and Gale (2000) find that a ring network – a structure in which one bank borrows from only one other bank – is most susceptible to contagion because the loss of value is borne by one party. In contrast, in a completely connected system risk is shared among many banks. An analog conclusion was drawn in another pioneering paper by Freixas, Parigi, and Rochet (2000).

Gai, Haldane, and Kapadia (2011) take a different approach in which they introduce randomness in the network structure while assuming a set of behavioral rules for banks. One important ingredient in this set of rules is that banks hoard liquidity when facing liquidity shortages. That is, a distressed bank reduces its interbank lending by more than required to satisfy the demand for liquidity - an empirical fact observed during and after the GFC. This channel makes it harder for banks borrowing from a distressed bank to satisfy their demand for liquidity without resorting to hoarding themselves. The authors derive a tipping point of connectivity above which any liquidity hoarding by a bank will cause all neighboring banks to become distressed and start hoarding as well.

In their baseline simulation, assuming maximum liquidity hoarding, the authors find that the probability of a crisis first increases and then decreases as the degree of connectivity grows. However, if a crisis has already materialized, then the severity is greater the more linkages there are. In further simulation exercises, they find that uncertainty in the collateral against which banks borrow liquidity exacerbates hoarding contagion. If complexity increases, i.e. the share of interbank liabilities in banks' balance sheets increases, then contagion occurs more often because larger funding withdrawals cannot be compensated by liquid assets. Gai et al. (2011) also study various policy reactions. Most importantly, they confirm the intuition that financial systems with stricter liquidity requirements are more resistant to shocks.

Eisenberg and Noe (2001) introduce what has become the workhorse model to study default cascades through payments that clear contractual obligations between banks in accordance with bankruptcy rules, priority of debt claims and limited liability of equity. Acemoglu et al. (2015) extend it to show that financial contagion exhibits a form of phase transition: when the size or number of shocks crosses a certain threshold, then the initially more robust structure with an equal distribution of connections becomes a fragile architecture. Furthermore, Acemoglu et al. (2015) show that a network with subsets of banks that are loosely connected is significantly less fragile under large shocks, essentially serving as a firewall.

These stylized models of default cascades in networks of contractual linkages suggest that financial systems can be robust yet fragile: While under some circumstances they are robust, under others they facilitate the propagation of shocks that reinforce and create systemic effects.

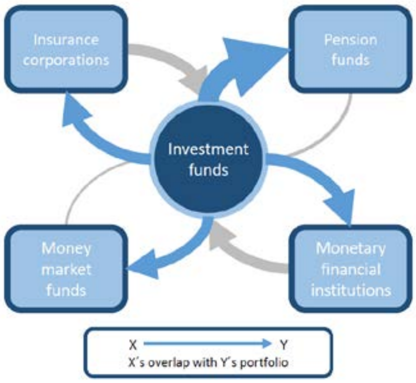
Spillover Effects from Common Exposures

Another stream in the financial networks literature studies spillovers from common exposures or investment similarities that can trigger fire sales (for an overview, see Shleifer and Vishny (2011)). Consider a financial market participant who is forced to sell illiquid assets in large volume due to unexpected payment obligations. This drives down the assets' prices which decreases the value of other investors' portfolios through a marked-to-market channel. In extreme cases, they have to sell assets as well, driving prices further down. In contrast to the linkages from contractual obligations considered in the previous section, network properties emerge from investment similarities.

To promote financial stability, Cont and Schaanning (2017), among others, have proposed frameworks that incorporate bank reactions to asset price shocks into stress-testing frameworks. In this model, banks deleverage in response to portfolio stress, consistent with empirical evidence from the GFC. In an application to data from European banks, they find that there is a tipping point for a critical level of a shock above which deleveraging triggers systemic risks. Further, they show that this point depends both on the institutions' leverage and on the concentration and commonality of their asset holdings. Fire sales contribute significantly to system-wide losses in stress scenarios, accounting for more than 20% of the total losses and between 20% to 40% of overall bank equity once deleveraging occurs.

In addition to the problem that there are only few datasets on granular asset holdings or interbank obligations available, the measurement of indirect linkages is subject to debate as well. A number of network measures have been proposed attempting to capture this contagion channel, though a consensus is far from being established (see Kara, Tian, and Yellen (2015) for an overview). Taking stock of a new security holdings dataset for European sectors, Figure 2 shows a measure that aggregates security-specific investment similarities. It shows the heterogeneity and asymmetry in the overlap at the example of the investment fund sector (INV): while MFI and insurance corporations (INS) have a strong overlap with INV, money market funds (MMF) and pension funds (PF) have very little. It is striking that this measure of indirect linkages presents a different picture of contagion channels than what linkages of contractual obligations discussed above suggest. Above, it seems clear that further work is needed to show the effectiveness of the CMU in integrating different markets and sectors.

Figure 2: Investment fund portfolio overlap in the euro area



Other sectors	$ovlp(INV, other)$	$ovlp(other, INV)$
PF	44%	9%
MMF	27%	2%
INS	32%	33%
MFI	34%	25%

Source: Financial Stability Board (2019), Box 3-1. ovlp(INV, other) indicates the degree to which holdings of the investment fund sector are also held in the portfolios of the other sector. Refer to the original article for the measure's definition. INV = investment funds, INS = insurance corporations, MFI = monetary financial institutions, PF = pension funds, MMF = money market funds.

Conclusion

Although the academic debate has not reached a consensus on the mechanisms through which shocks propagate in the financial network, empirical and theoretical papers suggest that interconnectedness is highly relevant to systemic risk. Further, it suggests that there is no clear one-sided directional effect of interconnectedness on financial stability but that it interacts with many variables like network structure, leverage and heterogeneity in size. As Glasserman and Young (2016) argue, next generation models have to depart from the still ad-hoc setup since it misses crucial ingredients, for example decentralized architectures where banks interact in sub-networks depending on their business models. It seems that modular network structures are particularly necessary to better assess the pass through of shocks in the European financial system. Furthermore, a range of open questions remains, e.g. how do financial networks form? How do contagion channels interact? What role does network opacity play and how to measure systemic risk?

Despite the gaps in our understanding, the literature creates the awareness that contagion channels in financial networks need to be monitored, especially as new laws constituting the CMU are implemented. Indeed, policy makers seem to agree that an understanding of the financial network is eminent to mitigate risk to the system as a whole which is why central banks have adopted new methods to their macroprudential policy toolset (see Constâncio (2016)). As more granular data is becoming available through programs like the G-20 data initiative of 2009, a fruitful discussion is developing to expand the knowledge of and tools for preventing and mitigating systemic crises.

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DIW Berlin – Deutsches Institut
für Wirtschaftsforschung
Mohrenstraße 58, 10117 Berlin

Tel. +49 (30) 897 89-0
Fax +49 (30) 897 89-200
http://www.diw.de

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