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Bankruptcy Cascades in Interbank Markets

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Abstract

We study a credit network and, in particular, an interbank system with an agent-based model. To understand the relationship between business cycles and cascades of bankruptcies, we model a three-sector economy with goods, credit and interbank market. In the interbank market, the participating banks share the risk of bad debits, which may potentially spread a bank's liquidity problems through the network of banks. Our agent-based model sheds light on the correlation between bankruptcy cascades and the endogenous economic cycle of booms and recessions. It also demonstrates the serious trade-off between, on the one hand, reducing risks of individual banks by sharing them and, on the other hand, creating systemic risks through credit-related interlinkages of banks. As a result of our study, the dynamics underlying the meltdown of financial markets in 2008 becomes much better understandable.

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Introduction

As economic literature has taught us in more than one occasion, there are many economic examples of situations in which mainstream theory, i.e., the Arrow-Debreu general equilibrium model, does not explain interactions between economic agents well. In particular, we believe that if we want to understand the dynamics of interactive market processes, and the emergent properties of the evolving market structures, it might pay to analyze explicitly how agents interact with each other, how information spreads through the market and how adjustments in disequilibrium take place.

To model how the agents' decisions are influenced by their mutual interactions and the repercussions that these may have on the economic system, we use a "communication structure" based on network theory, in which nodes can represent agents and edges connective links measuring the intensity of interaction between agents.

The recent vicissitudes of the credit market are a natural research issue to be analyzed with graph theory. If the banks were "isolated units", the bankruptcy of a borrower would be almost unimportant in the credit system. However, given the strong interdependence in the interbank market, the default of one bank can bring about phenomena of financial contagion.

In the last thirty years, in most advanced and developing economies, the financial sector has assumed an increasing relevance with respect to the production sector; furthermore, the role of the banking system has gradually shifted from the loan based financing of non-financial corporations to more market-based activities and speculative operations. This deep transformation, usually named as financialization of the economy, has not only increased the interdependence among financial institutions, but also determined an increase of "easy credit". This has created asset bubbles and debt-induced economic booms, with the consequent rising of corporate debt-equity ratios and bank leverage that have made the economy increasingly fragile and potentially unstable. Following the severe financial and economic crisis that started in 2007 in US, the phenomenon of growing financialization is increasingly under critical discussion as some of the major causes of the crisis. Although different important interpretations of the current crisis have been proposed (see, for instance, [1]), the effect of the increasing globalization and financialisation of the economic system is, certainly, one of the key elements to understand the current crisis.

Three types of propagation of systematic failure have been studied in the literature. First, the bank runs, known as self-fulfilling panic [2–6]. Second, the asset price contagion [7,8]. Third, the inter-locking exposures among financial institutions [8–13].

Following this last line of research, in this paper we are explicitly concerned with the potential of the interbank market to act as a contagion mechanism for liquidity crises and to determine macroeconomics outcomes such as bankruptcies. Allen and Gale (2000), Thurner et al. (2003) and Iori et al. (2006) have shown that, modeling the credit system as a random graph, when increasing the degree of connectivity of the network, the probability of bankruptcy avalanches decreases. However, when the credit network is completely connected, these authors have proven that the probability of bankruptcy cascades goes to zero. The explanation for this result is that, in credit networks, two opposite effects interact. On the one hand, increasing the network connectivity decreases the banks' risk, thanks to risk sharing. On the other hand, increasing the connectivity rises the systemic risk, due to the higher numbers of connected agents which, in case of default, may be compromised. According to the three cited models, the impact of the risk sharing plays a leading role. So, in these models there is a benefit in creating links between agents, because they allow to diversify risk.

An exception to this view is the recent contribution by Lorenz and Battiston (2008), where the authors show that the introduction