ASYMMETRIC INFORMATION, SYSTEMIC RISK AND FRAGILITY IN FINANCIAL MARKETS AND NETWORKS

ASIMETRIA INFORMAȚIONALĂ, RISCUL SISTEMATIC ŞI FRAGILITATEA PE PIAȚĂ ŞI ÎN REȚELE FINANCIARE

D. MATEŞ
West University of Timişoara

Abstract *.The aim of this research paper is to improve the (mostly) theoretical analysis of several issues related to the role of asymmetric information in financial markets and networks, with special reference to the problems of default, systemic risk and financial crises. The first issue is the one of default and of its role in determining the structure of financial systems and financial networks. From this viewpoint, a key role is played by international institutions (as lenders of last resort) and by central banks. A second research topic are non-market financial organization, based on bilateral relationships among agents. This sort of structure characterizes interbank relations and (at the other end of the spectrum) informal financial networks which play an important role in developing countries.*

Rezumat. *Obiectivul acestei lucrari este îndreptat spre o analizare aprofundată (obiectiv prevalent toretic) a unor aspecte legate de rolul asimetriei sistemului informațional pe piața şi in rețelele financiare, cu referință în special la problematica insolvabilității şi a crizelor financiare. Un prim aspect al cercetării este acela de a analiza falimentul şi rolul acestuia în determinarea structurii sistemelor finanaciare şi al relațiilor financiare internaționale. Din acest punct de vedere, un rol cheie revine instituțiilor internaționale (ca prestatori în ultimă instanță) şi băncilor centrale. Un al doilea aspect pe care ne propunem să-l analizăm, îl reprezintă studierea relațiilor financiare, care se desfăşoară pe piețele non- financiare, bazate pe relațiile directe între entități;astfel de relații caracterizează relațiile interbancare şi rețelele informaționale de creditare, cu rol important în multe țări în curs de dezvoltare.*

The general aim of the papers is to improve our understanding of several issues related to the role of asymmetric information in financial markets and networks, with special reference to the issues of default and financial crises.

Our aim is mainly theoretical: We want to improve our knowledge of some issues which are important for the understanding of financial systems. However, it is possible that some of the analytical tools we plan to develop will have interesting operative applications to the definition of systemic risk. These developments would be more than welcome but are not our main aim.

MATERIAL AND METHOD

Recently, the analysis of default as an equilibrium phenomenon has made impressive steps forward, also because of recent developments in the literature of general equilibrium models with incomplete financial markets. A first aim of the paper is to analyze the phenomenon of overborrowing in models with heterogeneous agents and non-exclusive contracts.

This issue is especially important in international financial relationships because these contracts are typically characterized by limited enforceability. With asymmetric information and non-exclusive contracts there is an important moral hazard problem in international finance due to the role of financial institutions as lenders of last resort. There is moral hazard on both sides: obviously for borrowers, but also for lenders. In fact, given the implicit warranty created by international institutions, lenders may find individually optimal to monitor borrowers below the (socially) optimal level. One of the aims of the research paper is to develop the analysis of this issue, also keeping into consideration its consequences of international capital flows and on financial crises.

Financial crises also affect currency markets. Within the paper, we plan to analyze models of exchange rate determination and to study the role of central banks, also taking into consideration the extremely important empirical results obtained in the last few years exploiting transaction data for currency markets.

RESULTS AND DISCUSSIONS

Financial systems are given by market and non-market institutions, mainly because of the direct relationships among banks and among banks and non-bank agents. A second aim of the paper is to study interbank relations using the tools of network theory and the results of the economic analysis of networks. We intend to analyze from this viewpoint both bank runs and default contagion due to interbanks loans. This second situation can be naturally described as a network where each agent is a node and where a loan relation is described by a link. This allows us to describe a well defined network where agents are not necessarily symmetrically located and this structure can be analyzed using some analytical results of network theory.

On the other hand, several results of the economic analysis of networks will be applied to analyze bank runs. Another example of financial network is given by the network of non-anonymous relationships typically characterizing underdeveloped financial systems or, more generally, financial systems where part of the population can not access organized financial markets. Our aim is to analyze these organizational structures (the typical example is given by Greeman Bank) using the techniques developed for the analysis of games on graphs. Finally, also to fully develop the analytical tools required for these applications, we plan to study some issues in network design and endogenous network formation, especially analyzing the effects of externalities on the network connectivity.

In the last few years, there have been tremendous advances in the analysis of the role, the structure and the micro-structure of financial markets with asymmetric information. They allowed for a much improved understanding of both the canonical anonymous and competitive model and of the direct bilateral financial relationships among economic agents. These developments allowed for a better understanding of many theoretical and empirical issues.

The first issue directly relevant for our research paper is the one of default and of its role in determining the structure of financial systems and international financial relationships.

In the last few years, there have been important advances in the analysis of bankruptcy in competitive economies. Starting with Dubey, Geanakoplos and Shubik (2001), the theoretical literature has considered both pure exchange economies (see, for instance, Bisin and Gottardi (1999) and Bisin and alii (2001)) and production economies (see, Dréze, Minelli and Tirelli (2003)). This kind of competitive models can be extended to study moral hazard problems. It suffices to allow individual agents to default.

Strategic bankruptcy is especially relevant when considering international financial markets, mostly due to the absence of international authorities able to enforce contracts. Generally speaking, the only possible punishments for default are seizure of assets abroad and exclusion from future loans.

There is a quite large literature on strategic default, analyzing (inter alia) its consequences on risk sharing and on the propagation of financial shocks. Kehoe and Levine (1993), Kocherlakota (1995) and Alvarez and Jermann (2000) have shown that perfect diversification of consumption risks across individuals may not be optimal and portfolio may be subject to solvency constraints prohibiting agents from holding large amounts of contingent debt. See also Kiyotaki and Moore (1997).

The concept of strategic bankruptcy is crucially relevant in the analysis of international financial crises and in explaining why capital flows toward poor countries are so small, a fundamental problem in the theory of development.

With respect to financial crises, it is often argued that the role of international institutions (e.g., IMF) as international lender of last resort induces moral hazard: expecting to be bailed out by the IMF, debtor countries have weak incentives to implement good but costly policies, thus raising the probability of a crisis (Meltzer Commission Report (2001)).

Hence, there is trade-off between official liquidity provision and debtors' moral hazard. This trade-off is studied, for instance, in Corsetti, Guimaraes and Roubini (2003), where international financial crises are caused by the interaction of bad fundamentals and self-fulfilling runs by international lenders.

The model has a unique equilibrium where agents have different behaviour according to their private information. Intervention by international institutions, given the fundamentals, may help to prevent liquidity crisis, due to the effect of the possibility of such an intervention on the portfolio policies of private investors. If there is an international institution ready to provide liquidity to a country in troubles, private investors will have a higher degree of confidence in such an economy and this will avoid capital runs.

Given the fundamentals, in general more private investors will be willing to roll over their investments. The influence of such an institution is increasing in the size of its interventions and the precision of its information. A second relevant result is established in Morris and Shin (2002): contrary to the conventional view, official lending may actually strengthen a government incentive to implement desirable but costly policies. This can make financial crises more unlikely and increase the governments' expected net benefits of stabilization policies (Corsetti, Desgupta, Morris and Shin (2002)).

International financial crisis involve also currency markets and movements of the exchange rates. In the last ten years, one of the most active fields of research in

international finance has been the analysis of the relevance of the order flow in determining exchange rates.

The canonical portfolio approach to the determination of the exchange rates is based on the equilibrium of the stocks of the relevant financial activities, currencies transactions per se are irrelevant

With respect to the second issue mentioned above (capital flows toward poor countries are quite small), strategic default can explain why liberalizing financial markets may have little impact on investment in developing countries. However, this assumption lends no immediate support to the idea that restricting capital inflows is beneficial. In general, models where borrowers cannot commit to repay loans are characterized by underinvestment with respect to first best allocations.

Hence, any policy restricting capital movements across countries is unambiguously harmful because it increases the spread between the marginal productivity of capital and the lending interest rate and also because it implies a limitation on the ability to insure investors from country specific risks.

On the other hand, since incentives to default are inversely related to a country's (or an investor's) output (cash-flow or net income), direct transfers to borrowers may be the most obvious welfare improving policy, since this policy increases the borrowers willingness to meet financial obligations, thereby raising investment.

However, the idea that international capital flows and direct financial transfers to developing countries should be stimulated as much as possible is challenged by a growing number of economists and policymakers.

The recent recessions and financial crises experienced by countries that have undergone substantial liberalizations in the past ten years have lead some to advocate capital controls and the development of a domestic financial market.

Overborrowing in a model with strategic default may actually occur when agents are able to borrow from multiple creditors under asymmetric information. It is often observed that entrepreneurs or governments are financing their papers by raising funds from different lenders simultaneously.

This problem is not exclusive to international financial markets. Non-exclusivity of financial contracts is an empirical fact and it is analyzed in a, by now, large literature. In general, contract non-exclusivity is a source of inefficiency in the presence of incentive problems, since it generates externalities across lenders. For instance, examining the case of sovereign risk where LDC countries borrow in a competitive international credit market, Kletzer (1984) shows that, when lenders are unable to observe the borrowers' total indebtedness, competitive equilibria may be inefficient (with respect to a second best) and characterized by relatively high rates of interest and lending. Incentive problems caused by limited commitment are not relevant just for international financial institutions. It is well known that, in developing countries, banks face very high insolvency rates and are often unable to observe the borrowers' balance sheet and their contractual obligations.

In these countries, the coexistence of formal and informal financial arrangements is a well documented phenomenon, where the informal sector includes credit cooperatives and associations, moneylenders and extended families (see Arnott and Stiglitz (1991), Stiglitz (1990), Besley and Coate (1995), Banerjee, Besley and Guinnane (1994)).

Network design has traditionally been studied as a problem of efficient internal organization of large economic units in the presence of complex informational processing needs. Recent works by Demange (2003) and Currarini (2003a, 2003b) have shown that new and interesting design issues emerge once the stability of the network is considered as the objective of design, and when spill-overs across organizations are possible.

These papers view the formation of economic networks as a game in which agents establish and sever links with the sole objective of maximizing their individual payoffs. Both papers highlight the possibility of a conflict between equilibrium and efficiency, in both a dynamic and a static framework.

The efficiency-stability conflict has been the object of a series of more recent papers, trying to characterize conditions under which this conflict would disappear. In particular, Currarini and Morelli (2000) have shown that letting agents bargain over payoffs at the same time as they establish links leads to efficient equilibrium networks in a large class of economic situations. However, bargaining over links does not seem to be sufficient for efficiency when spillovers are present. As shown in Currarini (2004), agents may fail to form the efficient network because of the distortions caused by spill-overs on the incentives to form and delete links.

These advances in network theory are important for the analysis of financial structures, mostly with reference to two different issues:

A. non-market structures, which can be analyzed using network theory, may be more efficient than markets in preventing opportunistic behaviour. Networks, based on non-anonymous and long term relationships, can use more effective sanctioning systems, which might not be available to banks and large financial institutions. This view is based on the assumption of peer monitoring (Stiglitz, 1990). For instance, the success and the social desirability of the financial contract of group lending may ultimately depend on the type of social structure that characterizes the community from which groups of borrowers are drawn (Besley and Coate, 1995).

B. network structures play an important role in the banking sector, too. Inter-bank networks affect the degree of liquidity of the system, the amount of risk run by individual bank and the possibility of disruptive bank runs. Network theory can have an important role in the analysis of systemic risk, i.e., the risk of contagion of default among banks. In the literature there are several definition of systemic risk (a recent survey is in De Bandt and Hartmann (2000)).

CONCLUSIONS

Network theory and the results of the economic analysis of networks can also be applied to the analysis of some of the issues mentioned above. Economic theory has recently devoted an increasing attention to the emergence and the functioning of non-market institutions.

This interest is partly motivated by the failure of decentralized markets to generate efficient allocations of resources in the presence of various kinds of imperfections. Moreover, by the empirically observed importance of many kinds of non-market arrangements, in particular in the early stages of development. Non-market institutions typically involve non-anonymous interpersonal relations.

These relationships, the way in which they emerge and their role for socio-economic outcomes, are the object of a large literature that studies networks and groups.

The theoretical theory of networks has traditionally followed two main lines of research. One direction has considered the network as given and unchangeable by economics agents, and has studied the actions taken by agents embedded in the network and the design of architectures that are desirable on efficiency or equity grounds. Another line of research views the network as a structure generated by economic agents via voluntary acts of link formation. Here the objective is determining which network structures form in equilibrium, and assessing whether equilibrium structures satisfy various desirable properties, such as efficiency.

REFERENCES

1. **Alvarez F. and U. Jermann, 2000 -** *Efficiency, Equilibrium and Asset Pricing with the Risk of Default.* Econometrica, 68, 775-798.
2. **Andersen T., T. Bollerslev, F. Diebold, C. Vega, 2003 -** *Micro Effects of Macro Announcements: Real-Time Price Discovery in Foreign Exchange".* Am. Econ. Review, 93.
3. **Bloise G. and P. Reichlin, 2002 -** *Risk and Intermediation in a dual financial market model".* CORE D.P. 2002/4.
4. **Caballero R. and A. Krishnamurthy, 2001 -** *International and Domestic Collateral Constraints in a Model of Emerging Market Crises.* Journal of Monetary Economics, 48, 513-548.
5. **Currarini S., 2003** - *Stable Organizations with Externalities.* Nota di Lavoro, Fondazione Eni Enrico Mattei (FEEM), Coalition Theory Network, 51 - 2002.
6. **Currarini S., 2003b -** *On the Stability of Hierarchies in Games with Externalities.* Nota di Lavoro, Fondazione Eni Enrico Mattei (FEEM), Coalition Theory Network, 19-2003.
7. **Currarini S., 2004 -** *Network Formation in Games with Spillovers.* mimeo, Università di Venezia.
8. **Drèze J., E. Minelli, M. Tirelli, 2003 -** *Production and financial policies under asymmetric information.* CORE DP, forthcoming.
9. **Dubey P., J. Geanakoplos and M. Shubik, 1990 -** *Default and Punishment in General*
10. ***Freixas* X., B. Parigi e J.-C. Rochet, 2000 -** *Systemic risk, interbank relations and liquidity provision by the central bank.* J. Money,Credit and Banking, 32. Froot, K.A., e
11. **T. Ramadorai, 2002** - *Currency Returns, Institutional Investor Flows, and Exchange Rate Fundamentals.* NBER Working Paper 9080.