



Contents lists available at ScienceDirect

Journal of Financial Economics

journal homepage: www.elsevier.com/locate/jfecAsset commonality, debt maturity and systemic risk[☆]Franklin Allen^{a,*}, Ana Babus^b, Elena Carletti^{c,d}^a Wharton School, University of Pennsylvania, 3620 Locust Walk, Philadelphia, PA 19104-6367, United States^b Imperial College, United Kingdom^c European University Institute, Italy^d CEPR, United Kingdom

ARTICLE INFO

Article history:

Received 1 July 2010

Received in revised form

21 March 2011

Accepted 19 April 2011

Available online 23 July 2011

JEL classification:

G01

G21

Keywords:

Contagion

Clustered and unclustered networks

Interim information

ABSTRACT

We develop a model in which asset commonality and short-term debt of banks interact to generate excessive systemic risk. Banks swap assets to diversify their individual risk. Two asset structures arise. In a clustered structure, groups of banks hold common asset portfolios and default together. In an unclustered structure, defaults are more dispersed. Portfolio quality of individual banks is opaque but can be inferred by creditors from aggregate signals about bank solvency. When bank debt is short-term, creditors do not roll over in response to adverse signals and all banks are inefficiently liquidated. This information contagion is more likely under clustered asset structures. In contrast, when bank debt is long-term, welfare is the same under both asset structures.

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1. Introduction

Understanding the nature of systemic risk is key to understanding the occurrence and propagation of financial crises. Traditionally, the term “systemic risk” describes a situation where many (if not all) financial institutions fail as

a result of a common shock or a contagion process. A typical common shock leading to systemic failures is a collapse of residential or commercial real estate values (see Reinhart and Rogoff, 2009). Contagion refers to the risk that the failure of one financial institution leads to the default of others through a domino effect in the interbank market, the payment system, or through asset prices (see, for example, the survey in Allen, Babus, and Carletti, 2009).

The recent developments in financial markets and the crisis that started in 2007 have highlighted the importance of another type of systemic risk related to the linkages among financial institutions and to their funding maturity. The emergence of financial instruments in the form of credit default swaps and similar products has improved the possibility for financial institutions to diversify risk, but it has also increased the overlaps in their portfolios. Whether and how such asset commonality among banks leads to systemic risk may depend on their funding maturity structure. With short-term debt, banks are informationally linked. Investors respond to the arrival of interim information in a way that depends on the composition of their asset structures. With long-term debt instead, interim information

[☆] We are particularly grateful to the referee, Viral Acharya, for very helpful comments. We also thank Aditya Chopra, Piero Gottardi, Iftekhhar Hasan, John Kambhu, Steven Ongena, Jay Sethuraman, Fernando Vega Redondo and participants at presentations at the NBER Meetings in July 2009, the NBER Financial Institutions and Market Risk Conference in June 2010, our discussants there, Mark Carey and Mark Flannery, the Bank of Italy, the Einaudi Institute for Economics and Finance, the European University Institute, the Federal Reserve Bank of New York, the Huntsman School of Business, the Thammasat Business School, Tilburg University, the University of Naples Federico II, and the University of Pennsylvania for helpful comments. We are grateful to the European University Institute and the Sloan Foundation for financial support. This paper was previously circulated under the title “Financial Connections and Systemic Risk.”

* Corresponding author. Tel.: +1 215 898 3629;

fax: +1 215 573 2207.

E-mail address: allenf@wharton.upenn.edu (F. Allen).

plays no role and the composition of asset structures does not matter for systemic risk.

In this paper we analyze the interaction between asset commonality and funding maturity in generating systemic risk through an informational channel. We develop a simple two-period model, where each bank issues debt to finance a risky project. We initially consider the case of long-term debt and then that of short-term debt. Projects are risky and thus banks may default at the final date. Bankruptcy is costly in that investors only recover a fraction of the bank's project return. As project returns are independently distributed, banks have an incentive to diversify to lower their individual default probability. We model this by assuming that each bank can exchange shares of its own project with other banks. Exchanging projects is costly as it entails a due diligence cost for each swapped project. In equilibrium, banks trade off the advantages of diversification in terms of lower default probability with the due diligence costs.¹

Swapping projects can generate different types of overlaps in banks' portfolios. We model banks' portfolio decisions as a network formation game, where banks choose the number of projects to exchange but cannot coordinate on the composition of their asset structures. For ease of exposition, we focus on the case of six banks with each of them optimally exchanging projects with two other banks. This leads to two possible asset structures. In one, which we call "clustered," banks are connected in two clusters of three banks each. Within each cluster all banks hold the same portfolio, but the two clusters are independent of each other. In the second, which we call "unclustered," banks are connected in a circle. Each of them swaps projects only with the two neighboring banks and none of the banks holds identical portfolios.

We show that with long-term debt, the asset structure does not matter for welfare. The reason is that in either structure each bank's portfolio is formed by three independently distributed projects with the same distribution of returns. The number of bank defaults and the expected costs of default are the same in the two structures and so is total welfare.

In contrast, the asset structure plays an important role in determining systemic risk and welfare when banks use short-term debt. The main difference is that at the intermediate date, investors receive a signal concerning banks' future solvency. The signal indicates whether all banks will be solvent in the final period (good news) or whether at least one of them will default (bad news). The idea is that banks' assets are opaque (see, e.g., Morgan, 2004; Flannery, Kwan, and Nimalendran, 2010) and thus, the market receives information on banks' overall solvency rather than on the precise value of banks' asset fundamental values. Upon observing the signal, investors update the probability that their bank will be solvent at the final date and roll over the debt if they expect to be able to recover their opportunity cost. Roll over always occurs after a good signal is realized

but not after a bad signal arrives. When roll over does not occur, all banks are forced into early liquidation. The failure to roll over is the source of systemic risk in our analysis.

Investors' roll over decisions depend on the structure of asset overlaps, the opportunity cost, and the bankruptcy cost. We show that, upon the arrival of bad news, roll over occurs less often in the clustered than in the unclustered asset structure. When investors recover enough in bankruptcy or have a low opportunity cost, debt is rolled over in both structures. As the amount they recover decreases and their opportunity cost increases, debt is still rolled over in the unclustered structure but not in the clustered one. The reason is that there is greater information spillover in the latter as defaults are more concentrated. Upon the arrival of negative information, investors infer that the conditional default probability is high and thus decide not to roll over. In the unclustered structure defaults are less concentrated and the arrival of the bad signal indicates a lower probability of a rash of bank defaults. When investors obtain little after banks default because of high bankruptcy costs or have a high opportunity cost, banks are liquidated early in both structures.

Even if the clustered structure entails more roll over risk than the unclustered structure, it does not always lead to lower welfare. The optimal asset structure with short-term finance depends on investors' roll over decisions, the proceeds from early liquidation, and the bankruptcy costs. When banks continue and offer investors a repayment of the same magnitude in either structure, total welfare is the same in both structures. When the debt roll over requires a higher promised repayment in the clustered than in the unclustered structure, welfare is higher in the latter as it entails lower bankruptcy costs. When banks are liquidated early in the clustered structure only, the comparison of total welfare becomes ambiguous. In the arguably more plausible case when neither the bankruptcy costs nor the proceeds from early liquidation are too high, total welfare remains higher in the unclustered structure. When instead investors recover little after bankruptcy and obtain large proceeds from early liquidation, welfare becomes higher in the clustered structure, and remains so even when early liquidation occurs in both structures.²

To summarize, the paper shows that clustered asset structures entail higher systemic risk when bad information about banks' future solvency arrives in the economy. This implies that unclustered asset structures typically lead to higher welfare, although there are cases where clustered structures can be superior. The focus of the analysis is the interaction of banks' asset structures, information, and debt maturity in generating systemic risk. The crucial point is that the use of short-term debt may lead to information contagion among financial institutions. The extent to which this happens depends on the composition of the asset structure, that is, on the degree of overlap of banks' portfolios. This result raises the

¹ The assumption that exchanging projects entails a due diligence cost implies that banks do not find it optimal to fully diversify. There are other ways to obtain limited diversification. For example, a decreasing marginal benefit of diversification or an increasing marginal cost would lead to the same result.

² This latter case is presumably less plausible. An example would be where the project has a high resale value because of the possibility of many alternative uses of its equipment in the first period, but low proceeds in the second period because of high direct and indirect bankruptcy costs.

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