1. Introduction

The financial crisis of 2007-08 has reinforced the view that interbank network linkages are crucial to understanding the financial fragility of a country's banking system.

For example, in the US, the collapse of Lehman Brothers was associated with a $423 billion dollar contraction in the US dollar interbank lending market (Gorton, 2010), and in turn pushed other banks to the brink requiring government bailouts (e.g. Morgan Stanley) or led them to be sold off, (e.g. Merrill Lynch).

The traditional view of financial crises as involving a run by bank depositors on their own bank has been modeled as a self-fulfilling equilibrium coordination game by Diamond and Dybvig (1983, hereafter, DD) where depositors’ beliefs play a pivotal role.

The more modern view of financial contagion as an equilibrium phenomena arising from the interbank network structure was first proposed by Allen and Gale (2000).

2. Contributions

We explore the key implications of Allen and Gale’s interbank model of financial crises, namely that network structure matters for the fragility of the banking system.

We address the importance of network structure for financial fragility using the methodology of experimental economics, which provides us with precise control over the network structure of interbank connections as well as over the information that is available to depositors in that network.

This control enables us to gather data that can be used to directly test the role played by network structure in the spread of a financial crisis.

While there are many experimental studies of the DD model of bank runs, our paper provided the first experimental test of whether the interbank network structure matters for the likelihood of financial contagion.

3. Model

3 periods: \( t = 0,1,2 \)

4 ex ante identical banks, labelled A, B, C and D.

Each bank contains a continuum of ex ante identical depositors.

Single consumption good that serves as the numeraire, which can also be invested in assets to produce future consumption.

At \( t = 0 \), each depositor has an endowment equal to one unit deposited at the bank.

The bank has 2 investment opportunities:

1. Liquid (or short) asset: acts as storage technology \( \rightarrow t = 1 \), the return is exactly equal to the amount invested

2. Illiquid (or long) asset: higher return but requires more time to mature \( \rightarrow t = 2 \), the return is an amount \( R > 1 \); however, premature liquidation of this asset has a cost, \( 0 < r < 1 \)

Depositors to all banks have the usual DD preferences:

1. With probability \( w \) they are impatient and value consumption only at date 1

2. With probability \( 1 - w \) they are patient and value consumption only at date 2

\( 2 \) possible values of \( w \): high value, \( w_1 \), and low value, \( w_2 \).

Table 1: Banks’ liquidity shock

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
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<td>( w_1 )</td>
<td>( w_1 )</td>
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|    | \( w_2 \) | \( w_1 \) | \( w_2 \) |

|    | \( w_2 \) | \( w_2 \) | \( w_2 \) |

Banks know ex ante the average fraction of impatient depositors across all banks, \( y = \frac{1}{4} \) \( \rightarrow \) invest amount \( y = y \) in short assets and \( x = 1 - y \) in long assets.

3.1. The Interbank Market

Optimal allocation of risk is achieved by transferring resources among the different banks \( \rightarrow \) introduce an interbank market of deposits.

3.2. Financial Fragility

The “zero probability at date 0” perturbation state \( S \), in which the fraction of impatient depositors in (say) bank A is \( y + e \).

As this perturbed state is not known in advance, the continuation equilibrium is different from the normal state and depends on the network structure.

4. Experimental Design

Our aim is to study the contagion of financial fragility, so we focus on the perturbation state.

In our experimental setting, there are four banks: A, B, C and D.

Each participants takes the role of a depositor.

Payoffs have been estimated based on 4 depositors in each bank.

We set \( w_1 = 1/4 \) and \( w_2 = 3/4 \). So, the average fraction of impatient depositors would be \( y = 0.5 \).

Bank A is the bank facing the financial fragility.

The number of impatient depositors in bank A is \( 4 + y = 2 \) and in banks B, C and D, it is \( 4 \times (y + e) = 3 \).

We implement a 2x2 between subjects design (four treatments):

Incomplete Network Structure Complete Network Structure

<table>
<thead>
<tr>
<th>( x )</th>
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4.1. Hypotheses

1. With LOW LR, in the INCOMPLETE Network, the original financial shock spreads to all banks as one after the other face bankruptcy.

2. With LOW LR, in the COMPLETE network, only the bank facing the financial shock should go bankrupt. The financial crisis does not become global in a fully integrated financial system.

3. With HIGH LR, in both the INCOMPLETE and the COMPLETE networks, only the bank facing the financial shock should go bankrupt. The high liquidation cost becomes a substitute for market structure completeness.

5. Results

5.1. The Interbank Market

Optimal allocation of risk is achieved by transferring resources among the different banks \( \rightarrow \) introduce an interbank market of deposits.

6. Conclusion

First experiment exploring the role of interbank network structure for the incidence of financial contagion.

We find that:

1. When the premature liquidation cost is high, while more complete interbank network structures may reduce the incidence of financial contagions by facilitating more efficient risk sharing among banks, such complete network structures are not a panacea for preventing such contagions.

2. When the premature liquidation rate is reduced, we observe no significant difference in the probability of contagions in the incomplete and the complete network structures.

3. Low premature liquidation cost is a substitute for a more efficient risk sharing environment (i.e., complete network structure).