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An experiment on the causes of bank run contagions

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ABSTRACT

To understand the mechanisms behind bank run contagions, we conduct bank run experiments in a modified Diamond–Dybvig setup with two banks (Left and Right). The banks' liquidity levels are either linked or independent. Left Bank depositors see their bank's liquidity level before deciding. Right Bank depositors only see Left Bank withdrawals before deciding. We find that Left Bank depositors' actions significantly affect Right Bank depositors' behavior, even when liquidities are independent. Furthermore, a panic may be a one-way street: an increase in Left Bank withdrawals can cause a panic run on the Right Bank, but a decrease does not calm depositors.

1. Introduction

Bank runs are important economic phenomena. Over the last decade, we have witnessed visible and traditional bank runs on banks such as Northern Rock, which was the first run on a UK bank in 140 years and Countrywide Financial in the USA. There have been many more non-traditional runs on other financial institutions, such as Bear Sterns, Lehman Brothers, as well as countries—Iceland and Greece being the most high-profile cases. The present paper seeks to understand how bank runs may spread from one economic institution to another (e.g., from Lehman Brothers to AIG; from Greece to Spain). In particular, we ask whether changes in banking fundamentals cause contagions or are pure panics to blame.

Diamond and Dybvig (1983) proposed an influential analysis of bank runs. In their paradigm, a bank run is one of many possible equilibria of the economic system. The driving force for a bank run is the fact that in a fractional reserve system, a bank does not hold enough liquid assets to serve all its customers should they all decide to withdraw their deposits at one given time. Hence, if depositors believe that too many people will withdraw their deposits such that in the future the bank will not have enough money to pay them, then all depositors will withdraw today. This causes a run on the bank, even if the bank is otherwise solvent. This is self-fulfilling because a bank must liquidate its investment portfolio at fire-sale prices in order to meet the unexpected demand today, which hurts its ability to pay tomorrow.[3]

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[3] There are alternative models in which bank runs are caused by asymmetric information among bank depositors about their banks' fundamentals. In these models, bank runs are caused by depositors' beliefs about solvency of their banks, rather than beliefs about the actions of other depositors. See, for instance, Chari and Jagannathan (1988), Jacklin and Bhattacharya (1988), Calomiris and Kahn (1991), and Chen (1999).

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The same logic may apply to contagions; however, it is important to distinguish between two types: *information-based* contagions and *panic-based* contagions. An information-based contagion occurs when a run on a bank conveys information about the wider financial system: it is a run on one bank caused by a revision of depositors' beliefs about its liquidity or solvency following a run on another bank with related liquidity or solvency. A pure *panic-based* contagion is the case where a run on one bank triggers a run on other banks even though their liquidity and solvency are unrelated. In this case, the behavior of depositors in the first bank should therefore be irrelevant for any revision of beliefs about the liquidity or solvency of the rest of the financial system. We will use this terminology throughout the paper.

An example of the former case was the perceived over-exposure of banks to assets based on sub-prime mortgages during the 2007–2009 financial crisis. A run on an over-exposed bank could conceivably trigger a run on other banks, as it provides the market with a signal about the liquidation value of assets held by the banking sector.[4] On the other hand, we may observe contagions that spread on the basis of pure panics. Friedman and Schwartz (1963) argue that the run on the Bank of the United States in 1930 was not based on fundamentals; yet the run on this bank nevertheless caused a panic on the US banking system, leading to runs on other US banks at the time.

It is difficult to distinguish information-based contagions from panic-based contagions, since historical data does not afford us insight into the beliefs of investors and depositors alike. It is very difficult to ascertain what information investors are responding to, and whether or not the information is spurious. In December 11, 1930, the New York Times reported that the run on the Bank of United States was based on a false rumor spread by a small merchant, a holder of stock in the bank, who claimed that the bank had refused to sell his stock (NYT, 1930). Was this information truthful? We will never know if depositors thought the rumor was true and were withdrawing because of the information; or if they thought the rumor was false, but nonetheless they were anticipating a mass withdrawal by other depositors.

Our paper seeks to answer two questions. Firstly, can a contagion spread by panic alone? Secondly, are there differences in the way pure panic contagions form, develop and subside relative to information-based contagions? These questions are important, as policy designed to prevent and contain an information-based contagion may differ from policy designed to tackle a panic. Making public announcements about banking fundamentals may prove counter-productive, as the recent Northern Rock case highlights.[5]

We seek to answer these questions using experimental data. By abstracting away from the complex reality of financial markets, we gain an insight into how information about banks' liquidity, as well as spurious information, can potentially trigger bank run contagions in a simulated banking system. To this effect, we conduct an experiment in a modified Diamond–Dybvig setup with two banks, Left and Right. Each bank has a mix of impatient depositors, who demand their deposits immediately, and patient depositors, who are willing to withdraw their deposits at a later date. The parameter we manipulate is the liquidation value of the both banks' long-term investment (liquidity). The Left Bank depositors see their own bank's liquidity level and make their withdrawal decisions first. The Right Bank depositors do not know the liquidity level of either bank; however, they do see how many Left Bank withdrawals are made before making their own withdrawal decision.

We consider two treatments: one where both banks' liquidity levels are always the same and another where they are independent of each other. In either treatment, it can be an equilibrium for the Right Bank depositors to imitate (or not) the decisions of the Left Bank depositors. However, we would expect information about Left Bank withdrawals to have a stronger influence on Right Bank depositors' decisions when both banks' liquidity levels are always the same, as this would be an indication of the liquidity level of the Right Bank. In contrast, information about past Right Bank liquidity, as well as past withdrawals on the Right Bank, ought to be more relevant to Right Bank depositors when liquidity levels of the two banks are independent of each other. All the above are plausible mechanisms that drive banking contagions. By studying these factors, we also better understand the processes that determine equilibrium selection in economic systems.

We find that actions taken by depositors in the Left Bank significantly affect Right Bank depositor behavior, especially when the two banks' liquidities are linked. This suggests that the Right Bank depositors use information about Left Bank depositors to update their beliefs about the liquidity of their bank. However, the fact that a similarly positive and significant (though weaker) relationship exists when liquidity levels of both banks are independent of each other means that we cannot rule out the existence of contagion equilibria triggered by 'sunspots', or in our context, pure panic.

When analyzing the dynamics of bank run contagions, we find evidence which suggests that a banking panic may be a one-way street: when both banks' liquidity levels are independent of each other, an increase in Left Bank withdrawals can cause a panic run on the Right Bank, but a decrease in Left Bank withdrawals cannot calm depositors as effectively.

Changes in the Right Bank's liquidity over time also regulate the likelihood of a run on that bank. Increases in the Right Bank's liquidity level between rounds $t-2$ and $t-1$ lead to increases in withdrawal levels by patient Right Bank depositors in round t and vice-versa, but only significantly in the case where liquidities are independent. That is, in the absence of

[4] Goldstein and Pauzner (2005) analyze this type of contagion effects through a two-bank model where investors get noisy signals about fundamentals about bank 2 after observing aggregate outcomes pertaining to bank 1.

[5] As the *Economist* reported at the time: "Only when the Bank of England said that it would stand by the stricken Northern Rock did depositors start to run for the exit. Attempts by Alistair Darling, the chancellor of the exchequer, to reassure savers served only to lengthen the queues of people outside branches demanding their money. The run did not stop until Mr. Darling gave a taxpayer-backed guarantee on September 17th that, for the time being, all the existing deposits at Northern Rock were safe." (The Economist, 20/09/2007). For a theoretical analysis of the effect on the banking system of revealing information about fundamentals, see Kaplan (2006) and Dang et al. (2012).