Panic bank runs
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HIGHLIGHTS

• We study bank runs in a sequential setting, where depositors can observe the action of others.
• Observing withdrawals leads to panic behavior and affects the beliefs that a bank run is underway.
• Panic bank runs occur in the absence of fundamental problems and coordination failures.
• Panic behavior is affected by loss aversion but not with risk or ambiguity aversion.

ARTICLE INFO

Article history:
Received 5 September 2017
Received in revised form 2 November 2017
Accepted 10 November 2017
Available online 20 November 2017

JEL classification:
C7
C9
D8
G2

Keywords:
Bank runs
Beliefs
Panic
Coordination
Observability
Loss aversion

ABSTRACT

We provide experimental evidence that panic bank runs occur in the absence of problems with fundamentals and coordination failures among depositors, the two main culprits identified in the literature. Depositors withdraw when they observe that others do so, even when theoretically they should not. Our findings suggest that panic also manifests itself in the beliefs of depositors, who overestimate the probability that a bank run is underway. Loss-aversion has a predictive power on panic behavior, while risk or ambiguity aversion do not.

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1. Introduction

Bank runs have been frequently associated to problems with the fundamentals of the bank (e.g., Calomiris and Mason, 2003) or viewed as a coordination failure among depositors (e.g., Diamond and Dybvig, 1983; henceforth D&D). We consider a sequential version of the coordination problem embedded in D&D and provide experimental evidence that bank runs emerge even in the absence of these two problems.

In our setting, depositors observe the decision of others before deciding whether to keep their funds deposited (henceforth to wait) or to withdraw. Theoretically, the observability of decisions should prevent bank runs by solving the coordination problem; i.e. depositors without liquidity needs should wait in the unique equilibrium. However, our findings indicate that depositors withdraw upon observing that others do so. In such circumstances, depositors have unreasonable beliefs about the behavior of others. We refer to these runs that occur because of the observability of withdrawals as panic bank runs.

Our paper complements empirical (e.g. Iyer et al., 2012; Starr and Yilmaz, 2007) and experimental studies (e.g. Brown et al., 2015).
2. Theoretical framework

2.1. Depositors' types, actions and order of decisions

Three depositors are endowed with 60 ECUs. Depositors invest part of their endowment (40 ECUs) in a common bank that consequently has 120 ECUs. After making their investment decision, depositors realize that one of them needs the money urgently (this impatient depositor is going to withdraw the deposit with certainty), while the other two patient depositors can wait or withdraw.

Depositors contact their bank to determine the order of decisions; i.e., who will be the first, second and third depositor in making a decision. We model this as a first-price auction in which depositors bid simultaneously what part of their remaining endowment (20 ECUs) they want to spend on arriving early to the bank. These bids are intended to capture the efforts and opportunity costs of depositors to have an earlier position.

Depositors are ordered depending on their bids from depositor 1 (largest bid) to depositor 3 (smallest bid). Once depositors are in the line of decisions and know their position, they choose in sequence whether to wait or withdraw. Depositors who withdraw receive their money immediately, while depositors who wait receive their payoff once all depositors decided. This is because the bank carries out a project as in D&D that matures only after the withdrawal decisions (see Fig. 1). Actions (but not types) are observable; i.e., if a patient depositor 2 observes a withdraw from depositor 1 it could be due to a patient or impatient depositor, whoever arrived first to the bank (after bidding the most).

2.2. Payoffs

There is no uncertainty about the payoffs, thus the bank has no fundamental problems. Depositors who withdraw immediately receive 50 ECUs if the bank has enough funds. That is, depositor 1 and 2 receive 50 ECUs for sure if they withdraw, while depositor 3 receives 20 ECUs if she withdraws after two withdrawals, but earns 50 ECUs if at least one of the predecessors waited. The bank pays 70 ECUs to the patient depositors if both of them wait. A patient depositor who waits alone receives 30 ECUs. Table 1 summarizes the payoffs (further details about the model, including a rationale for the payoffs are presented in Section A1 in the Online Appendix).

2.3. Equilibrium

Our payoffs resemble the coordination problem in D&D. The two patient depositors earn the maximum payoff (70 ECUs) if they both coordinate and wait, but waiting alone results in 30 ECUs, thus a patient depositor in position 1 or 2 might have incentives to withdraw and immediately receive 50 ECUs. We define a bank run as a situation in which at least one of the patient depositors withdraws. In our setting, sequential rationality guarantees that patient depositors wait in any Perfect Bayesian Equilibrium, regardless of their position and what they observe; i.e., the coordination problem disappears. This is because withdrawal decisions are observable and any patient depositor in positions 2 or 3 waits in equilibrium if she observes a waiting. Anticipating it, a patient depositor in position 1 will wait so as to induce the other patient depositor to follow suit. As a result, rational beliefs imply that any patient depositor in position 2 who observes that depositor 1 withdraws should believe that this was the impatient depositor. Hence, a patient depositor 2 should wait in equilibrium even if she observes a withdrawal to coordinate with depositor 3.

Prediction. A patient depositor in position 2 waits regardless of what she observes. In addition, she believes that any withdrawal in position 1 is due to the impatient depositor.

Note that our prediction implies that the order of decisions is not important to our setting (and patient and impatient depositors should bid nothing in equilibrium). This is because there is a unique equilibrium in which both patient depositors wait, so patient depositors do not have any incentives to rush. If a patient depositor 2 withdraws upon observing a withdrawal, then a bank run occurs; and this is not caused because of a fundamental problem or a coordination failure.

3. Experimental design and procedures

A total of 156 subjects participated in our computerized sessions in Spain. We use the strategy method. After making sure
In line with the theoretical prediction, depositor 3 does not react differently to this finding that subjects overbid in first-price auctions. Importantly, the Wilcoxon test suggests no difference between the bids of patient (7.53 ECUs) and impatient (7.25 ECUs) depositors ($p = 0.408$). This, in turn, implies that the order of decisions (i.e., the position of the impatient depositor) does not create different incentives for patient and impatient depositors in our setting, as predicted by our model.

**Fig. 2** displays the likelihood of withdrawal for patient depositors in each position. Contrary to the theoretical prediction that depositor 2 waits regardless of what she observes we find that depositor 2 is far more likely to withdraw when a withdrawal is observed (57.7% vs. 5.1%, $p < 0.001$, Wilcoxon signed-rank test). We interpret this as evidence of panic behavior.\(^{13}\)

**Result 1.** Depositor 2 withdraws when she observes withdrawals.

In the unique equilibrium, depositor 2 should believe that withdrawals in position 1 are always due to the impatient depositor (see “Rational beliefs” in Table 2). However, only 34.52% of subjects have such belief (see “Elicited beliefs” in Table 2).\(^{14}\) To further illustrate that depositor 2 has distorted beliefs about the behavior of the other patient depositor, we rely on our experimental data. Fig. 1 shows that depositor 1 withdraws 20% of the times if patient, what may suggest that depositor 1 is pessimistic about the behavior of subsequent depositors. We form all the possible banks with 3 depositors and use the bids of subjects to determine the order of decisions. Given the bids, 26.87% of the withdrawals in position 1 would be due to patient depositor (see the last column of Table 2). Statistically, patient depositors in position 2 overestimate the likelihood that patient depositors withdraw in position 1 ($p < 0.001$, test of proportion). The result holds also if we split those who replied that “the withdrawal was due to any of the two types with the same probability” (47.68%) into two groups and update the likelihood that the withdrawal is due to the impatient depositor to be 58.36% ($p = 0.019$).\(^{15}\)

\(^{13}\) Fig. 1 reveals also that depositor 3 withdraws roughly 10% of the times. Because depositor 3 has a dominant strategy, this can be considered as noise or irrational behavior.

\(^{14}\) Depositors are less likely to withdraw when they believe that the withdrawal was due to the impatient depositor, but differences across groups are not statistically significant according to the Wilcoxon rank-sum test ($p > 0.129$).

\(^{15}\) See Section A3 in the Online Appendix for further evidence that depositor 2 does not have rational beliefs about the behavior of other patient depositors.

\(^{10}\) When observing a waiting and a withdrawal, we asked subjects what they would do if depositor 1 waited and depositor 2 withdrew and the other way around. In line with the theoretical prediction, depositor 3 does not react differently to this information ($0.090$ vs. $0.083$, $p = 0.808$), thus we pool the results (“Obs. a waiting and a withdrawal”).

\(^{11}\) Beliefs were only elicited at LINEX ($N = 84$ participants).

\(^{12}\) Note that we needed the bidding stage before the withdrawal decisions so that the sequence of decisions is endogenous. Without it, the order should have been imposed exogenously, but then beliefs would obviously reflect the exogenous line-information mechanism.
Table 2
Beliefs of depositor 2 when depositor 1 withdraws.

<table>
<thead>
<tr>
<th></th>
<th>Rational beliefs</th>
<th>Elicited beliefs</th>
<th>Observed (simulations)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The withdrawal is due to the...</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>...impatient depositor</td>
<td>100%</td>
<td>34.52%</td>
<td>73.13%</td>
</tr>
<tr>
<td>...patient depositor</td>
<td>0%</td>
<td>17.86%</td>
<td>26.87%</td>
</tr>
<tr>
<td>...any of the two types with the same probability</td>
<td>0%</td>
<td>47.68%</td>
<td></td>
</tr>
</tbody>
</table>

Table 3
Marginal effects for withdrawal decisions upon observing a withdrawal in position 2: probit regression.

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk aversion</td>
<td>−0.115</td>
<td>−0.132</td>
</tr>
<tr>
<td></td>
<td>(0.079)</td>
<td>(0.094)</td>
</tr>
<tr>
<td>Loss aversion</td>
<td>0.200*</td>
<td>0.199*</td>
</tr>
<tr>
<td></td>
<td>(0.091)</td>
<td>(0.091)</td>
</tr>
<tr>
<td>Ambiguity aversion</td>
<td>0.0002</td>
<td>0.00002</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Age</td>
<td>−0.005</td>
<td>−0.014*</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>Female</td>
<td>−0.004</td>
<td>0.020</td>
</tr>
<tr>
<td></td>
<td>(0.010)</td>
<td>(0.127)</td>
</tr>
<tr>
<td>Cognitive abilities</td>
<td>0.033</td>
<td>0.028</td>
</tr>
<tr>
<td></td>
<td>(0.041)</td>
<td>(0.048)</td>
</tr>
<tr>
<td>Income (= 1 if above median)</td>
<td>0.051</td>
<td>0.048</td>
</tr>
<tr>
<td></td>
<td>(0.076)</td>
<td>(0.067)</td>
</tr>
<tr>
<td>Big-5</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>SVO</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Obs. probability</td>
<td>0.577</td>
<td>0.583</td>
</tr>
<tr>
<td>Observations</td>
<td>144</td>
<td>143</td>
</tr>
</tbody>
</table>

Result 2. Depositors overestimate the likelihood that a withdrawal in position 1 is due to the patient depositor.

While there are no fundamental problems and depositors should coordinate successfully in our setting, we find that (i) depositor 2 withdraws upon observing a withdrawal, and (ii) they overestimate the likelihood that other patient depositor withdraws, compared with the theoretical prediction and the experimental data. These two findings support the idea of panic bank runs.17

Next, we use a probit specification and find that more loss averse/younger subjects in position 2 are more likely to withdraw when they observe withdrawals, ceteris paribus (see Table 3). These results reinforce the findings in Trautmann and Vlahu (2013) on the explanatory power of loss aversion in a bank run context and suggest that more attention should be devoted to the study of loss aversion during bank runs episodes.

5. Conclusion

While traditional explanations for the occurrence of bank runs are based on fundamentals and coordination problems, we highlight that panic bank runs may occur as well. Policies devised to avoid bank runs, such as the deposit insurance or suspension of convertibility, must take into account this possibility.

Acknowledgments

We thank Vita Zhukova for her excellent research assistance. The authors are grateful for the financial support from the Spanish Ministry of Economy, Industry and Competitiveness under the projects ECO2014-58297-R (Ismael Rodriguez-Lara), ECO2014-52372 (Hubert J. Kiss) and ECO2016-76178-P (Alfonso Rosa-Garcia). Hubert J. Kiss also thanks support from the János Bolyai Research Scholarship of the Hungarian Academy of Sciences (BO/00125/15/9) and from the National Research, Development & Innovation (NKFIH) under project K 119683.

Appendix A. Supplementary data

Supplementary material related to this article can be found online at http://dx.doi.org/10.1016/j.econlet.2017.11.014.

References


17 In their theoretical paper, Chen and Hasan (2008) refer to panic bank runs as those that occur by changes in depositors’ expectations of the bank-specific information process, thus they do not consider the observability of actions as a possible source of ban runs.