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RESEARCH PROPOSAL

**Deposit Decision, liquidity management and bank
runs**

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Abstract

An important role of the financial system in a market-based economy is to match lenders and borrowers. Banks serve as financial intermediaries by issuing short-term obligations (deposits) to fund short-term and risk-free investment (liquidity) and long-term, risky investments (loans). The maturity mismatch between deposits and long-term loans may render banks vulnerable to unexpected large withdrawals (bank runs). In this paper I modify the Diamond and Dybvig (1983)'s model to study the interaction between banks' portfolio choices and agents' deposit and withdrawal decisions in the presence of investment risk and bank-run risk. Previous literature shows that a welfare maximizing bank optimally hedges against both risks by increasing its liquid reserves. This result, however, typically assumes that agents are not strategic and always deposit their entire endowment in the bank. By realistically endogenizing agents' ex ante deposit decisions, I show that if the probability of a bank run is sufficiently small, efficient allocation requires that liquid reserves used for risk hedging be held outside the banking system (i.e., the optimal deposit level is less than full deposit). Moreover, I show that for sufficiently low deposit level, the problem of multiple equilibria never arises since the bank optimal contract eliminates the possibility of bank run equilibrium. Finally, I plan to apply the global games approach (Goldstein and Pauzner, 2005) to link the probability of a run to economic fundamentals and optimal bank contract and deposit level. This analysis can shed light on the implications of precautionary liquid reserves holding on agents' withdrawal incentives and bank-run probability.

Description of the basic research question and expected contribution

The basic research question is how does the possibility of a bank run or investment failure influence the bank's portfolio, the resulting demand-deposit contract offered by the bank and the optimal deposit level. To mitigate the detrimental effects of such risks it stands to reason that holdings of precautionary safe and liquid assets may be beneficial. This hedging measure can be taken by the bank itself through increasing the amount of liquid assets it holds. Alternatively, depositors can self-insure against the risks involved in the banking arrangement by lowering the level of deposit and individually invest in liquid assets outside the banking system.

The main contribution of the paper lies in the constructing of a novel framework that enables to analyze the optimal hedging policy and to draw the differences between centralized hedging by the bank and decentralized hedging by the depositors and their implications. This framework is of great importance since previous literature typically focuses on depositors' withdrawal decision while ignoring depositors' initial deposit decision.

Description of the research topic

This paper is related to the literature on bank liquidity management and financial fragility. Cooper and Ross (1998) and Ennis and Keister (2006) study banks' liquidity management with run risk, but with no investment risk and with no option of partial deposit. The bank can hold *excess liquidity* aimed at hedging against the risk of self-fulfilling bank-run, occurring upon the realization of an exogenous sunspot. Ennis and Keister (2006) show that the bank holds excess liquidity in equilibrium, but only in case the optimal deposit contract is run proof, which does not provide liquidity risk sharing. Assuming preferences are of the constant-relative-risk aversion variety, they show that the bank will never hold excess liquidity when the optimal contract offers exhibits liquidity risk sharing.

As mentioned above, most of the vast literature that studies various versions of the Diamond and Dybvig (1983) does not address depositors' ex-ante decision of how much to deposit. This literature commonly assume that depositors deposit their entire endowment with the bank and as a result, the bank's deposit base (pool size) is fixed. There are only a few exceptions. Peck and Shell (2003) consider a model in which agents decide whether or not to deposit their entire endowment with the bank, rather (But not how much to deposit). Gu et al. (2019) connect between agents' deposit level and the bank's incentive to misbehave which affects the bank fragility (in our main setting the probability of bank default is exogenously given). The closest work to our approach is in a recent paper by Peck and Setayesh (2022). In their work agents allocate their endowment between bank deposit and long-term, risky investment. In our paper the focus is on liquidity management and self-insurance made by the depositors hence the depositors' outside option is investing in safe and liquid assets.

Description of the research design and method

A brief description of the model's basic set-up: I incorporate depositors' ex-ante deposit decision of how much to deposit into a theoretical model of banking's arrangement. This is a sequential game using sub-game Nash perfect Nash equilibrium as a solution concept. The model spans three time periods and features a unit mass of ex-ante identical agents. In period 0, agents choose a fraction of their endowment to be deposited in a bank while holding the complementary fraction in liquid assets or private storage. In period 1, each agent privately observes whether she is impatient, who has urgent consumption needs, or patient, who is able to delay consumption until period 2.

At the beginning of period 0, the bank offers each agent a menu of contracts, which specifies a return function for every given deposit level. The bank's menu puts forth payments to agents upon period 1 and period 2 withdrawals. Because the investment is risky, period 2's payment is contingent on the actual proceeds of the

investment realized in period 2. There is perfect competition with free entry in the banking sector, and so banks offer a contract that maximizes depositors' expected utility.

Both the depositors and the bank may ex-ante hedge against the risks embedded in the pooling arrangement. The depositors' privately-held storage provides certain consumption level at every state of the world including in bad events such as bank run or investment failure. The bank ex-ante hedging decision is twofold. First, it chooses the fraction of investors' deposits that placed into long-term investment. The lower the investment, the lower the bank's exposure to investment risk and the greater the amount of liquid resources that the bank must hold. Second, the bank chooses a fraction of its remaining assets (that were not placed into long-term investment) to be held as liquidity during periods 1 and and period 2; the bank's short-term storage and long-term storage, respectively. The bank's short-term storage backs up its payments obligations for early withdrawals in period 1 whereas the rest of the bank's long-term storage is held until period 2 and serves as a liquid source of consumption in case of investment failure. Apart from hedging against the investment risk, the long-term storage may also mitigates the run risk. The interplay between the various sorts of liquidity held by the bank and by the public lies at the heart of this paper.

Preliminary results

- The benefit from the pooling arrangement is limited in the presence of investment risk. In particular, there exists a threshold deposit level, which is strictly less than full endowment, above which the expected utility induced by the optimal bank contract for every deposit level is fixed. In this range of deposit levels, the expected utility of the representative agent is maximized. Therefore, full deposit is not necessary for attaining the social optimum. In fact, if there are even negligible costs of deposit, full deposit is sub-optimal.
- In the presence of both investment risk and (an exogenous) run risk efficient allocation requires that liquid reserves used for risk hedging be held outside the banking system by depositors individually. This implies that partial deposit enhances social welfare when investment risk and run risk entail a threat to the banking arrangement.
- For sufficiently low deposit levels, the problem of multiple equilibria never arises since the bank optimal contract eliminates the possibility of bank run equilibrium.

Detailed planned schedule

This paper is part of my PhD dissertation that expected to be submitted at December 2023.

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