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## Bank runs: A risk mismanagement perspective : A Note

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This paper demonstrates that the fractional reserve system is a source of instability in commercial and investment banks. The purpose of investment banks is to enhance completeness of financial markets and thereby contribute to an efficient allocation of risk. When funds are raised through commercial banks to transact in securities of investment banks, this can cause instability to commercial and investment banks as is experienced currently in world financial markets.

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### Introduction

World financial markets experience currently great instability. There has recently been a major reduction in investment banks operations. This paper demonstrates that the fractional reserve system in commercial banks is a significant factor for instability of the banking sector. The purpose of investment banks is to enhance completeness of financial markets and thereby contribute to an efficient allocation of risk. When, however, funds are raised through commercial banks to engage in security transactions of investment banks, this can cause instability to commercial and investment banks.

The paper is organized as follows. The next section presents the commercial bank's balance sheet as based on the fractional reserve principle. The third section explains the operation of commercial banks in light of their balance sheet. The section is based on the classical framework of bank runs due to Diamond and Dybvig (1983). The fourth section describes the financial principles underlying the operation of investment banks. In particular, this section highlights the main purpose of investment banks as institutions that contribute to the completeness of financial markets and thereby render the allocation of risk in financial markets more efficient. The last section concludes the paper with some remarks.

### A commercial bank's balance sheet

Banks receive deposits from customers to create loans. They operate under the principle of fractional reserves. That is, banks retain only a fraction of deposits and the rest they use to finance illiquid (long term) projects which are more profitable than liquid (short term) projects. This raises the possibility that a substantial number of depositors may decide to withdraw their funds from the bank for reasons

unrelated to the need for liquidity; the outcome may be a bank run (e.g., Freixas and Rochet (1997), p. 20).

Bank runs may be illustrated by a bank's balance sheet (e.g., Allais (1986)) as follows,

Assets		Liabilities
Cash	0.1A	Deposits A
IOU (on maturity)	<u>0.9A</u>	(withdrawal on demand)

The above bank's balance sheet indicates that for an A size deposit (the bank's liability in rands) the bank should retain only a fraction of A (say 10%) in cash (the bank's liquid asset) and the rest the bank can lend in the form of an IOU with fixed maturity. Thus, the bank can honour a maximum 10% of its liability in the case of a sudden withdrawal of deposits. The underlying principle of the above bank's balance sheet is that the bank knows from past experience that no more than 10% of individuals' deposits may be withdrawn within a certain time period. This, however, exposes the bank to a run should the other 90% holders of deposits decide to withdraw their funds simultaneously.

### A classical explanation of bank runs

The classical explanation of bank runs in a competitive environment is Diamond and Dybvig (1983) (for a review see Tirole (2006), pp. 447-468). Their explanation is the following. The bank receives deposits (which may be withdrawn on demand) from many risk averse customers. In turn, the bank invests the deposits in various projects. The longer the investment, the higher is the return. Therefore the

bank tends to invest in long term illiquid projects where the return is  $R > 1$ , rather than in short term projects where the return is  $r = 1$ . The bank can liquidate a long term project at a penal return  $r = 1$ . At the time a deposit is made, the bank is unaware whether the customer is a short term or a long term depositor. The bank, however, knows from past experience that 'on average' a proportion  $P$  of customers are short term depositors and a proportion  $1 - P$  are long term depositors. Since the bank has many depositors, the law of large numbers applies: the bank knows with full certainty that  $P$  and  $1 - P$  are, respectively, the true proportions of short and long term depositors. Hence, the bank can act as a central planner under full certainty where it pools all deposits to maximise utility of all customers. The outcome of the bank's pooling of deposits is Pareto optimal; and in particular, it supersedes a market solution.

The main result of the above scenario of central planning by a commercial bank is that each short term depositor receives a payoff  $x > 1$  for each 1 unit deposited; and each long term depositor receives a payoff  $y$  where  $R > y > x > 1$  for each 1 unit deposited. The Pareto optimality of this outcome gives justification for the operation of banks. This outcome, however, is predicated on the assumption that the proportions  $P$  and  $1 - P$  may not be altered because of any internal or external factors. If, however, this is not the case then a run may take place and the bank may run out of liquidity. Thus, the bank's practice of pooling deposits for the sake of Pareto optimal allocation of returns between short and long term deposits is paradoxical: the Pareto optimal criterion may itself trigger a suboptimal outcome where a run on the bank happens.

The above argument explains that the risk of bank runs is a direct consequence of the bank's balance sheet as is depicted in the previous section. The bank's operation as a receiver of deposits that may be withdrawn on demand, and a provider of loans at fixed maturity, is sound for as long as  $P = 0,1$  and  $1 - P = 0,9$  are maintained. That is, in the above bank's balance sheet it is assumed that  $\phi(P = 0,1, 1 - P = 0,9) \approx 1$  (in words, the probability  $\phi$  that  $P = 0,1$  is close to 1). The possibility, however, that  $\phi$  may be significantly less than 1, under any unforeseen circumstances, renders the bank susceptible to runs.

## Investment banking

An investment bank issues or buys securities. The issue of securities may be considered as the investment bank's deposits and the purchase of securities may be considered as its loans. Investment banks contribute to the completion of financial markets and until recently had a great influence on stock markets.

Consider a case where the possible number of states of the world in an uncertain environment is  $S$ . (A state of the world is a complete description of any possible outcome of uncertainty (see e.g., Arrow and Hahn (1971), p. 122.) In an uncertain environment of  $S$  possible number states of the world, investment banks contribute to the maintenance of complete financial markets where the number of linearly independent securities is kept as close as possible to the

number  $S$ . In turn, when markets are complete there exists, before the resolution of uncertainty, a market for each contingent security. The current purchase or sale in the contingent security market is a promise for future purchase or sell of the security when a certain state of the world appears in the future.

It is important to note that although future delivery is contingent on the appearance of the state of the world, payment for a purchase of a contingent security is done at the present time. The funds to purchase the security are provided by a commercial bank where the security itself acts as collateral. In light of the fractional reserve principle in commercial banks, this can cause a financial crisis. If customers come to realize that, because of any reason, financial markets are due to decline, this can trigger a run on both, commercial banks and investment banks. Commercial banks would put pressure on their clients to repay their loans, and in turn individual investors will be forced to sell securities in investment banks to repay their loans in commercial banks. The outcome might be a strongly depressed securities market with clients' equities fall short of their debt to commercial banks. In this regard a proper process of information revelation is essential to avoid a sell off of investment banks' securities. Roughly put, a proper process of information revelation is one in which there is flow of information to distinguish between any two different states of the world (see e.g., Mas-Colell *et al.* (1995), p. 690).

It is known that in an environment of complete markets, at equilibrium (where no arbitrage is possible) risk is allocated efficiently. The contribution of investment banks in this regard is significant. In an episode of financial crisis, however, as is the case currently, the operation of investment banks may be restricted by outside agents to, seemingly, mitigate the crisis; furthermore, some contingent markets may be eliminated completely by regulation. If such unfortunate restrictions happen then the transfer of purchasing power between future states of the world will be restricted or completely prohibited. Reducing the likelihood of sell off of investment banks' securities and avoiding runs on commercial banks depend ultimately on a proper dissemination of information and thereby a proper risk management.

## Concluding remarks

Two factors for instability of the banking sector are, (i) the excess liquidity produced by commercial banks because of the fractional reserve system, and (ii) the excess liquidity may be provided in the form of collateralized loans to clients who wish to engage in security operations of investment banks. The two factors, when combined, may be a major cause for financial instability.

Commercial banks are aware that depositors frequently reconsider their decisions regarding their deposits in light of the above. That is, depositors form posterior probabilities of bank run based on observed signals concerning the riskiness of commercial banks' loans. The posterior probabilities may be formed according to the usual Bayes' formula,

$$P(\theta | R) = \frac{P(R | \theta)P(\theta)}{P(R | \theta)P(\theta) + P(R | \delta)P(\delta)},$$

the letter R stands for the event 'depositors look for signals that trigger run on the bank and they do find some', the letters  $\theta$  and  $\delta$  are two exclusive and exhaustive hypotheses; they are, respectively, the hypothesis that a run is due to take place or will not take place. Accordingly,  $P(\theta | R)$  is the probability that depositors hypothesise that a run is due to happen and they find some evidence to support their hypothesis. It is known (e.g., Raiffa (1968), pp. 20-21) that even a small sample of observations renders the posterior probability  $P(\theta | R)$  much greater than the prior probability  $P(\theta)$ . Therefore, it may be sufficient to have some vague evidence on a bank run to trigger an actual run.

Given the liquidity available in the market, investment banks act upon the prevailing market risk; the problem of financial instability, however, lies within the operation of commercial banks.

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