

Banks and Liquidity*

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Banks perform valuable activities on either side of their balance sheets. On the asset side, they make loans to difficult, illiquid borrowers. On the liability side, they provide liquidity on demand to depositors. But there seems to be a fundamental incompatibility between the two activities -- the demands for liquidity by depositors may arrive at an inconvenient time and force the fire-sale liquidation of illiquid assets. Furthermore, because depositors are served in sequence, the prospect of fire sales may precipitate self-fulfilling runs that further jeopardize bank activities. Is this an aberration, stemming from historical accident, and enshrined by deposit insurance? Or is there logic, hitherto unnoticed, for the bank's choice of activities? Our recent work suggests the answer "yes" to the latter question. In order to describe why a bank's fragile capital structure allows it to create liquidity and to explain why bank loans are illiquid, we present a simple example based on Diamond and Rajan (2001a).

I. The Model

Consider an economy, with 3 dates: 0,1, 2. The economy has investors, some with an endowment of 1 at date 0, others with an endowment of 1 at date 1, and entrepreneurs with no endowment but with a project that requires an investment of 1 at date 0. Each project produces a cash flow of 1.5 at date 2. To finance the project, the entrepreneur can raise money by issuing debt to investors. A debt contract specifies a required payment on particular date(s), with the proviso that the lender gets control rights over the project if the entrepreneur defaults. The specific abilities of the entrepreneur are required to generate the cash flow from the project. If the entrepreneur refuses to work once the investment is made, another use will have to be found for the project's assets, and this will generate a smaller cash flow.

The date-0 lender to a project, whom we will call the relationship lender, develops specific skills in identifying alternative uses for the assets -- she has been in a relationship with the entrepreneur at an early enough stage to know how the business was built, and knows what alternative strategies were considered. She can "liquidate" the project by taking it away from the entrepreneur and placing it in its second best use. At date 1, she can generate 0.9 by liquidating

the project. If she waits till date 2, before the cash flow is produced, to do so, she gets 1.1 because the project is closer to maturity. After the cash flow is produced at date 2, the project is worthless in anyone's hands. Lenders who come later do not have her specific skills in finding the next best alternative use, so they can generate only 0.8 at either date 1 or at date 2. Since educating a lender takes time and effort, the entrepreneur can borrow from only one lender initially.

Everyone has access to constant returns to scale storage with return 1, and the aggregate endowment exceeds the total input required by projects.

A. Limited Commitment.

There are two limitations on the willingness of investors to lend. First, at any date an agent can commit to work on the specific venture only for that date (as in Hart and Moore (1994)) – the law prevents him from irrevocably selling himself into bondage. This implies that after borrowing and investing at date 0, the entrepreneur could threaten to quit before cash flows are due to be produced at date 1 unless the terms of financing are renegotiated. He can do this again before date 2. Second, the relationship lender cannot commit to others that she will use her specific skills on their behalf at any future date. This can limit her ability to borrow against her loan to the entrepreneur.

Limited commitment implies loans can be renegotiated. For simplicity, we assume that the entrepreneur has all the bargaining power; If the entrepreneur defaults on a scheduled payment, he can make a take-it-or-leave-it offer with a revised schedule of payments, and can commit not to work for that period if the offer is rejected. If the lender accepts the revised schedule, the entrepreneur produces that date's cash flow, makes the spot payment required by the revised schedule, and continues in possession of the asset. If the lender rejects the revised schedule, the cash flow is not produced that period; the lender takes possession of the asset and does as she chooses with it.

Because the best users of the asset cannot commit to employing their specialized human capital on behalf of others, the asset is illiquid. So, for example, the entrepreneur can threaten to

quit at date 2 unless any pre-contracted loan payment is renegotiated down. This limits the amount he can commit to pay the relationship lender to 1.1. The relationship lender will not be willing to lend the entrepreneur more than 1.1 at date 0, even though the entrepreneur can generate 1.5 with certainty.

B. Investor demand for liquidity

With probability θ , each investor who receives an endowment at date t will get a liquidity shock at date $t+1$ that gives her an immediate need for goods to consume or invest.¹ Assume for now that $\theta=1$, so that the date-0 investor's need for liquidity at date 1 is certain. This implies that she will have to sell, or borrow against, the loan to raise money at date 1, raising the funds from investors who get an endowment at date 1 and who wish to consume at date 2.

The problem is that the loan will be illiquid for the same reason as real assets. If the relationship lender borrows from a new lender against the loan at date 1, everyone knows that she can always turn around at date 2 and make the following speech: "I promised to pay you the \$1.1 that I expected to collect from the entrepreneur. But you know that only I have the skill to collect it, while if you tried to collect, you would only get 0.8. Therefore, come sir, take 0.8." For simplicity, we assume that the new lender has no bargaining power. The new lender would have no option but to accept. Anticipating this, he would not lend the relationship lender more than 0.8 at date 1 against the collateral of the loan to the entrepreneur, even though the relationship lender can generate 1.1 from it in repayments. The loan is also illiquid.

C. Consequences of illiquidity

Anticipating that the loan she has made to the entrepreneur will be illiquid, a lender who knows that she will need liquidity will not make the loan. An investment of 1 produces 0.8 if sold, and 0.9 if the lender liquidates the project at date 1, and these are both below the return on storage. When the probability, θ , of the liquidity shock is positive but less than one, it is possible that a loan will be made. But even if the lender liquidates the entrepreneur's project (for 0.9)

¹ One can think of this as a highly valued investment opportunity at date 1 or a shock to her discount rate,

when she needs liquidity, she still does not recover as much when in need as she would if she had stored. The lender will require a higher expected return than storage (an illiquidity premium) to compensate for the low value she obtains when she needs liquidity. Even if illiquidity does not prevent lending, it makes it more expensive, and may result in the entrepreneur being liquidated. Relationship loans, held directly, are illiquid and this can be problematic for all!

II. A Remedy: The Bank

The adverse consequences of the loan's illiquidity could be avoided if the relationship lender could borrow its full value when she faces a need for liquidity. She can do this only if she can commit to deploy her collection skills for free in the future on behalf of the new lenders. One way to commit is for the relationship lender to set up a fragile capital structure, issuing demand deposits that are subject to a collective action problem among investors. If the relationship lender threatens to withdraw her specific collection skills as a ploy to get more rents, she will precipitate a run, which will drive her rents to zero. Fearing this outcome, she will not attempt to renegotiate any pre-committed payments, and will be able to commit to pay depositors all that she extracts from the entrepreneur. So the fragility of capital structure enables the relationship lender to issue demand deposits worth the full value of the illiquid loan portfolio she holds. This then enables her to lend up front as if the loan itself were liquid.

To see all this, at date 1 let the relationship lender have a claim of 1.1 on the entrepreneur at date 2. Now let her set up as a bank at date 1 by issuing many small demand deposits with a total face value of $d=1.1$. A depositor can come at any time and present his claim. To each depositor in line who demands payment, the relationship lender (henceforth, "the banker") will have to pay cash equal to the face value of the deposit or, equivalently, allow the depositor to seize loans (or fractions thereof) equal in market value to the face value of his claim, until the entire line has been served or the bank has no more assets. Since the market value of the loan in

which is zero absent the shock. See Diamond-Rajan (2001).

sale is only 0.8, the bank will have to sell all loans and still leave some depositors unsatisfied if they all come for their money before the loan matures.

Our argument that the banker's rents will be driven to zero if she attempts to renegotiate down payments before date 2 has three parts. First, such an attempt will trigger off a run by depositors. Second, the run will result in the bank having to part with ownership of the financial asset – the loan. Third, the loss of ownership will lead to a complete loss of rents even though the banker still has the best skills to extract payments from the entrepreneur.

To see this, suppose the banker threatens to not collect payments from the entrepreneur unless depositors accept lower payment than 1.1. It is a dominant strategy for any depositor who anticipates that some depositor will incur a loss to go immediately and ask for repayment. If he thinks others will accept the banker's low offer, he will immediately present his claim to the bank because he will be paid in full, while others will get the lower, renegotiated amount. If he thinks others will go for their money, it makes sense for him to do so also for he then gets a higher chance of getting repaid than if he waits out the run.

Once the depositors are in line to demand payment, each will withdraw his entire deposit. Otherwise he will have to receive payments from bank loans that have not been seized by other depositors. Knowing that there are too few assets to go around, and that other depositors will not forbear, he has no alternative. Therefore, the run will cause the bank's loans to end up in the hands of the depositors or third parties.

Having lost ownership of the loan to the entrepreneur, the banker loses the right to negotiate it unless hired to do so. But her services are redundant despite her collection skills, and her rents are driven to zero. The entrepreneur can make an offer directly to the new owner of the loan, of full payment less any rent the banker would capture if the new owner hired her to negotiate on the new owner's behalf. The new owner cannot do better than accept. The banker cannot intervene in this process because she has no control rights over the loan. She is cut out of the negotiation and gets zero. Anticipating this outcome of a run, the banker will not renegotiate

and can commit to pay depositors 1.1.

The run disciplines the bank because the banker's skills are useful only in making transfers, not in creating value. Having made the loan, she gets an economic benefit from her collection skills only because she also owns the loan. Once the run disintermediates her, she no longer has ownership to give her a share of rents, and thus is completely cut out. This allows her to live up to a commitment to pay depositors their promised amount despite their low ability to collect the loan.

A. Ability to commit implies ability to provide liquidity and create inside money

By issuing demand deposits at date 1, the relationship lender can commit to pay 1.1 at date 2, and thus raise 1.1 at date 1. The banker transforms an illiquid loan to the entrepreneur with market value of 0.8 into liquid demand deposits that pay 1.1 at date 2. Thus she effectively creates collateral value by issuing demand deposits.

Moreover, this allows her to create liquid assets to be held by others who might need liquidity. Even though agents typically need specific liquidation skills to extract repayment in this world, depositors need no such skills. The collective action problem created by their contractual structure is sufficient threat for the banker to commit to deploy her skills on their behalf. When some of depositors need liquidity, she can pay them by raising the equivalent sum from a fresh set of demand depositors. Her ability to commit to pay makes this process seamless. Similarly, deposits are readily transferable – and liquid – because buyers of deposits have no less ability to extract payment than sellers of deposits. Thus, the deposits can serve as bank notes or checks that circulate between depositors. This explains the special role of banks in creating inside money.

B. Could the Entrepreneur Issue Demand Deposits?

Our theory also suggests why the entrepreneur cannot directly issue demand deposits in an attempt to commit to pay more. Even if run, he is the best agent to generate cash flows from the assets. Unlike the banker who facilitates a transfer from the entrepreneur ex post, the entrepreneur creates value. So his rents cannot be driven to zero by a run, and he cannot commit

via demand deposits.² This distinguishes our theory from Calomiris and Kahn (1991), where demand deposits play a disciplinary role regardless of the nature of the issuer. Our theory also predicts that a bank is more likely to have very short-term debt.

III. Conclusion

Banks, more than other borrowers, benefit from the commitment power provided by a run prone capital structure. Runs can occur even when they hurt depositors. This implies that banks can be fragile if loan payments are uncertain, or if there are episodes of aggregate shortage of liquidity. In the former case, we show there is a strategic role for bank capital (see Diamond and Rajan (2000a)). In the latter case, we study in Diamond and Rajan (2000b) the effects of bank runs triggered by anticipated shortages of liquidity. These runs exacerbate shortages and result in gross misallocation of existing liquidity.

The desirability of ex-ante fragility implies that stability from policies such as deposit insurance, lender of last resort, and suspension of convertibility, is costly because each reduces commitment. Fragile bank capital structures (or country capital structures) are not an aberration but a consequence of the illiquidity of the underlying assets (Diamond and Rajan (2001b)). To mandate that these institutions finance themselves with less fragile claims may be to impair their economic activities.

² This also applies to lenders who add management value after financing, e.g. venture capitalists.

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