Who Runs? The Importance of Relationships in Bank Panics

Rajkamal Iyer[&] and Manju Puri[£]

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Abstract

What role do individual depositor characteristics play in bank runs? We use a unique data set that provides exhaustive details on individual depositor characteristics in conjunction with a bank run to study if cross-selling, relationships, social networks and distance affect depositor behavior in times of panic. We find that depositors that have availed of loans from a bank have a lower likelihood of withdrawing during a panic, suggesting that cross-selling acts not just as a revenue generator but also as a complementary insurance mechanism for the bank. Further, we find that depositors with longer duration of relationship with a bank are less likely to panic. Finally, we find that the social networks have an important effect on depositor panic. Our results suggest that relationships with a bank play an important role in influencing depositor panic and in turn hold important policy implications.

[&] Preliminary draft, comments welcome. University of Amsterdam, Department of Finance, Roetersstraat 11, 1018 WB, Amsterdam, Netherlands. Email: R.J.Iyer@uva.nl

[£] Fuqua School of Business, Duke University, 1 Towerview Drive, Durham NC-27708, and NBER. Email: mpuri@duke.edu

1. Introduction

Bank runs are situations where depositors withdraw their deposits from banks for the fear of the safety of their deposits. Most of the existing theoretical literature assumes that depositors are homogeneous except in terms of the timing of their liquidity needs (Diamond and Dybvig, 1983). However, depositors could differ on many dimensions, some of which might be important for bank runs. Some potential factors, among others, are the length and breadth of the relationship with the bank; the impact of social networks; physical proximity of the depositor. Hence an interesting question is whether depositor characteristics matter during bank panics; in particular do they affect depositors' incentive to run. Given the large costs associated with bank failures understanding the factors that affect depositor behavior in a crisis is of utmost importance.[1]

There are several possible reasons why depositor characteristics could matter during a bank panic. A large literature suggests that bank-firm relationships are beneficial to firms (see e.g., Petersen and Rajan, 1994). A growing literature expands on the importance of cross-selling multiple products to the same firm for increased revenue generation (Drucker and Puri, 2005; Bharath et al., 2006). The length and depth of the relationship of depositors with the bank could mitigate depositor incentive to run. Social network of depositors could also play an important role in bank runs as it could act like a channel for word of mouth contagion (Kelly and O' Grada, 2000). With regard to geography, on the one hand geographical proximity could reduce information asymmetry and therefore reduce depositor incentive to run (Mian, 2006); on the other hand geographical proximity could increase depositor incentive to run as it lowers the shoe-leather costs of running.

Despite the importance of understanding the factors that affect depositor behavior during a crisis, empirical research has been hampered due to lack of detailed data at depositor level. In this paper, we overcome this hurdle by using a unique data set from India that provides us with exhaustive details of accounts at depositor level for a bank. To conduct the analysis, we use this data set in conjunction with a shock that triggered a run on the bank. The shock, which triggered

[1] Even if there is no failure, loss in deposits could lead banks to cut down on loans, which could impose high costs on borrowers in the presence of information asymmetry.

the run, was caused by the failure of a large bank due a fraud. The bank that we use for this study had no fundamental linkages with the failed bank in terms of interbank linkages or loans outstanding with the failed bank. Furthermore, the bank that we use for this study faced depositor withdrawals for a few days after the date of failure of the large bank. There were hardly any significant withdrawals in the following period with activity returning to pre-panic levels.

Using the depositor level data, we first create proxies for different dimensions across which depositors differ. We proxy for depositor relationships with the bank using two measures. The first is the age of the account which measures the length of the relationship. The second is whether the depositor avails of loans from the bank, suggesting the relationship is multi-pronged or has more depth than as suggested by simply holding an account. We identify social networks in three ways. One proxy we use is based on the ethnic group that the depositor belongs. We sort depositors primarily into two categories Minority (Muslims) and Non-Minority (Hindus) using the last name of the depositor.[2] The other way we capture social network of a depositor is based on the introducer name associated with the account. Finally, we also create a measure for the geographical proximity of the depositor to the bank using the address of the depositor. To identify depositors that run, we categorize a depositor as panicker if he/she liquidated his/her deposits in the three days following the date of the failure of the large bank.[3] The deposit insurance limit in India is Rs 100000 ($2000). We additionally test how significant the effect of the deposit insurance limit is in bank panics.

We find that longer the duration of the deposit account lower the likelihood of a withdrawal during the panic. Interestingly, we find that depositors that have a loan linkage with the bank are less likely to panic. We do not any effect of geographical distance on depositor behavior. The ethnic status of the depositor also has an effect on the likelihood of a withdrawal. Depositors belonging to the minority community are more likely to panic during a crisis. We also find that depositors with accounts that have outstanding balance over the deposit insurance limit are more likely to withdraw. Finally, even if we consider accounts below the deposit insurance limit, we find that account balance positively influences the likelihood of a withdrawal.

[2] From the last name of the depositor we identify if he/she is a Hindu or Muslim.

[3] We also use other thresholds like 50% and find that none of the results of the paper are altered.

To further examine the importance of loan linkages, we investigate whether depositors who have deposits above the deposit insurance limit and have loan linkages, differ in their behavior. We find that while depositors holding balances above the deposit insurance limit are more likely to panic, depositors with loan linkages holding balances above the deposit insurance limit do not have a higher likelihood of panicking.

Why are depositors with loan linkages less likely to withdraw? There are several possibilities: 1) Even though, by regulation banks are not allowed to set-off deposits outstanding with the bank against loans outstanding in the event of failure, depositors with loan linkages might perceive a set-off and therefore might be less likely to panic. 2) Depositors with loan linkages could be subject to a hold-up problem, as they may fear that in case they withdrew their deposits and the bank survives the crisis, the bank could pull back on their credit in future. 3) Depositors with loan linkages could have better relationships with the bank, more trust in the bank's safety and soundness, and therefore are less likely to panic. 4) Finally, depositors with loan linkages might differ from other depositors in terms of education, wealth etc that might make them less likely to panic.

To further disentangle the effect, we investigate the behavior of depositors that had availed of a loan in the past but have no loan currently outstanding. Interestingly, we find that even depositors that had availed of a loan in the past are also less likely to panic. This suggests that the behavior of depositors with loan linkages is not driven by the perceived set-off (natural hedge). Also, the hold-up by the bank is unlikely to be a concern of depositors with past loan linkages. We also find that depositors with loan linkages are not ex-ante different from other depositors in terms of account balance or account length. Furthermore, loans are uniformly availed by depositors with different levels of account balances.

As it could be possible that depositors with loan linkages might differ as compared to other depositors in unobservable dimensions (which could be the driver of the results), we look at the behavior of depositors who originate their first loan relationship after the crisis but have a deposit account active before the crisis. As it likely that these depositors are similar in

unobservable dimensions to depositors with loan linkages, if unobservable characteristics are the main driver, depositors that started their loan relationship after the crisis should also be less likely to panic. We do not find any difference in the behavior of depositors with future loan linkages as compared to other depositors. We also find that depositors with loan linkages do not differ in age, education or wealth as compared to other depositors. These findings suggest the behavior of depositors with loan linkages is most likely a product of relationship.

One possible reason for minority community being more likely to panic could be due word of mouth contagion through social networks. To further investigate the importance of social networks in a panic, we construct the network of a depositor based on different measures. We construct a network using the introducer name associated with the depositor account. We also create two other networks based on neighborhood of the depositor and the ethnic group of the depositor. We then look at the effect of the behavior of other people in the network on the depositor. We find that a depositors' likelihood of running is increasing in the fraction of other people in the network that are running. We find that once we control for networks, minority community dummy loses significance. We further find that even within the network where other depositors are running, loan linkage and length of the relationship with the bank have a mitigating effect. This finding further highlights the importance of relationships.

We also find that the effects of the panic are long lasting. Of the depositors that withdrew during the crisis, only in 10% of the cases does the account balance return to pre-crisis levels even after 6 months of the crisis. Further, we do not find that the aggregate level of deposits of the bank return to the pre-crisis levels in the short run.

Our paper contributes to the existing literature in a number of ways. First, our paper finds evidence on the importance of relationship banking in influencing depositor behavior during a panic. We find that cross-selling of products by a bank to depositors reduces depositor panic. While the importance of cross-selling has largely been thought to be in revenue generation (Drucker and Puri, 2005; Bharath et al., 2006), our evidence suggests that cross-selling of products by a bank is important in protecting the downside risk as it acts as a complementary insurance mechanism. Second, our paper contributes to the literature that highlights the

importance of coexistence of deposit taking and lending (Kashyap et al., 2002) by pointing towards the benefits of tying deposits and loans to the same depositor. Third, our paper also adds to literature that studies the real effects of bank failures as we find that effects of panics are long lasting are not reversed in the short run. Our paper also speaks to the role of depositor insurance in banking panics by highlighting the costs associated with delays in implementation of deposit insurance. Finally our results also highlight the importance of social networks.

The remainder of the paper is organized as follows. Section 2 describes the institutional setting. Section 3 provides details of the event. Section 4 describes the data set. Section 5 presents the results. Section 6 concludes.

2. Institutional Details

Before we proceed further, a brief summary of the institutional setting is helpful to set things in perspective. The Indian banking system primarily constitutes of three types of banks: public sector banks, private banks and cooperative banks. The cooperative banks in each state have a three tier structure. At the top of the chain is the state cooperative bank, followed by the local district central cooperative bank, and then the urban cooperative banks.[4] Cooperative banks' deposit base primarily constitutes of small depositors.

The main regulatory authority of the banking system in India is the Reserve Bank of India (RBI). Cooperative banks, however, come under dual regulation, i.e. they are supervised by the RBI as well as by the local state government. The RBI is responsible for monitoring the banks portfolios while the state government is responsible for governance issues. The insurance cover granted under the deposit insurance scheme is Rs. 100,000 (approximately 2,000$) for each account.[5] Though deposit insurance is present, there are several delays in processing the claims of depositors, as the central bank first suspends convertibility when a bank approaches failure. After suspension of convertibility, the central bank takes a decision of whether to liquidate a bank or arrange a merger with another bank. During this period depositors are allowed a one

[4] The state co-operative bank and district central co-operative bank can be considered as public banks as they are under control by the local governing body of the state.
[5] The deposit insurance is based on a flat premium. See www.dicgc.org.in.

time nominal withdrawal up to a maximum amount that is stipulated by the central bank.[6] In case of failure of a bank, the deposits held by a depositor cannot be adjusted against loans outstanding. The stipulated cash reserve ratio and statutory liquidity ratio to be maintained by the banks are 5.5% and 25% respectively.[7] Depositors of cooperative banks are not required to hold an equity claim in the cooperative bank. Also, any depositor can avail of a loan from the bank. Thus the cooperative structure of the banks does not lead to significant differences in characteristics of depositors as compared to banks with other ownership structures. Also, shareholders of cooperative banks have limited liability.

3. Event Description

We now turn to the description of the event that we use in this paper. The whole episode started with a fraud in the largest cooperative bank named Madhavpura Mercantile Cooperative Bank (hereafter referred to as MMCB) in the state of Gujarat.[8] MMCB had granted loans to stock brokers without appropriate collateral in contravention of the guidelines prescribed by the central bank.[9] The amount of loans given to stock brokers amounted to nearly 80% of the deposit base (Rs. 10 billion were advanced as industrial loans to stock brokers without appropriate collateral). On the 8th of March 2001, some major brokers defaulted on their pay-in obligations to the stock exchange. Rumors were floating around that MMCB had over-stretched lending positions to a major stock broker who had suffered huge losses in his share dealings in a select group of stocks. This led to a run on the bank on the 9th and 12th of March 2001. As the bank failed to repay depositors on the 13th of March 2001, the central bank temporarily suspended convertibility and restrained the bank from making payment to depositors beyond Rs. 1,000 per account.[10] The failure of MMCB triggered runs across other cooperative banks in the state.

[6] In most cases, depositors are allowed a one time withdrawal of up to Rs. 5,000 (100$) per account.

[7] Statutory Liquidity Ratio (SLR) is the one which every banking company shall maintain in India in the form of cash, gold or unencumbered approved securities, an amount which shall not, at the close of business on any day be less than such percentage of the total of its demand and time liabilities in India as on the last Friday of the second preceding fortnight.

[8] See www.manupatra.com/downloads/JPC/part%201.pdf.

[9] Co-operative banks were not allowed to have direct exposure to stock market or lend to stock brokers. They were, however, allowed to lend to an individual against collateral of shares up to Rs. 1 million if the shares are in physical format, and up to Rs. 2 million if the shares are in demat (electronic) format.

[10] See the report of the Joint Parliamentary Committee at www.manupatra.com/downloads/JPC/part%201.pdf

After the collapse of MMCB there was a huge debate whether MMCB should be bailed out. The revival scheme was organized in terms of a privately arranged bailout. However, the revival scheme was a non-starter.

4. Data

We obtain data from a cooperative bank that was located in the same city as the failed bank. After the failure of the large cooperative bank this bank faced runs in the subsequent days. In terms of deposits, the total deposit base of this bank was approximately, Rs 300 million. This bank hardly had any exposure to the failed bank. The exposure was 0.001% of the total assets. Also, this bank did not have any correspondent banking relationship with the failed bank.

Firstly, we obtain all the transactions for the depositors that have an account at the head quarters of the bank (the bank had 2 branches with the bulk of the deposits in the head office). The transaction data provides us details of every transaction undertaken by a depositor in the period between January 2000 and January 2002. For each transaction, we can also identify whether it is a deposit or withdrawal along with the time and date. We also have the opening balance of each account at the beginning of the month. This enables us to compute the total balance in each account and also the daily inflow and outflow in each account. For each deposit account we also have details of the date on which the account was opened along with information about the name of the depositor and the address of the depositor.[11] Apart from the details of deposit accounts, we also have information on the loans that have been made by the bank. For the loan accounts also we can identify the name of the person who has taken the loan, the address, the type of loan. For the fixed deposit accounts, we have information on the name, address, the initial amount of the term deposit, the maturity amount, maturity date and the date at which the term deposit was liquidated. Our data set also allows us to identify the mode of each transaction undertaken. For instance, if on any of the days there is a withdrawal made from an account, we can identify if the withdrawal was made in person or through a cheque or the withdrawal was due to an internal transfer. Note that the bank did not have any automatic teller machines (ATM's).

[11] For some accounts, the address is missing.

To construct the variables that we use in this paper, we first use the data on daily transactions and compute the outstanding balance in an account on a daily basis. Thus for each account we compute the balance at the close of each day. The difference in the daily balances provides us information on whether there is a net inflow or net outflow from the account for the interval. To make sure that the algorithm we use to compute daily balances is correct, we compare the balance that we obtain at the end of the month using our algorithm with the monthly closing balance for each account provided by the bank. We do not find any difference in these two variables. We also compute the length of the days the account has been active by computing the difference between the opening date of the account and the 13th of March, 2001. Note that as computerization of the bank data occurred only in April, 1995, for some accounts the information on the opening date is not filled. These accounts had been opened before the 1st of April 1995. We assume the opening date of these accounts to be 1st of April 1995 for computation. This provides us with the duration of each account as on the 13th of March, 2001. To obtain the total number of transactions undertaken by an account, we count the number of transactions for an account beginning the 1st of January 2000 till the 13th of March 2001. For example, if an account had 4 transactions in the period between 1st of January and 13th of March, 2001, we record the total transaction count as 4 for that account.

To determine if there are loan linkages associated with an account, we first match all the accounts by the name and address associated with the account. Thus for each account we have two separate matches. The name match indicates whether there is another account with the same name. The address match indicates whether there is another account that has the same address. The name and address match algorithm that we use provides a unique number to two accounts that have the same name and similarly another unique number if two accounts have the same address. After the initial match using the algorithm, we manually matched the names and addresses. We then create an address match identifier that acts as indicator of accounts that belong to the same household. As loans could be taken by any member of the household, we define an account to have a loan linkage if any member of the household has/had a loan outstanding with the bank. Thus, loan linkage is a dummy variable that takes the value of one for an account if any member of the household has/had a loan outstanding with the bank on/before

the 13th of March 2001. In defining the loan linkages we exclude over drafts that are taken against fixed deposits with the bank as these may have restrictions in terms of liquidation of deposits.[12]

To determine the ethnic status of a depositor, we first use an algorithm that sorts depositors based on their last names. The two main ethnic groups which depositors belong to are Muslims and Hindus (Gujarati). In most of the cases it is very easy to identify the ethnic profile of a depositor based on the last name. However, since we do not have an exhaustive of last names that are associated with Muslims or with Gujaratis', we manually categorize the ethnic status of each depositor. The manual procedure also helps in correctly categorizing depositors that could have the same surname as a Hindu depositor but have a very distinctive Muslim first name. For example, 'Patel' is a last name that is used by both Hindus and Muslims. However, from the first name it is easy to categorize a depositor with the name `Ahmed Patel' as a Muslim as against 'Vaibhav Patel'. Thus, we create a minority dummy that takes the value of one if the ethnic group of the depositor is Muslim and zero otherwise.

. To capture the effect of past deposits and past withdrawals, we generate two variables. The variable 'change in deposits' is defined as the fraction of balance outstanding as on the 12th of March, 2001 that is deposited with the bank in the interval between the 12th and the 13th of March. The variable change in deposits takes the value of zero if there are no deposits. Similarly, the variable 'change in withdrawals' is defined as the fraction of balance outstanding as on the 12th of March, 2001 that is withdrawn from the bank in the interval between the 12th and the 13th of March. We also create a dummy variable called 'above insurance cover' that takes the value of one if the total balance of the depositor with the bank as on the 13th of March, 2001 is greater than the deposit insurance level. In addition, we generate a variable called 'opening balance' that is the opening balance in an account as on the 13th of March, 2001 if the account is below the deposit insurance level.

[12] We also do not include accounts that currently avail of cash credit facility against fixed deposits in the definition of loan linkages as these accounts could also have restrictions on liquidation of deposits. In addition we also do not include staff loans in the definition of loan linkages.

We also utilize the time of withdrawal for each depositor to create a variable called 'failure time'. We set the starting time as the time of failure of the large bank (13th of March, 2001). We evaluate failures in one minute intervals, beginning from 10:30 am on the 13th of March, 2001.[13] For example, the withdrawal by a depositor on the 13th of March, 2001 at 10:36:36 am, would have a failure time of 7.[14]

Finally, we construct the social network of each depositor using the name of the introducer associated with the depositor account. We first link all people who share the same introducer. In case we find more than one introducer within a household, we cross the networks. For example, if household no 1 has introducer A and B; we pool all depositors with introducer name A or B into a single network. We then construct a variable called *runners introducer network(t-1)* at each point in time (t) that captures the fraction of other depositors in the network that are have run until time (t-1) excluding those within the household of a depositor.[15] In case we find that the introducer is a member of the household itself or, if we find no introducer name associated with an account, we do not associate the account to any network and the variable *runners introducer network (t-1)* takes the value of 0. In addition we also define two other variables to capture networks based on neighborhood of the depositor and his/her ethnic status. *Runners in neighborhood (t-1)* that captures the fraction of other depositors in the neighborhood that are have run until time (t-1) excluding those within the household of a depositor. Note that neighborhood is defined as the municipal ward that a depositor resides (the average area a ward covers is approximately 2 sq kms). Similarly *minority runners in neighborhood (t-1)* capture the fraction of minority community depositors in the neighborhood that have run until time (t-1).

5. Empirical Results

Before presenting the summary statistics, a look at the graphs helps highlight the magnitude of the runs faced by the bank. Graph 1 presents the amounts that were liquidated from the fixed

[13] The banking hours are from 10:30 am to 4:30 pm, thus we measure time failure in reference to the time when the bank is open for business.

[14] Note that a withdrawal by a depositor at 10:59:01 am will also have the failure time as 7, while a depositor by a depositor at 11:00:03 am will have a failure time of 8. Also, cheques are generally cleared together in a sequence; in that case we gave them the same failure time.

[15] In case there are two depositors with withdrawal times 10:35:00 am and 10:35:45 am belonging to the same network, the variable *runners network (t-1)* takes the value that was associated with the network at 10:34:00 am.

deposit accounts for the month of March, 2001. As be seen from the graph, there is a sharp spike in the liquidations beginning the 13th of March, 2001 up to the 15th of March. This coincides with the date of failure of the large cooperative bank. Also, one can clearly see that after a few days the runs subside and there is no further spike in liquidations in the subsequent period. Graph 2 presents the evolution of the transaction accounts for the month of March. Again a similar picture unfolds. As can be seen from the graph, there were runs to the extent of 10% of the deposits outstanding in the transaction accounts. Thus, these graphs highlight the extent of runs faced by the bank in the period subsequent to the failure of the large bank. Graph 3 and 4, presents the fraction of outstanding balance liquidated by depositors that withdrew during the crisis. Furthermore, from Graph 5, we can see that most of the withdrawals occurred on the 14 and the 15th of March, 2001.

Table 1 A (panel 1) presents the summary statistics for fixed deposit accounts. As on the 13th of March 2001, there are 4588 depositors that have fixed deposit accounts active at the head office of the bank. Out of these accounts only 6.7% of the depositors have an account balance more than the deposit insurance level ($2000). This shows that the majority of depositors are small depositors. We can also see that 8% of depositors have/had some loan linkage with the bank as on the 13th of March 2001. In terms of the ethnic profile of depositors, 28% of the depositors belong to the minority community.

Table 1 A (panel 2) presents the summary statistics for the transaction accounts (savings and current accounts). As on the 13th of March, 2001, there are 10691 depositors with transaction accounts that are active at the head office of the bank. Out of these accounts, only 1 % of the depositors have an account balance that is more than the deposit insurance level. The extent of depositors with loan linkage is similar to that of fixed deposit accounts (7.4%). The average number of transactions per depositor is 14.68 over the interval between 1st of January, 2000 and 13th of March, 2001. In terms of the ethnic profile of the depositors, 26% of the depositors belong to the minority community. We can also see that for depositors that deposited cash with the bank in the day prior to the crisis, the average deposit is 14%. On the other hand for depositors that withdrew cash in the day prior to the crisis, the average withdrawal is 0.5%.

To analyze the characteristics of depositors that panicked during the crisis, we conduct the analysis separately for fixed deposit accounts and transaction accounts. It is necessary to separate the analysis as there are higher costs to liquidation of fixed deposits as against withdrawals from savings accounts. The bank charges a penalty of 2% of interest accrued if the fixed deposit account is liquidated before maturity. Splitting the analysis also provides an additional robustness to the strength of the findings. For the fixed deposit accounts, we construct a dummy variable that takes the value of one if the depositor liquidated any part of his fixed deposit in the period between the 13th and the 15th of March, 2001. For the transaction accounts, classification of a depositor as a panicker is more difficult as transaction accounts are also used to meet daily liquidity needs. We therefore, categorize a depositor as a panicker if he/she withdraws more than 75% of the deposit outstanding as on the 13th of March, 2001. We also use other thresholds like 50% and do not find any significant change in the main results.

Table 1B presents the summary statistics for the panickers and stayers separately. A t-test of difference in means across the two groups shows that there are significant differences. Firstly, we find that higher fraction of panickers are from the minority community. We also find that stayers have longer length of relationship with the bank. Lower fraction of Panickers have loan linkages with the bank. Finally, we also see that while for transaction accounts a higher fraction of panickers have deposits above the insurance cover, we do not find any significant difference for fixed deposit accounts.

To further investigate the factors that influence depositor panic, we run probit estimations, the results of which are reported in table 2. We find that longer the duration of the account lower the likelihood that the account is liquidated. We also find that depositors with deposit balance over the deposit insurance levels are more likely to liquidate their deposits. This effect is more prominent in transaction accounts. Interestingly, we find that depositors that have a loan linkage with the bank are less likely to panic during a crisis. Note that loan linkages do not include overdrafts taken against fixed deposits. Thus loan linkages do not capture the mechanical effect that could arise due to an overdraft.[16] We also find that the minority dummy is significantly

[16] Depositors that have taken an overdraft against a fixed deposit cannot liquidate their deposit. Thus including overdrafts in the definition of loan linkages could mechanically lead to a negative coefficient.

positive in explaining depositor panic. Depositors belonging to the minority community are more likely to panic as compared to other depositors. We also find that even for depositors with balances below the deposit insurance level, the higher the account balance, higher the likelihood of panic. Finally, we also find that depositors that made higher percentage of deposits in the day before the crisis and higher percentage of withdrawals the day before the crisis are more likely to panic. Note that these effects are robust to controlling for the neighborhood where the person resides. Also, we do not find any significant effect of geographical distance (proxied by the distance of the neighborhood from the bank) on depositor panic.

We further investigate the importance of loan linkages by categorizing depositors that have account balances above the insurance level based on whether there are loan linkages associated with these depositors. Thus, we divide depositors with account balance above the insurance level into ones that have loan linkages and ones that do not have any linkage. As results in table 3 show, there is a striking difference in the behavior of depositors with loan linkages. In fact there is complete switch in the signs. We find that depositors with accounts above the insurance coverage level without loan linkages are more likely to panic while accounts above the insurance level with loan linkages do not have a higher likelihood of panic. An F-test significantly rejects equality of the coefficients across the two groups. These results are especially stark given the findings in table 2, that depositors with accounts that have deposits above the insurance level have 30% higher likelihood of panicking. Note that we also find that loan linkages have an important effect for depositors who hold balances below the deposit insurance level. In table 3 column 1, we estimate the probit only for accounts below the deposit insurance coverage limit and find similar effect of loan linkages.

The findings in table 2 and 3 show that loan linkages have a significant effect on the likelihood of panicking. This raises the question: why are depositors with loan linkages less likely to panic? There are several potential explanations: 1) Even though, by regulation banks are not allowed to set-off deposits outstanding with the bank against loans outstanding in the event of failure, depositors with loan linkages might perceive a set-off/offset and therefore might be less likely to

panic.[17] 2) Depositors with loan linkages could be subject to a hold-up problem, as they may fear that in case they withdrew their deposits and the bank survives the crisis, the bank could pull back on their credit in future. 3) Depositors with loan linkages could have better relationships with the bank and therefore less likely to panic. 4) Finally, depositors with loan linkages might differ from other depositors in terms of education, wealth etc that might make them less likely to panic.

To further disentangle the effect of the loan linkages on depositor panic, we first look at whether accounts that had loan linkages in past but currently have no outstanding loan linkages differ in their behavior as compared to other depositors. Interestingly, we find that depositors with loan linkages in the past are also less likely to panic (table 4). We find that both depositors that had a loan linkage in the past and depositors that have a loan currently outstanding are less likely to panic. As depositors with loan linkages in past are less likely to face a hold up problem by the bank and also do not have the benefit of any set-off in case of failure, the results above suggest that the behavior of depositors with loan linkages could be a product of relationship with the bank. However, as stated before another possible explanation could be that depositors with loan linkages are different in other dimensions like education that we do not capture.

We try to address this concern by looking at depositors who started a loan relationship with the bank after the crisis but have a deposit account with the bank at the time of the crisis. These depositors do not have any loan linkage with the bank in the past or any loan that is currently outstanding but availed of a loan from the bank after the crisis. We first check whether there are any ex-ante differences between the depositors that availed of loan linkages after the crisis and depositors that have/had loan linkages with the bank as on the date of the crisis. As results in table 9, show we do not find any significant differences between the two groups. Thus, if we assume that the loan criteria of the bank was not altered much by the shock, a noticeable difference at the time of the crisis is that one group had a relationship with the bank while the other did not. As results in table 4, column 2 and 4 show we only find that only depositors who have/had loan linkages with the bank as on the date of the crisis are less likely to panic. In

[17] Only, under exceptional circumstances, with the permission of the Central bank, set-offs could be allowed. Even in those cases, the recovery of assets and the payment to depositors are carried out independently as separate procedures.

contrast, we do not find any significant difference in the behavior of depositors that originated a loan relationship with the bank after the crisis as compared to other depositors. A F-test rejects equality of coefficient between the depositors with outstanding loan linkage as compared to depositors with future loan linkage at 11% (column 4). In sum, the results taken together suggest that the effect of loan linkages on deposit behavior is most likely to be a result of relationship with the bank.

We also check whether accounts with loan linkages differ significantly in observable dimensions as compared to other deposit accounts. As reported in table 8 A and 8 B, we do not find any significant ex-ante differences in terms of duration of account or deposit balance. We cannot reject the null that there is no ex-ante difference in deposit accounts using a t-test of difference in means between the two groups. We also find that loans are availed by depositors with different levels of deposit balance in the bank (Table 8 C), thus it does not appear that only a certain class of depositors avail of loans.

From table 2, apart from the effect of loan linkages on depositor panic, we also find that depositors who belong to the minority community are more likely to panic. We also find that the effect of minority community reduces once we control for neighborhood. There could be several reasons why depositors from minority community are more likely to panic. One among the many reasons could be that presence of stronger social networks among minority depositors could lead to contagion due to word of mouth communication. To examine the importance of social networks in the panic, we model the influence of the actions of other people in the depositors' network on depositor behavior.

As stated earlier, we capture the network of a depositor in 3 different ways. We first use the name of the introducer that is associated with a depositors account. We then cross networks of different depositors to generate the composition of the social group that a depositor belongs. We have 63 groups where at least one other member of the group is running. The minimum number of people in a group is 2, while the maximum is 431. To examine the effect of social network, we construct a variable that captures the proportion of other depositors in the social group of a depositor that have run at a given point in time. We do not include runs by members of the

household of the depositor to construct this variable. We also create a network for a depositor based on the neighborhood of the depositor. Finally, we also look at the effect the behavior of other minority community depositors in the neighborhood has on a minority community depositor.

As results from the estimation of the cox model in table 5, column 2 show, we find that higher fraction of runs by other depositors in the neighborhood increases the hazard rate. In column3, we find that runs by other minority community depositors in the neighborhood increases the hazard rate for a minority community depositor. We also find that minority community dummy is no longer significant. This suggests social networks play an important role in the behavior of minority community depositors.

While the results in table 5, column 2 and 3 suggest that networks based on the neighborhood of a depositor play an important role, it is possible that these effects are driven by other neighborhood characteristics. To further explore the role of social networks, we look at the effect of networks based on introducer name. As results in column 4 shows, we again find that the behavior of other depositors in the network has a significant effect. To further understand the importance of social networks, we further look at what factors affect the behavior of depositors within a network. In table 5, column 5, we estimate the model where at each point in time we only include depositors where at least one other depositor in the network is running. Interestingly, we find that even within this network, the hazard rate is lower if a depositor has loan linkages with the bank and has a longer length of relationship with the bank.

The results in table 5 suggest that networks have a significant effect on depositor behavior. To further understand the how the behavior of depositor is affected by other depositors, we the probability of running as result of contact with a person who has already run. We draw on the epidemiology literature to model the transmission probability. The parallel in epidemiology is the probability that a person gets infected through a contact with another infected person. The transmission probability is estimated using the following model:

$$\lambda_i(t) = C \prod_i P(t) \exp\{\beta_1 x_{i1} + \beta_2 x_{i2} + \beta_z x_{iz}\}$$

where $\prod_i$ is *runners network(t-1) or neighborhood runners (t-1). C* is the number of people in ones social network or neighborhood that one comes in contact and is assumed to be 1 per time interval. *P (t)* is the transmission probability, that is the probability for running due a single contact with a person who has already run. This model can be thought of as the cox model with the base hazard rate equal to P(t) and log-transformed $\prod_i$ that is $x_{\prod} = \log(\prod_i)$, is a covariate having a coefficient equal to one (Geoffard and Philipson, 1995; Halloran, 1998; Hudgens et al, 2002). In the model above the hazard rate of running is zero if $\prod_i$ is equal to zero.

We fit the transmission probability model described above and estimate the transmission probability. As results in table 6, show we find that the average transmission probability across time is 2% via social groups and 5% via neighborhoods. The maximum value that the transmission probability takes is 19% for social groups and 52% for neighborhood based network. Averaging across transmission probabilities in 2 hours intervals, we find that the average transmission probabilities are higher in day 1 and day 2 of the crisis and drop in day 3 of crisis. This could hold implications in terms of the timing of regulatory action.

In table 7, we look at whether depositors that withdraw their deposits during the crisis, return to the bank. We define that a depositor returns to the bank if after the crisis, the account balance returns to the pre-crisis level. As results, show, we find only a maximum of 10% of the depositors return back to the bank. This could have real costs for the bank as it could affect credit available to borrowers of the bank who might find it difficult to raise funds from other sources due to information asymmetry problems.

While so far our analysis focuses on the importance of individual characteristics in depositor panic, an interesting question that arises is how long lasting are the effects of the panic. More precisely, do depositors that panic re-deposit their money in the bank after an interval of time? To address this question, we first take all the savings accounts that withdrew during the crisis. For these accounts, we compute the fraction of depositors for which the deposit balance returns to the pre-crisis levels after the crisis. As results in table 7 show, we find a maximum of 11% of the depositors return back to the bank. Thus, it does appear that depositors that panic do not return back to the bank. We also find that even after two months following the crisis, the total

level of deposits in the bank does not recover to the pre-crisis. This suggests that the effects of the panic are not reversed in a short interval of time. This could have real costs for the bank as it could affect credit available to borrowers of the bank who might find it difficult to raise funds from other sources due to information asymmetry problems.

Finally, to further investigate the robustness of the results, for a sample of depositors we collected information on age, education and proxies for wealth using a survey. We randomly selected 100 depositors that withdrew during the crisis, along with 300 other depositors and conducted a survey. To construct a measure of depositor wealth, we asked whether the household of the depositor owns a car, bike, land, and apartment. We use these responses to create a measure of depositor wealth by weighting the asset ownership based on the fraction of the other people that own the asset.[18] We did not find any significant differences between runners and stayers in the above dimensions. We also did not find any significant differences between depositors with loan linkages and other depositors along these dimensions.[19]

6. Conclusion:

This paper presents a detailed micro level analysis of the individual characteristics of depositors that affect depositors' incentive to run. We use a shock that triggered panic among bank depositors to study what are the factors that affect depositor behavior. We find that longer the duration of an account with the bank, lowers the likelihood of depositor panic. We also find that depositors that have loan linkages are less likely to panic. Furthermore, we find that even for depositors with accounts below the deposit insurance level, the size of the deposit balance affects the incentive to withdraw. Our analysis also shows that social networks play an important role in affecting depositor behavior. Finally, we also find the effects of the panic are long lasting.

These results highlight the importance of relationships with a bank in influencing depositors' incentive to run. Our results also suggest that cross-selling of deposits and loans to depositors

[18] In total, we were able to survey 282 depositors out of the 400.

[19] In addition, we also looked at effect of literacy and wealth level (proxied by the density of slums) in the neighborhood of the depositor based on census data. We also looked at the effect of distance from the depositors' neighborhood to the bank. We did not find any significant effect of these variables on the likelihood of withdrawing.

can act as a complementary insurance mechanism. This in turn further adds to the rationale for coexistence of deposit taking and lending. In terms of policy implications, our results suggest that allowing banks to provide an umbrella of products could help strengthen the relationship with the depositor, which in turn could help reduce fragility. Our analysis also raises the issue of the long lasting effects of panics. These could impose high social costs especially when we take into account opaqueness of borrowers and their reliance on bank financing. Finally, the analysis also points to the ineffectiveness of deposit insurance mechanism due to delays in implementation.

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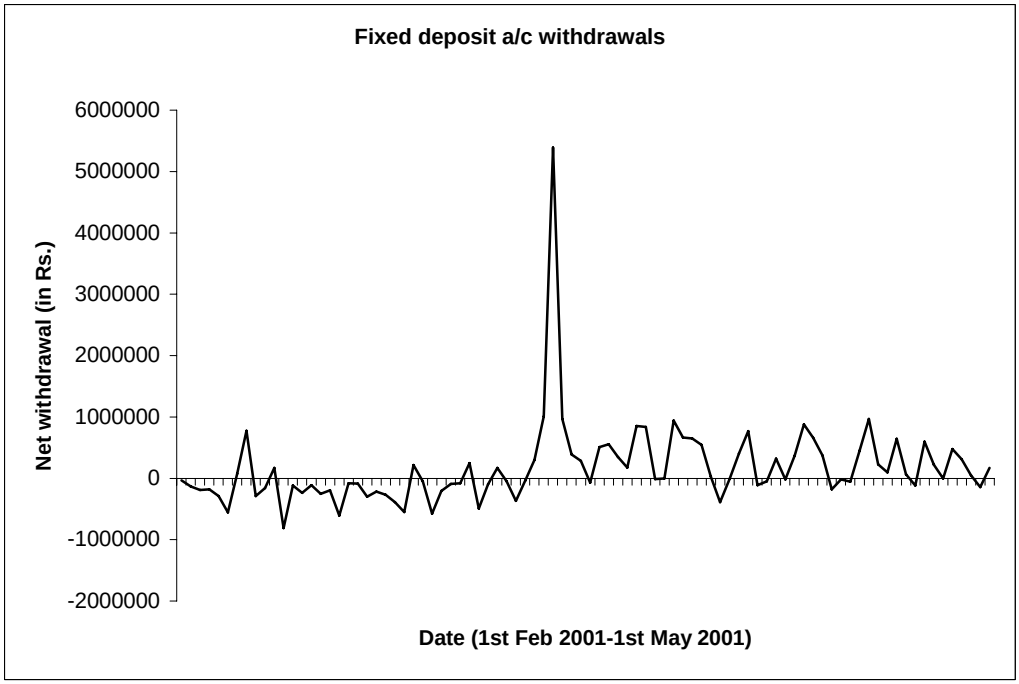
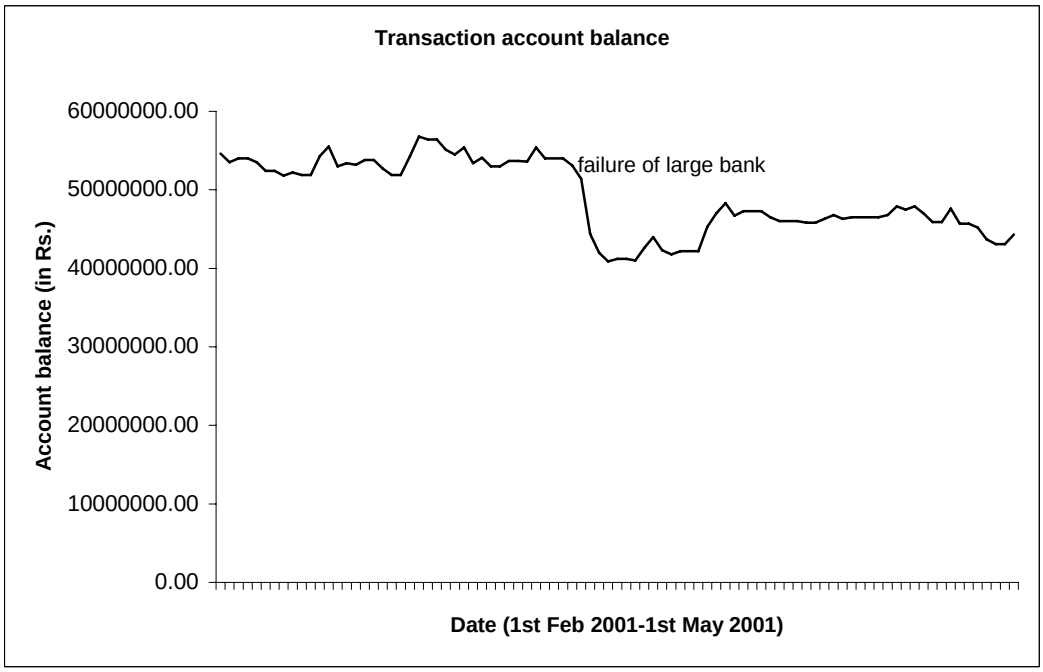
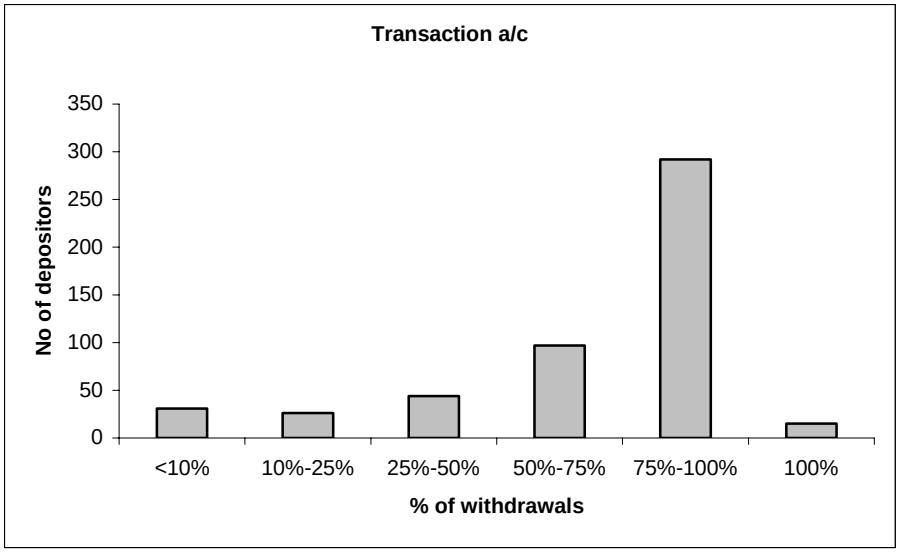
Graph 1: Withdrawals from Fixed deposit a/c from Feb-May 2001 (13th of March is the date of failure of the large bank)



Graph 2: Deposit Balance in transaction accounts for the period between February-May 2001



Graph 4: presents percentage of outstanding account balance (transaction a/c) withdrawn by a depositor that withdrew during the crisis



Graph 5: presents the time of the day (10:30 am-4:00 pm) when depositors withdrew during the crisis (Transaction a/c)

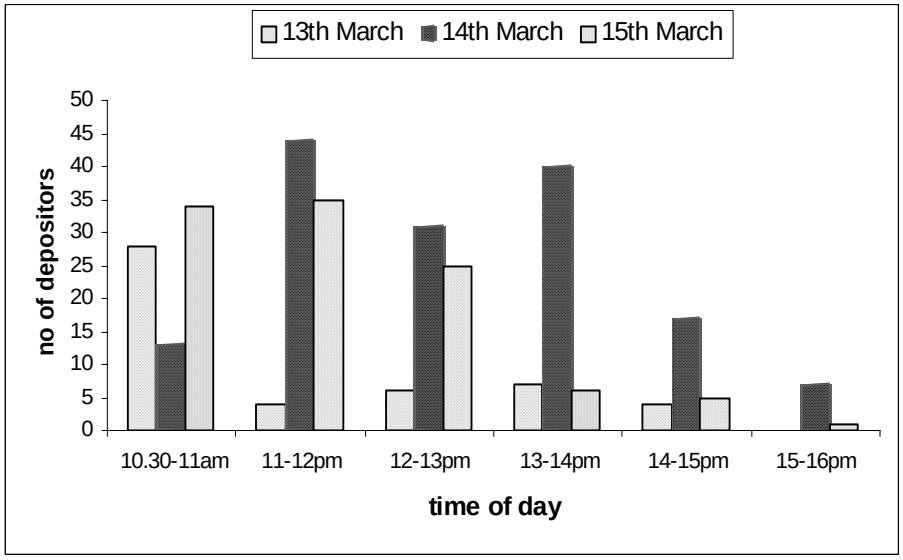


Table 1 A: Summary statistics

Minority community is a dummy variable that takes the value of 1 if the account belongs to a depositor from the minority community. Above Insurance cover is a dummy variable that takes the value of 1 for a depositor if his/her balance in the bank as on the event date is above the deposit insurance coverage limit. Change in deposits is the percentage change in deposits between the 12th of March, 2001 and event date if there is an inflow and is zero otherwise. Change in withdrawals is the percentage change in deposits between the 12th of March, 2001 and event date if there is an outflow and is zero otherwise. Opening balance is the deposit balance (amount in Rs.) in an account as on the event date if the depositor is below the deposit insurance coverage limit. Age of account is the length of time (days), for which the account has been open as on the event date. No of transactions is the total number of transactions (deposits, withdrawals, transfers) associated with an account between the 1st of January 2000 and event date. Loan linkage is dummy variable that takes the value of 1 for a deposit account if the household (associated with the account) has/had a loan account with the bank as on event date. Days to maturity are the number of days left for maturity for the fixed deposit account.

Fixed Deposit a/c (panel 1)	Observation	Mean	Median	Std. Dev	Min	Max
Minority community	4574	0.293	0	0.455	0	1
Above Insurance Cover	4574	0.066	0	0.248	0	1
Opening balance	4271	23823	16813	21365	402	99906
Age of account	4574	1057	1105	562	1	7585
Loan linkage	4574	0.080	0	0.272	0	1
Days to maturity	4574	384	262	378	0	2248
Transaction a/c (panel 2)						
Minority community	10691	0.267	0	0.442	0	1
Above Insurance cover	10691	0.010	0	0.103	0	1
Opening balance	10575	3258	683	9131	0.39	99780
Change in deposits	10691	0.141	0	5.711	0	428.08
Change in withdrawals	10691	0.005	0	0.062	0	0.994
Age of account	10691	2286	2173	1307	8	16640
No of transactions	10691	14.68	4	50.26	0	1421
Loan linkage	10691	0.074	0	0.262	0	1

Table 1 B

For fixed deposit accounts, panicker is defined as a depositor who liquidates any part of his/her account in the period between the 13th and the 15th of March, stayer otherwise. For savings and current account panicker is defined as a depositor who withdraws more than 75% of the opening balance as on the event date in the period between the 13th and the 15th of March, stayer otherwise. In the row with opening balance, we only report statistics for depositors with accounts below the deposit insurance cover.

	Panickers			Stayers			
Fixed deposit a/c	obs	Mean	Std.Dev	Obs	Mean	Std.Dev	Diff (t-stat)
Minority community	249	0.369	0.483	4325	0.289	0.453	2.704***
Above Insurance cover	249	0.080	0.272	4325	0.065	0.247	0.918
Opening balance	229	27177	19900	4042	23633	21432	2.443**
Age of account	249	873	591	4325	1067	559	-5.310***
Loan linkage	249	0.024	0.153	4325	0.083	0.276	-3.365***
Days to maturity	249	261	423	4325	391	374	-5.273***
Savings & Current a/c							
Minority community	307	0.335	0.472	10384	0.265	0.441	2.71***
Above Insurance cover	307	0.133	0.340	10384	0.007	0.084	21.50***
Opening balance	266	22903	23247	10309	2752	7718	37.87***
Age of account	307	1872	69.33	10384	2298	12.83	-5.63***
No of transactions	307	49.23	118.2	10384	13.66	46.40	12.30***
Loan linkage	307	0.022	0.149	10384	0.076	0.265	-3.50***

Table 2

What factors affect depositor behavior during a panic?

This table presents results of probit models (co-efficient reported are marginal effects). For fixed deposit accounts, the dependent variable is an indicator variable that takes the value of one if the depositor liquidates any part of his/her account in the period between the 13th and the 15th of March. For savings and current account the dependent variable takes the value of one if the depositor withdraws more than 75% of the opening balance as on the event date in the period between the 13th and the 15th of March, 2001. The analysis is conducted separately for fixed deposit accounts and transaction accounts (savings and current a/c). Minority community is a dummy variable that takes the value of 1 if the account belongs to a depositor from the minority community. Above Insurance cover is a dummy variable that takes the value of 1 for a depositor if his/her balance in the bank as on the event date is above the deposit insurance coverage limit. Opening balance is the balance (amount) in an account as on the event date if the depositor is below the deposit insurance coverage limit. Loan linkage is dummy variable that takes the value of 1 for a depositor if the household (associated with the depositor) has/had a loan account with the bank as on event date. Account age is the log of the length of time, for which the account has been open as on the event date. Days to maturity are the number of days left for maturity for the fixed deposit account. No of transactions is the total number of transactions (deposits, withdrawals, and transfers) associated with an account between the 1st of January 2000 and event date. Change in withdrawals is the percentage change in deposits between the 12th of March, 2001 and event date if there is an outflow and is zero otherwise. Change in deposits is the percentage change in deposits between the 12th of March 2001 and event date if there is an inflow and is zero otherwise. All dummy variables are 0 otherwise. Neighborhood controls represents the municipal ward where the depositor resides. White heteroscedasticity consistent standard errors are reported in parentheses. The symbols ***, **, * indicate significance levels of 1%, 5%, and 10% respectively.

	Fixed deposit a/c		Transaction a/c	
	(1)	(2)	(4)	(5)
Minority community	0.016**	0.012	0.006**	0.006**
	(0.007)	(0.008)	(0.002)	(0.003)
Above Insurance cover	0.023*	0.037**	0.307***	0.329***
	(0.015)	(0.019)	(0.053)	(0.046)
Opening balance	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.001)	(0.000)	(0.000)
Loan linkage	-0.037***	-0.039***	-0.014***	-0.012***
	(0.006)	(0.007)	(0.002)	(0.002)
Account age	-0.017***	-0.015***	-0.005***	-0.005***
	(0.002)	(0.003)	(0.001)	(0.001)
Days to Maturity	-0.005***	-0.006***		
	(0.001)	(0.001)		
No of transactions			0.000***	0.000*
			(0.000)	(0.000)
Change in withdrawals			0.025*	0.030**
			(0.013)	(0.012)
Change in deposits			0.002*	0.002**
			(0.001)	(0.001)
Neighborhood control	no	yes	no	yes
N	4574	3612	10691	9910
Pseudo/Adj R2	0.047	0.075	0.248	0.269

Table 3
How important are loan linkages?

This table presents results of probit models (co-efficient reported are marginal effects). Column 1 and 4 report the results excluding depositors above the insurance coverage limit. For fixed deposit accounts, the dependent variable is an indicator variable that takes the value of one if the depositor liquidates any part of his/her account in the period between the 13th and the 15th of March. For savings and current account the dependent variable takes the value of one if the depositor withdraws more than 75% of the opening balance as on the event date in the period between the 13th and the 15th of March, 2001. The analysis is conducted separately for fixed deposit accounts and transaction accounts (savings and current a/c). Minority community is a dummy variable that takes the value of 1 if the account belongs to a depositor from the minority community. Above Insurance cover is a dummy variable that takes the value of 1 for a depositor if the depositors' balance as on the event date is above the deposit insurance coverage limit. Above Insurance with loan linkage is a dummy variable that takes the value of 1 if a depositor is over the deposit insurance limit and has a loan linkage with the bank. Above Insurance with no loan linkage is a dummy variable that takes the value of 1 if the depositor is over the deposit insurance limit and the depositor has no loan linkage with the bank. Opening balance is the deposit balance (amount) in an account as on the event date if the depositor is below the deposit insurance coverage limit. Loan linkage is dummy variable that takes the value of 1 for a depositor if the household (associated with the depositor) has/had a loan account with the bank as on event date. Account age is the log of the length of time, for which the account has been open as on the event date. Days to maturity are the number of days left for maturity for the fixed deposit account. No of transactions is the total number of transactions (deposits, withdrawals, and transfers) associated with an account between the 1st of January 2000 and event date. Change in withdrawals is the percentage change in deposits between the 12th of March, 2001 and event date if there is an outflow and is zero otherwise. Change in deposits is the percentage change in deposits between the 12th of March, 2001 and event date if there is an inflow and is zero otherwise. Neighborhood controls represents the municipal ward where the depositor resides. White heteroscedasticity consistent standard errors are reported in parentheses. The symbols ***, **, * indicate significance levels of 1%, 5%, and 10% respectively. The symbol &&& indicates perfect prediction of failure.

	Fixed deposit a/c		Transaction a/c	
	(1)	(2)	(4)	(5)
Minority community	0.014**	0.016**	0.005***	0.006**
	(0.007)	(0.007)	(0.002)	(0.003)
Above Insurance with loan linkage		&&&		&&&
Above Insurance with no loan linkage		0.030**		0.320***
		(0.017)		(0.046)
Opening balance	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Loan linkage	-0.033***	-0.033***	-0.012***	-0.013***
	(0.008)	(0.008)	(0.002)	(0.002)
Account age	-0.017***	-0.017***	-0.005***	-0.005***
	(0.002)	(0.002)	(0.002)	(0.001)
Days to Maturity	-0.005***	-0.005***		
	(0.001)	(0.001)		
No of transactions			0.000	0.000***
			(0.000)	(0.000)
Change in withdrawals			0.030**	0.026**
			(0.011)	(0.014)
Change in deposits			0.002*	0.002*
			(0.001)	(0.001)
Neighborhood control	no	no	no	no
N	4271	4513	10575	10685
Pseudo/Adj R2	0.044	0.046	0.212	0.249

Table 4

Is there a difference in the behavior of depositors who had availed of a loan in the Past versus depositors who avail of a loan in the Future?

This table presents results of probit models (co-efficient reported are marginal effects). For fixed deposit accounts, the dependent variable is an indicator variable that takes the value of one if the depositor liquidates any part of his/her account in the period between the 13th and the 15th of March. For transactions account the dependent variable takes the value of one if the depositor withdraws more than 75% of the opening balance as on the event date in the period between the 13th and the 15th of March, 2001. The analysis is conducted separately for fixed deposit accounts and transaction accounts. Minority community is a dummy variable that takes the value of 1 if the account belongs to a depositor from the minority community. Account age is the log of the length of time, for which the account has been open as on the event date. Above Insurance cover is a dummy variable that takes the value of 1 for a depositor if the depositors' balance as on the event date is above the deposit insurance coverage limit. Opening balance is the deposit balance (amount) in an account as on the event date if the depositors balance is below the deposit insurance coverage limit. Outstanding loan linkage is a dummy variable that takes the value of 1 for a deposit account if the household (associated with the account) has a loan account with the bank as on event date. Past loan linkage is a dummy variable that takes the value of 1 if any member of the household (associated with the account) had a loan account with the bank before event date and there is no outstanding loan linkage. Future loan linkage is a dummy variable that takes the value of 1 for a deposit account if the household (associated with the account) had no loan account with the bank before/on the event date but availed of a loan from the bank in the future. Days to maturity are the number of days left for maturity for the fixed deposit account. Change in deposits is the percentage change in deposits between the 12th of March, 2001 and event date if there is an inflow and is zero otherwise. Change in withdrawals is the percentage change in deposits between the 12th of March, 2001 and event date if there is an outflow and is zero otherwise. No of transactions is the total number of transactions (deposits, withdrawals, and transfers) associated with an account between the 1st of January 2000 and event date. Neighborhood controls represents the municipal ward where the depositor resides. White heteroskedasticity consistent standard errors are reported in parentheses. The symbols ***, **, * indicate significance levels of 1%, 5%, and 10% respectively.

	Fixed Deposit a/c		Transaction a/c	
	(1)	(2)	(3)	(4)
Minority community	0.012	0.013	0.006**	0.006**
	(0.008)	(0.008)	(0.002)	(0.003)
Account age	-0.015***	-0.015***	-0.005***	-0.005***
	(0.003)	(0.003)	(0.001)	(0.001)
Above Insurance cover	0.036**	0.036**	0.307***	0.335***
	(0.019)	(0.019)	(0.044)	(0.047)
Opening balance	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.001)	(0.000)	(0.000)
Outstanding loan linkage	-0.043***	-0.043***	-0.013**	-0.012*
	(0.007)	(0.007)	(0.001)	(0.003)
Past loan linkage	-0.032*	-0.032*	-0.013**	-0.012**
	(0.011)	(0.011)	(0.000)	(0.002)
Future loan linkage		-0.008		-0.010
		(0.023)		(0.004)
Days to maturity	-0.006***	-0.006***		
	(0.001)	(0.001)		
Change in deposits			0.002*	0.002**
			(0.001)	(0.001)
Change in withdrawals			0.025*	0.029**
			(0.013)	(0.012)
Number of transactions			0.000***	0.000**
			(0.000)	(0.000)
Neighborhood controls	yes	yes	no	yes
N	3612	3612	10691	9910
Pseudo R2	0.074	0.075	0.248	0.269

Table 5

Cox proportional hazard model with time varying covariates to analyze networks effects

This table presents coefficients from the estimation of the cox model with time varying covariates. The failure time is the time in minutes until withdrawal by a depositor with starting time of 10:30 am on the 13th of March 2001 (date of failure of the large bank). Each interval of time represents one minute. *Runners in neighborhood (t-1)* is the fraction of other depositors in the neighborhood of the depositor that have run until time t-1 (excluding runs associated with the depositor household). *Minority runners in neighborhood (t-1)* is the fraction of minority community depositors in the neighborhood of the depositor that have run until time t-1 (excluding runs associated with the depositor household). We also construct the social network of the depositor using the introducer name associated with the deposit account. *Runners introducer network (t-1)* is the fraction of other depositors in the social network of the depositor that have run until time t-1 (excluding runs associated with the depositor household). Column 5 report results of the estimation where at a point in time, only depositors in whose network there is at least one other depositor running (*runners network (t-1)>0) are included in the estimation*. The Breslow method is used to adjust for ties in the cox regression (ties represent two subjects with same failure time). The cox model estimated in column 1 does not have any time varying covariates. The symbols ***, **, * indicate significance levels of 1%, 5%, and 10% respectively.

	Transaction accounts				
	(1)	(2)	(3)	(4)	(5)
Minority community	0.301**	0.301**	0.091	0.280**	0.345
	(0.122)	(0.124)	(0.145)	(0.122)	(0.245)
Account age	-0.284***	-0.291***	-0.303***	-0.260***	-0.299***
	(0.057)	(0.057)	(0.057)	(0.057)	(0.095)
Above Insurance cover	3.039***	3.062***	3.104***	3.028***	2.924***
	(0.183)	(0.186)	(0.187)	(0.183)	(0.339)
Opening balance	0.004***	0.004***	0.004***	0.004***	0.004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
loan linkage	-1.328***	-1.276***	-1.395***	-1.344***	-1.219**
	(0.387)	(0.387)	(0.417)	(0.386)	(0.528)
Runners in neighborhood (t-1)		17.438***			
		(5.906)			
Minority runners in neighborhood (t-1)			0.695		
			(5.00)		
Min runners Neighbor (t-1) x Minority community			14.635**		
			(5.920)		
Runners introducer network (t-1)				5.236***	3.908***
				(0.617)	(0.823)
Change in deposits	0.012**	0.012**	0.011**	0.012***	0.039***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.013)
Change in withdrawals	0.539	0.713	0.329	0.580	2.098***
	(0.649)	(0.650)	(0.721)	(0.639)	(0.691)
Number of transactions	0.002***	0.001***	0.001***	0.002***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
No of subjects	10691	10383	9927	10691	1267
No of obs	10691	2342915	2239864	2411757	255105

Table 6

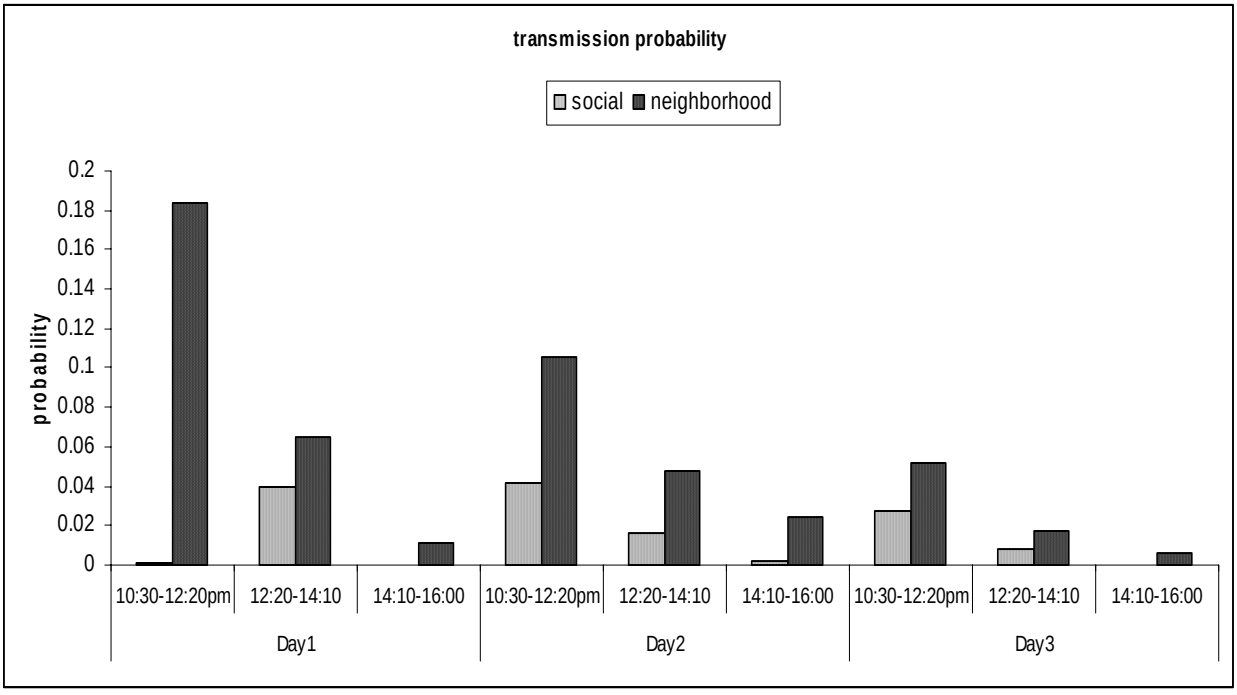
Estimation of transmission probability

Transmission probability is the probability of running (getting infected) as result of single contact with a person who has already run (infected person).

This table presents results of estimation of transmission probability using the model: $\lambda_i(t) = C \prod_i P(t) \exp\{\beta_1 x_{i1} + \beta_2 x_{i2} + \beta_z x_{iz}\}$ where $\prod_i$ is *runners network(t-1) or neighborhood runners (t-1)* . *C* is the number of people in ones social network or neighborhood that one comes in contact and is assumed to be 1 per time interval. *P (t)* is the transmission probability, that is the probability for running due contact with a person who has already run. This model can be thought of as the cox model with the base hazard rate equal to P(t) and log-transformed $\prod$ that is $x_{\prod} = \log(\prod)$, is a covariate having a coefficient equal to one. The transmission probability via social networks is estimated using the model described above with the covariates specified in table 7 column 1 along with *runners network(t-1)* whose coefficient is constrained to be one. Note that in the estimation at any point in time, only depositors in whose network there is at least one other depositor running (*runners network (t-1)>0) are included in the estimation*. *Similarly the* transmission probability via neighborhood is estimated with the coefficient of *neighborhood runners (t-1)* constrained to be one. Also the estimation at any point in time, only includes depositors in whose network there is at least one other depositor running (*neighborhood runners (t-1)>0).* The Breslow method is used to adjust for ties (ties represent two subjects with same failure time). Each interval of time represents one minute. The mean transmission probability is the average of P(t) across time.

Transmission Probability	Mean	Std. Dev	Min	Max
via social network	0.027	0.036	0.0003	0.194
via neighborhood	0.052	0.076	0.0007	0.520

The graph below represents the average transmission probability via social networks and neighborhood at different points in time (1 hr 10 minute intervals). The average transmission probability for an interval is obtained by computing the average of estimated transmission probabilities across failure times within an interval.



Do depositors that withdraw during the crisis return?

The graph below presents the deposit balance in transaction account from 1st February 2001 through to 1st May 2001 for depositors that withdrew during the crisis

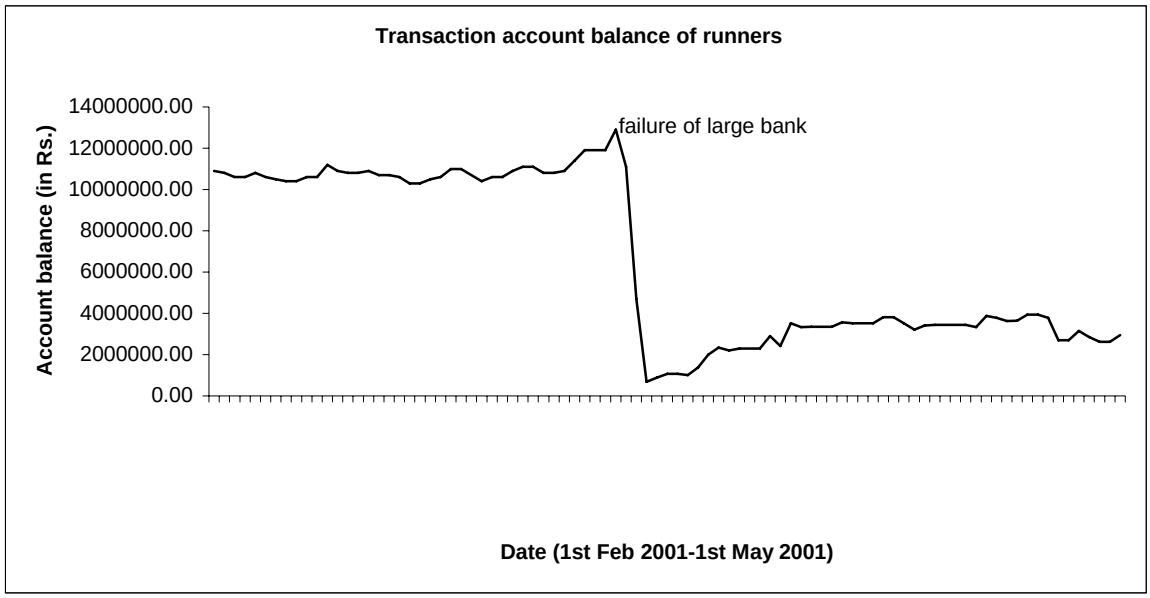


Table 7

This table reports the fraction of depositors who withdrew during the crisis and retuned to the bank after the crisis. After 1 month (May 1st, 2001), After 3 months (July 1st 2001), After 6 months (Oct 1st, 2001) are the dates in the future where the deposit balance is examined.

	Transaction a/c		
Panel A	After 1 month	After 3 months	After 6 months
fraction of depositors with balance higher than pre-crisis level	0.058	0.110	0.065
fraction of depositors with balance 25% higher than pre-crisis level	0.035	0.068	0.048
fraction of depositors with balance 50 % higher than pre-crisis level	0.032	0.068	0.042
fraction of depositors with balance 75 % higher than pre-crisis level	0.022	0.045	0.029
Panel B			
fraction of depositors with balance 75% lower than pre-crisis level	0.824	0.729	0.762
fraction of depositors with balance 50 % lower than pre-crisis level	0.872	0.791	0.843
fraction of depositors with balance 25 % lower than pre-crisis level	0.902	0.843	0.889

Table 8 A

Ex-ante differences in characteristics of depositors with loan linkages as compared to depositors without loan linkages

Table 8A and 8B presents the comparison of means for accounts with loan linkages versus accounts without loan linkages. Table 8C reports the percentage of depositors with loan linkages based on different account balances. The analysis is conducted separately for fixed deposit accounts and transaction accounts (savings and current a/c). Accounts with loan linkages is a dummy variable that takes the value of 1 for a depositor if the household (associated with the depositor) has/had a loan account with the bank as on event date. Account Balance is the opening balance (amount in Rs.) in an account as on the event date. Account age is the log of the length of time, for which the account has been open as on the event date. ***, **, * indicates significantly different than zero at the 1%, 5%, and 10% level, respectively, in a two-sided t-test of the mean of accounts without linkages versus accounts with loan linkages.

	Fixed deposit a/c		Transaction a/c	
	Account Balance	Account age	Account Balance	Account age
Accounts without loan linkages				
Mean	36149	6.703	3280	7.556
Standard Error	(1378)	(0.014)	(93.47)	(0.007)
N	4206	4206	9893	9893
Accounts with Loan Linkages				
Mean	78716	6.653	3226	7.578
Standard Error	(11723)	(0.054)	(303.57)	(0.024)
N	368	368	798	798
Diff between means (t-stats)	-7.331***	0.948	0.158	-0.847

Table 8 B: **Excluding depositors above insurance cover**

	Fixed deposit a/c		Transaction a/c	
	Account Balance	Account age	Account Balance	Account age
Accounts without loan linkages				
Mean	23705	6.700	3259	7.559
Standard Error	(339)	(0.015)	(92.74)	(0.007)
N	3964	3970	9783	9783
Accounts with Loan Linkages				
Mean	25345	6.640	3246	7.587
Standard Error	(1206)	(0.061)	(305.7)	(0.024)
N	307	307	792	792
Diff between means (t-stats)	-1.295	1.033	0.03	-1.058

Table 8 C: distribution of depositors with loan linkages

	Fixed deposit a/c	Transaction a/c
% of depositors with loan linkages with account balance		
lower than 1000	0.032	0.066
between 1000 and 25000	0.069	0.089
between 25000 and 50000	0.082	0.062
between 50000 and 75000	0.068	0.088
between 75000 and 100000	0.082	0.029
Higher than 100000	0.208	0.054

Table 9

Ex-ante differences in characteristics of depositors with loan linkages as compared to depositors who obtained a loan in the future

This presents the comparison of means for accounts with loan linkages versus accounts with loan linkages in the future. The analysis is conducted separately for fixed deposit accounts and transaction accounts. Accounts with loan linkages is a dummy variable that takes the value of 1 for a deposit account if the household (associated with the account) has/had a loan account with the bank as on event date. Accounts with future loan linkage is a dummy variable that takes the value of 1 for a deposit account if the household (associated with the account) had no loan account with the bank before/on the event date but availed of a loan from the bank in the future. Account Balance is the opening balance (amount in Rs.) in an account as on the event date. Account age is the log of the length of time, for which the account has been open as on the event date. ***, **, * indicates significantly different than zero at the 1%, 5%, and 10% level, respectively, in a two-sided t-test of the mean of accounts with linkages versus accounts with future loan linkages.

	Fixed deposit a/c		Transaction a/c	
	Account Balance	Account age	Account Balance	Account age
Depositors with Loan Linkage				
Mean	78716	6.653	3226	7.578
Standard Error	11723	0.054	303.5	0.024
N	368	368	798	798
Depositors with future loan linkage				
Mean	44030	6.771	4153	7.444
Standard Error	5577	0.104	1218.2	0.114
N	59	59	84	84
Diff between means (t-stats)	1.180	-0.832	-0.912	-1.567

Table 10 (Robustness)

This table presents results of probit models (co-efficient reported are marginal effects). In column 1, the dependent variable takes the value of one if the depositor withdraws more than 50% of the opening balance as on the event date in the period between the 13th and the 15th of March, 2001. Similarly in column 2 the threshold is set at 25%. In column 3, the dependent variable takes the value of one if the depositor withdraws more than 75% of the opening balance with the event window defined as withdrawals between the 9th and the 15th of March, 2001. Column 4 presents the results with the standard event window (withdrawal between 13th and 15th March, using the 75% threshold) where account age is defined as the maximum time that an account has been open in the household of the depositor. Minority community is a dummy variable that takes the value of 1 if the account belongs to a depositor from the minority community. Above Insurance cover is a dummy variable that takes the value of 1 for a depositor if his/her balance in the bank as on the event date is above the deposit insurance coverage limit. Opening balance is the balance (amount) in an account as on the event date if the depositor is below the deposit insurance coverage limit. Loan linkage is dummy variable that takes the value of 1 for a depositor if the household (associated with the depositor) has/had a loan account with the bank as on event date. No of transactions is the total number of transactions (deposits, withdrawals, and transfers) associated with an account between the 1st of January 2000 and event date. Change in withdrawals is the percentage change in deposits between the 12th of March, 2001 and event date if there is an outflow and is zero otherwise. Change in deposits is the percentage change in deposits between the 12th of March 2001 and event date if there is an inflow and is zero otherwise. All dummy variables are 0 otherwise. Neighborhood controls represents the municipal ward where the depositor resides. White heteroscedasticity consistent standard errors are reported in parentheses. The symbols ***, **, * indicate significance levels of 1%, 5%, and 10% respectively.

	Transaction a/c			
	50% threshold	25% threshold	Event window 9th-15th March	
Minority community	0.005	0.006	0.006**	0.006**
	(0.003)	(0.004)	(0.002)	(0.003)
Account age	-0.008***	-0.008***	-0.006***	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
Above Insurance cover	0.325***	0.360***	0.423***	0.337***
	(0.047)	(0.049)	(0.057)	(0.047)
Opening balance	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.001)	(0.000)	(0.000)
loan linkage	-0.015***	-0.012**	-0.013***	-0.012***
	(0.003)	(0.004)	(0.002)	(0.002)
Change in deposits	0.003*	0.003*	0.006***	0.002**
	(0.002)	(0.002)	(0.002)	(0.001)
Change in withdrawals	0.059***	0.074***	-0.030	0.031**
	(0.015)	(0.016)	(0.020)	(0.012)
Number of transactions	0.000***	0.000***	0.000***	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)
Neighborhood controls	yes	yes	yes	yes
N	9910	9910	9993	9910
Pseudo R2	0.240	0.242	0.298	0.265