Deposit and Credit Reallocation in a Banking Panic: The Role of State-Owned Banks

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Abstract

We study a bank run in India in which private bank branches experience sudden and considerable loss of deposits, which migrate to state-owned public sector banks (PSBs) that serve as safe havens. We trace the consequences of the deposit reallocation using granular bank-firm relationship and branch balance sheet data. The flight to safety is *not* a flight to quality. Lending shrinks and credit quality improves at the run banks but worsens at the PSBs receiving the flight-to-safety flows, especially the weaker ones. The resource reallocation is inefficient in the aggregate.

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A bank run occurs when many depositors suddenly withdraw their deposits within a short period of time. Avoiding runs has been a key focus for bank regulators and supervisors because runs can trigger bank failure and cascade across banks, threatening financial stability (Calomiris and Mason, 1997; Saunders and Wilson, 1996).

Our study focuses on the *resource reallocation* triggered by runs. As motivation, consider the banking crisis in the U.S. in March 2023, when three major banks – Silicon Valley Bank, First Republic Bank, and Signature Bank – failed due to runs (Acharya et al., 2023). This caused an "unprecedented flight to safety of deposits..." (Caglio, Dlugosz and Rezende, 2023) from regional banks to banks perceived as safer When such reallocation of deposits occurs from run banks to safe havens, what are its onward consequences – for banks, bank borrowers, and the real economy? While it is too early to evaluate the fallout of this recent deposit reallocation episode in the U.S., we provide some answers to the question posed from a historical bank run with a similar flight to safety.

Briefly, our setting is a significant run that occurred in the Indian banking system after the 2008 global financial crisis. We use granular branch-level data to identify runs, characterize the resource reconfiguration it triggers across the banking system, and assess real effects using both branch-level balance sheet data and additional microdata on bank-firm linkages and firm financials. Two lessons emerge from our analysis. One, a flight to safety is *not* a flight to quality. Two, and relatedly, while much of received research (correctly) focuses on banks facing runs, the aggregate effects of runs also depend on the recipients of the run flows, and in particular, the nature and the quality of the reintermediation offered for the windfall surpluses.

The run we study occurs in the aftermath of the 2008 global financial crisis when some branches of private banks in India experience a sudden and rather extreme loss of deposits. India's state-owned "public sector" banks (PSBs), the safe-haven destination for the run outflows, see a surge in stable deposit funding. A unique feature of our study is that we have two micro-level datasets on both the private banks losing run resources and the PSBs that gain the flight-to-safety flows. A proprietary branch-level dataset, which India's central bank shared with us, lets us identify runs, the related resource flows, and markers of credit quality at the branch level. A second dataset on bank-firm relationships, which we obtain from statutory filings, lets us analyze the real side consequences of the runs. We find that lending becomes more disciplined at the private banks that are run but credit quality worsens at the PSBs receiving the run surpluses, particularly in the weaker PSBs. In the aggregate, allocative efficiency worsens, impairing productivity growth. In other words, the run does not just reallocate – but *misallocates* resources.

Two key features help frame our analysis. One, the formal protection for Indian bank depositors is very limited and offers little comfort to panicked depositors (Iyer and Puri, 2012). A second feature is the presence of state-owned public sector banks (PSBs) in India, which are credible safe havens for the run flows. The Indian government holds large direct stakes in PSBs, 70% on average. In addition, the state exercises significant control over all aspects of PSBs, including director appointment, strategic and operational planning, as well as hiring, pay, retention, rotation, and promotion of employees at all levels. Finally, India's Banking Regulation Act obliges the Indian government to fulfill the obligations of PSBs in the event of bank failure. How this support plays out in practice is untested but the clause adds comfort to the perceived safety of PSBs. Thus, depositors fleeing private banks could reasonably regard PSBs as safe repositories for their funds.

We start with the "Basic Statistical Returns" (BSR) dataset, which is compiled annually at the branch level. This level of granularity is important as we study runs at the branch level within a bank. That is, we identify *intra-bank* runs, a unique variety of "silent runs" (Baron, Verner and Xiong, 2020), which have significant real consequences that we show here. In our study, fiscal year t refers to the 12-month period ending on March 31 of the calendar year t. We define a bank branch as having a run if it experiences extreme deposit flight in fiscal 2009, which brackets the 2008 Global Financial Crisis (GFC).

We use three criteria to identify extreme deposit losses. We require that the 2009 deposit growth rate of a bank branch be less than growth predicted on an out-of-sample basis, be below the 5th percentile of growth rates in 2007 and 2008, and transition from being above the 5% left tail cutoff in 2008 to below this cutoff in 2009. Simple descriptive statistics show that our filter identifies branches with extreme deposit losses in 2009. The median growth in deposits for run branches flips from +25% to -25% in one year while the 99th and 1st percentiles of deposit losses are -14% and -89%, respectively. Fixed effects regressions confirm these patterns.

We find that private bank branches facing runs lose deposits across current, savings, and term deposits. PSB branches within the run geography gain deposits, in particular, the more stable term deposits. An interesting sample includes private bank branches that are *not* run but are present in the run district. These branches show no deposit gains. Thus, the state ownership of the destination banks and the protection it confers does seem central to panicked depositors seeking safe havens.

We find that runs impact credit. The direct effect is in the run branches, which contract credit. The result is consistent with the view that banks face frictions in raising external finance, so deposits lost in runs are not easily replaced (Kashyap and Stein, 1995, 2000). An equally interesting question is what happens outside the run geographies. Because the banks in our sample operate nationally, runs in select geographies can have bank-wide repercussions outside the run regions. To assess these effects, we define "run exposure" as the fraction of a private bank's deposits subject to runs. For state-owned PSBs, the run exposure variable is the weighted average of its deposits in the districts subject to runs.

For private banks facing runs, credit – particularly non-agricultural credit less subject to oversight and regulation (Cole, 2009*b*) – decreases significantly both within and outside run regions. In contrast, credit increases at the state-owned PSBs receiving more run inflows. Perhaps more interestingly, we also find changes in credit quality. Non-performing assets (NPAs) decrease at the run banks, indicating the disciplinary effects of runs (Calomiris and Kahn, 1991; Diamond and Rajan, 2001). However, NPAs increase, i.e., credit quality worsens, at the PSBs receiving run flows.

The results are consistent with the view that state ownership, which lets PSBs act as safe havens for panicked depositors seeking safety in times of stress, also shelters PSBs from deposit market discipline Thus, the PSBs make poor lending choices with the surpluses that they attract. As Jensen (1986) notes, excess free cash flow leads to inefficient investment in corporations, due to the agency problem of insufficient managerial ownership. Here, the agency problem comes from *excessive* (state) ownership, which lets PSBs access stable low-cost external financing via deposits, shielded from market discipline.

We turn to firm-level tests next. Here, we exploit a special database maintained by India's Ministry of Corporate Affairs (MCA) on bank-firm relationships drawn from security interest filings (Chopra, Subramanian and Tantri, 2021). We match the MCA data with firm-level identifiers in the CMIE Prowess financial database. We find that at the firm-bank level, firms exposed to run banks (through their lending relationship) are more likely to exit these relationships. Credit to these run-exposed borrowers decreases. Conversely, credit increases for firms banking with state-owned banks that benefit more from the run surpluses. Firms in the latter group get more credit but of weaker quality. They are more likely to have future interest coverage ratios below 1.0 – indicating impaired credit quality – and witness lower sales and capital growth.

We next examine the aggregate consequences of the run. Following Hsieh and Klenow (2009), the dispersion of marginal productivity of capital indicates deterioration in allocative efficiency. We find that productivity dispersion increases in industries more exposed to runs. Using the approach suggested by Sraer and Thesmar (2023), we assess outcomes relative to a no-run counterfactual. The estimates show that aggregate productivity declines by about 5%. We also find that the results mainly reflect within-sector effects, i.e., continued lending to weak firms within a sector rather than reallocation across industries.

We present additional results on deposit flights to safe havens. One test exploits the exogenous variation in the exposure of private banks to the presence of state-owned banks. In 2005, India's central bank liberalized branch licensing rules selectively across geographies, using cutoffs based on per-capita bank branch density (Young, 2017; Cramer, 2020). This policy generates a regression discontinuity design for the exposure of private banks to PSBs. We find that private sector deposits are more flighty in districts with greater exposure to state-owned PSBs.

What about the variation within the state-owned PSBs? We conjecture that weaker state-owned banks are more likely to draw the run flows. The economic intuition is the weaker PSBs should be more likely to exploit the implicit put due to state ownership to attract flows. (Acharya et al., 2017) suggest a measure of a bank's weakness, the Marginal Expected Shortfall (MES).[1] We find that weak PSBs with greater MES are more likely to expand lending in response to runs, and their loans have poorer ex-post performance. We

[1] MES is the negative of the average returns of a stock given that the market return is below its 5th-percentile during the period 1st January 2007 to 31st December 2007.

obtained data on deposit rates and find that the weaker PSBs have higher deposit rates. The evidence indicates that the presence of PSBs makes private bank deposits flighty (Business Line, 2008). In fact, press reports (Business Line, 2008) indicate that deposit-chasing by weaker PSBs became so rampant that the central government had to step in to curb it. These results, coupled with the absence of run deposit migration to other private banks, suggest that the state ownership of banks makes them credible as safe havens but also results in negative aggregate economic effects.

We proceed as follows. Section I describes the institutional details and the data. Section II examines deposit and credit growth triggered by the runs. Section III analyzes firm-level outcomes and the aggregate allocative effects of the run. Sections IV and V provide additional evidence from the exogenous entry of banks and the variation *within* PSBs. Section VI discusses the related literature. Section VII concludes.

I Institutional Details and Data

India has two major types of banks: private banks and state-owned or public sector banks (PSBs). Among the PSBs, the State Bank of India, formed in 1806, is the oldest. The other PSBs, formed through two nationalization waves in 1969 and 1980, are also old, with an average age of about 80 years. Both PSBs and private banks are licensed to operate across the country. The PSBs have a combined 70% market share of banking assets, while a 28% share is with private banks, primarily the "new private banks" formed after India's 1991 liberalization (Mishra, Prabhala and Rajan, 2022).

The run episode we analyze occurs around the 2008 global financial crisis (GFC). The collapse of reputed financial institutions such as Lehman Brothers and Bear Stearns triggered worldwide panic. India was no exception. The shock led depositors to move from private to public sector banks. Figure I depicts this effect using publicly available bank-level data. The solid line dates the Bear Stearns rescue in March 2008. The dashed line dates to the September 2008 bankruptcy of Lehman Brothers. While the pre-crisis deposit growth rates are similar for PSBs and private banks, stark differences emerged as the GFC took root with the Bear Stearns collapse in March 2008.[2]

I.A State Support for PSBs

India's 1949 Banking Regulation Act states that all obligations of PSBs will be fulfilled by the Indian government in case of failure. The government is an active shareholder, involved in all important aspects of PSB operations. On the financial side, the government periodically injects capital to recapitalize PSBs. For example, it infused about INR 31 billion (approximately $0.5 billion) in 2009 through budget appropriation (World Bank, 2009). These features make PSBs credible safety nets for depositors.

Deposits at PSBs and private banks are insured by India's Deposit Insurance and Credit Guarantee Corporation (DICGC). However, the coverage (INR 0.1 million or about $2000) per depositor per bank in 2007, is quite limited and depositors face delays in processing deposit insurance claims. Not surprisingly, the insurance program has not mitigated the propensity to run (Iyer and Puri, 2012). In addition, because Indian sovereign paper was available only for banks and other large institutions, PSBs were perhaps the only accessible safe havens for depositors fleeing private banks.[3]

[2]While the exact reason for the run is not critical for our analysis, panic seems to be a key element, given that Indian banks had little exposure to the U.S. mortgage securities market at the root of the mortgage crisis, e.g., Acharya and Richardson (2008). Note that the aggregate data are only at the bank level and not at the level of the branches that faced deposit flights.

[3]Private banks held state support as being responsible for the 2008 deposit flight and thus lobbied for an increase in deposit insurance to level the playing field (LiveMint, 2011). On February 4, 2020, more than a decade after the run episode we analyze, the deposit insurance coverage was increased to INR 500,000.

I.B Data

Branch-level data on deposits and credit come from the "Basic Statistical Returns" (BSR) dataset maintained by India's central bank, the Reserve Bank of India (RBI). The BSR data are annual as of March 31, the financial year-end for banks. Thus, fiscal 2009 refers to the financial year ending on March 31, 2009. The geographical marker for a branch is a district, which is roughly comparable to a US county. It is reasonable to view the PSBs in a district as safe-haven destinations for depositors fleeing private banks. The BSR data identify agricultural and non-agricultural loans. Banks have more discretion over the latter as agricultural lending is politically sensitive (Cole, 2009*b*).

We obtain aggregate bank-level variables as either the sum of individual branch-level data or from annual audited financial statements in the Prowess DX database compiled by the Center for Monitoring the Indian Economy (CMIE). The Prowess DX data also provides financial data for corporations that we use in the firm-level analyses. Please see Appendix Table B.1 for more details on variables used in our analysis. A third database is a loan-level dataset compiled by the Ministry of Corporate Affairs, which identifies bank relationships using security interest filings (Chopra, Subramanian and Tantri, 2021), akin to those in the U.S. analyzed by Gopal and Schnabl (2022). Table I provides the summary statistics of the variables used in our analysis.

II The Deposit Run

We define a bank branch as having a run if it satisfies three criteria.

Criterion 1 requires that the branch deposit growth rate is less than its out-of-sample predicted value, which we estimate using a regression. The data are from pre-2006, one year prior to the run. The explanatory variables are the lagged log branch assets, the branch age, a dummy variable for whether the branch is in a rural district, the lagged credit-to-deposit ratio and a dummy variable for whether the bank is state-owned.

Criterion 2 attempts to identify an extreme left tail in deposit growth. We require that the fiscal 2009 branch deposit growth rate is below the 5^{th} percentile of the distribution of branch growth rates in the pre-run year (fiscal 2008).

Criterion 3: Define p_5 as the 5^{th} percentile of deposit growth rates for private banks in 2008, one year before the run. We require that a branch is not in the left tail of deposit growth rates g in 2008 but has a left tail event in 2009, i.e., $g_{2008} > p_5$ but $g_{2009} < p_5$.

In our sample, about 0.7% of all branches face runs. Figure II shows a heat map in which lighter shades (whites) correspond to more run-prone regions. For private banks (Panel (b)), more regions have low deposit growth relative to PSBs (Panel (c)). Internet Appendix Figure C.1 shows that our screens identify left tail events in 2009 for private banks relative to 2008. Descriptive statistics in Internet Appendix Figure C.2 show that run branches are significant contributors to deposit-raising activities. They are located in regions with a greater presence of PSB branches, making it easier for panicked depositors to move funds to PSBs. At the bank level, the run banks are weaker as per the marginal expected shortfall (MES) criterion (Acharya et al., 2017).

II.A Event Study Evidence on Deposits

We begin by estimating an event-study regression

$$Y_{jbdt} = \alpha_j + \theta_{dt} + \gamma_{bt} + \sum_{\tau} \eta_\tau \times \mathbb{1}_\tau \times \mathbb{1}_{(Run_j)} + \epsilon_{jt}, \tag{1}$$

where the dependent variable Y_{jbdt} is the annual deposit growth for branch j of bank b in district d for fiscal year t, α_j, θ_{dt}, and γ_{bt} are branch, district-time, and bank-time fixed effects respectively, and $\mathbb{1}_\tau = 1$ if the fiscal year is τ (ranging from 2002 to 2011).

If the run and non-run branches have similar (parallel) trends before the run year, we should find that the coefficients η_τ are close to zero in the pre-run period. Figure III shows that this is the case in both the specifications with and without bank-time fixed effects. Figure III also shows a sharp decline in deposits for the branches we identify as having a run in fiscal 2009. The coefficients stabilize after the initial 2009 drop.

II.B The Run: Deposit Losses

We analyze deposit growth in the post-run period using the following specification:

$$Y_{jbdt} = \alpha_{bt} + \gamma_{dt} + \beta \times \text{Branch run}_j + \eta \times X_{jbdt} + \epsilon_{jbdt}, \quad (2)$$

where Y_{jbdt} is the annual deposit growth rate for a given branch j of a bank b in district d for time t between 2009 to 2011. The variable Branch run_j is an indicator for whether a branch j has a run. α_{bt} and γ_{dt} are bank-year and district-year fixed-effects respectively. X_{jbdt} are the control variables, which include branch characteristics and their interaction with a time trend from 2009 to 2011.[4] We obtain branch characteristics from the BSR dataset made available to us. We include the 2008 credit-to-deposit ratio. A high value of this ratio signals that the branch is deposit-constrained. We also include the percentage of skilled officers in a branch. The greater placement of skilled officers may indicate a branch with better growth prospects.. Robust standard errors are clustered at the branch level. The results are similar if clustered at the district level.

[4]The specification is akin to that used in Alencar (2016) and Drechsler, Savov and Schnabl (2021), in which the post-period is the focus of the primary analysis and the pre-period is used to control for parallel trends. In unreported results, we find that alternate specifications that include the pre-period data yield similar results. Because runs are at the branch level, controls are at the branch-year level.

Table II reports the estimates of equation (2). The key coefficient of interest is β, which estimates the deposit growth for run branches relative to the remaining branches of the *same* bank. The estimates of β are negative and significant, indicating that our run definitions appear to identify run branches even after including controls and a rich of fixed effects, and in a sample that also includes PSBs. Column (2) in Table II reports similar negative and significant estimates but for a sample comprising private sector banks alone. Placebo tests reported in the Internet Appendix Table D.1 show that the run results are not typical of non-run years.[5]

II.C Deposit Flights to PSBs

Our local geographic unit is a district, a region that is roughly akin to a US county. A district is an economically integrated region placed administratively under a "collector," a bureaucrat appointed by the government. We use the districts demarcated by the Indian Census in 2001, which are relevant for the time period covered by our sample. To assess deposit flights to PSBs, we construct variable $\textit{District Exposure}_d$, the negative of the deposit growth of the run branches in district d. The greater its value, the greater the deposit flight in district d. We estimate the following specification for 2009, the run year, and the next two years.

$$Y_{jbdt} = \alpha_{bt} + \kappa_{dt} + \eta \times \textit{District Exposure}_{jd} \times PSB_b + \gamma \times X_{jbdt} + \epsilon_{jbdt} \tag{3}$$

The key outcome variable Y_{jbdt} is the deposit growth rate for branch j of a bank b in district d in year t, while α_{bt} and κ_{dt} are bank-year and district-year fixed-effects, respec-

[5] We show that there is no difference in deposit growth between run and non-run branches in fiscal 2005, 2006, and 2007. Branches in the left tail of fiscal 2005 (as placebo) show no extreme deposit losses in 2009.

tively. X_{jbdt} denotes both branch-level controls and (for parsimony) district-level controls and their interactions with a time trend. The branch characteristics (X_{jbdt}) from the BSR datasets include an indicator for whether a branch is deposit-poor (below-median deposits in 2008), the percentage of skilled officers, and the fiscal 2008 credit-to-deposit ratio. The district-level controls are the fraction of its urban population, their average age, the unemployment rate, and the average weekly wages of households in 2008. Robust standard errors are clustered at the district level.

The coefficient of interest in Equation (3) is η. We report $\eta * 100$, the impact on the outcome variable, say deposit growth, due to a 1 percent decline in the deposit growth of private sector branches with runs in the district. Table III reports the results. In column (1), the sample includes all branches, and the specification has bank-time fixed effects, so the coefficient η compares a branch in a district with high exposure to runs with another branch of the *same* bank with low exposure. The negative and significant estimate of η shows that branches in districts with greater run exposure lose deposits. The interaction term of district exposure and its interaction with a PSB dummy variable is positive and significant, so the inflows are driven by a deposit flight to PSBs, while the negative coefficient for *District Exposure* shows that private bank branches suffer net deposit losses. Column (3) reports the specification for PSB branches alone and finds similar results. Column (2) includes a more demanding specification with district-time effects in equation (3), which absorbs *District Exposure* and isolates the flows to PSB branches after absorbing district heterogeneity. Here too, the PSB coefficient for run exposure is positive, significant, and similar in magnitude to that in column (1).

Were *private* bank branches – rather than PSBs – the beneficiaries of run flows? We examine this proposition through an analog of specification 3 in Table III. The results are in column (4), which restricts the sample to private bank branches that did not face runs. The deposit growth coefficients are insignificant, and an order of magnitude smaller than those for PSBs. Thus, state ownership is crucial in attracting flight-to-safety flows.

Figure IV shows another point of interest. The left Panel (a) reports estimates of the run coefficients β from Equation 2 for different types of deposits. Private bank branches lose demandable current deposits that are typically held by firms. Savings deposits, short-term savings set aside by small retail customers, do not seem as flighty as current accounts. Term deposits, which could be in jeopardy if the bank is in distress, witness greater flights. The right Panel (b) reports the corresponding equation (3) estimates of η. The deposit gains by PSB branches with greater exposure to private branch runs are in the more stable savings and term deposits, perhaps due to proactive deposit-seeking by weaker PSBs. We return to this point in Section V.

II.D Credit Quantity

Runs at a branch deplete its resources. If the bank does not have frictionless access to external funds (e.g., (Kashyap, Stein and Wilcox, 1993; Kashyap and Stein, 2000)), local deposit losses can translate into credit losses, both locally and bank-wide, given that banks operate nationally. Conversely, for PSBs, windfall inflows can translate into extra lending. To estimate these effects, we develop the following metrics of exposure to runs, one for private banks and another for PSBs.

$$Private\ bank\ exposure_b = \sum_{j \in b} \frac{\text{Deposit}_j}{Deposit_b} \times Branch\ Run_j \quad (4)$$

$$PSB\ exposure_b = \sum_{j \in b} \frac{Deposit_j}{Deposit_b} \times District\ Exposure_{jd} \quad (5)$$

where b denotes a bank, *Branch Run*$_j$ is an indicator for whether branch j experienced a run, District Exposure$_{jd}$ is (as before) the negative of the deposit flows at the private sector bank branches that had a run in district d in which PSB branch j is located. The weights are based on fiscal 2007 (pre-crisis) deposits, and the measure is standardized (z-scored) for easy interpretation. The two exposure variables have symmetric interpretations. Because one type of entity faces outflows while the other finds itself with surpluses, the exposure captures outflows (inflows) for the private (public sector) bank indexed by b.

The specifications to assess run effects outside the run geographies follow. They are:

$$Y_{jbdt} = \alpha_{dt} + \gamma \times \textit{Branch Run}_j + \beta \times \textit{Private bank exposure}_b + \eta \times X_{jbdt} + \epsilon_{jbdt} \quad (6)$$

$$Y_{jbdt} = \tau_t + \gamma \times \textit{District Exposure}_{jd} + \beta \times \textit{PSB exposure}_b + \eta \times X_{jbdt} + \epsilon_{jbdt} \quad (7)$$

where, Y_{jbdt} denotes credit growth in branch j of bank b in district d and year t, X's denote controls and interactions as in equation (1) and the exposure variables are as defined in equations (4) and (5). We include district-year fixed effects α_{dt} as strong controls for local heterogeneity except, of course, in one specification that includes a district-level invariant (*District Exposure*). Standard errors are robust and clustered at the district level.

Table IV reports the estimates. In column (1), we see that the coefficient for *Branch Run* is negative and significant. Thus, branches facing runs contract credit with a direct effect of -15.1 pp for a one-SD increase in the run exposure. For robustness, column (2) includes bank-year fixed effects, which absorb the (bank level) private bank exposure variable. The own effect is of similar magnitude. Returning to column (1), we find that the coefficient for *Private Bank Exposure* is negative and significant, indicating that a run in a branch has a bank-wide effect outside the run geography. The indirect effect is a 2.25 pp decrease in credit growth. Columns (3) and (4) report analogous specifications for PSBs. We see significant credit growth for PSBs, both bank-wide and in run geographies, respectively.[6]

It is also instructive to compare the point estimates in Column 2 of Table II with those in Column 2, Table IV. We find that an INR 1 decrease in branch deposits is associated with a lending decline of INR 0.77. Similarly, comparing the estimate from column 4 in Table III to the column 4 estimate in Table IV, indicates an INR 1 increase in run-inflow-related deposits at PSBs leads to an INR 0.84 increase in branch credit.[7]

We also report in the Internet Appendix Table D.2 a coarse specification relating bank-level outcomes to bank run exposure (derived from branch data):. The specification is

$$Y_{bt} = \theta_t + \beta \times \text{Bank Exposure}_b + \gamma \times X_{bt} + \epsilon_{bt}, \tag{8}$$

where y_{bt} is the growth in credit for bank b in year t, θ_t is a time-fixed effect, and X_{bt} denote bank-level controls, which include banking density as reflected in ATMs per capita, the FY 2008 gross NPA by gross advances, the capital-to-risk-weighted assets ratio, and the interaction of the last two controls with a time trend. Briefly, we find that deposit growth slows at private banks and increases at PSBs. Credit contracts at private banks, but we find weaker evidence of credit expansion at PSBs, reinforcing the value of using branch-level data rather than bank aggregates in assessing run outcomes.

[6] The credit cutback at private sector branches and the credit disbursed at PSBs are comparable. In our sample, 0.7% of the private branches are classified as having runs. Of the total deposits at PSBs and private sector banks, PSBs constitute 77% of deposits. The run branches cut credit by 15.107% and by 2.254% across all branches of the exposed private sector banks (column 1). The average across the entire branch system = 15.107%*0.7% + 2.254%*99.3% = 2.34%. The PSBs constitute 77% of deposits, so their gains should be 0.7%(=2.34%*(1-0.77)/0.77), which is the same order of magnitude as the 0.89% in column (3), Table IV.

[7] These estimates are similar to those in a different setting in Paravisini (2008). He estimates that loans increase by $0.66 for every dollar of additional external financing at the monthly horizon and $0.82 at the yearly horizon in Argentina. In a developed country setting, Drechsler, Savov and Schnabl (2017) estimate that a $1 increase in deposits leads to a $0.57 decline in lending.

We close the section with some evidence on the *within*-organization reallocations triggered by runs, a subject of interest in corporate finance (e.g., (Lamont, 1997; Campello, 2002)) although not a focus in our study. We examine which branches cut back lending more in response to the resource deficit created by the run. We consider a branch's credit-to-deposit (C/D) ratio, which is an indicator of the lending opportunities available to the branch. Internet Appendix Table D.3 provides the results. We see a clear difference between PSBs and private bank allocation decisions. While PSBs expand lending more in the branches with low C/D ratios, private banks cut less in branches with greater credit-to-deposit ratios. The results are suggestive of resource misallocation, a question that we will turn to shortly with granular firm-bank relationship data.

II.E Credit: Quality

India's central bank, RBI, provided us with data on markers for non-performing assets (NPAs) at the branch level. Impaired loans are marked as substandard, doubtful, or loss.[8] We analyze the relation between loan quality and run inflows or exposures.

We report the additional results for versions of equations (6) and (7) applied to NPAs, in Table V. Briefly, we find that NPAs shrink at the private sector banks experiencing runs. At PSBs, there is an interesting difference between agricultural and non-agricultural lending.[9] Specifically, the run-related NPA coefficients are more significant for the *non-agricultural* sector both in the run districts and beyond. These results suggest that unexpected surpluses in runs flow to unproductive non-agricultural lending by PSBs.[10] An-

[8] In our sample period, substandard loans are delinquent for between 90 days and two years. Doubtful loans have no repayments for more than two years. Loss loans are loans that are written off.

[9] The analysis only covers all branches that report agriculture=-non-agricultural split.

[10] These results are in columns (1) and (6). It is reasonable to ask why agricultural NPAs don't expand. This is a political economy question. In India, farmers enjoy frequent support from the state, e.g., through interest "subvention" or loan waivers in which the state or central government repays loans. See, e.g.,

other indicator of credit quality is the level of stressed assets, or NPAs plus restructured assets, which is available only at the bank level. Internet Appendix Table D.4 shows that the patterns are similar. Private banks with greater run exposure had less growth in stressed assets, a disciplining effect that we do not see in PSBs.

In sum, we find both credit quantity and credit quality effects associated with the run. Private banks facing runs contract credit and improve loan quality. PSBs that served as safe havens for the run inflows have worsening credit quality. We next turn to the aggregate effects of this resource reallocation by exploiting data on bank-firm linkages.

III Aggregate Effects

We turn to a firm-level analysis next. The tests contrast the credit impacts for firms exposed to banks facing runs with those for firms with PSB relationships. We then assess the aggregate effect across firms from the resource reallocation due to the run. The data on firm-bank relationships come from security interest filings with the Ministry of Corporate Affairs (MCA), which we combine with financial data from the CMIE Prowess database.[11]

III.A Changes in Credit Relationships

We estimate the following specification for firms f borrowing from bank b:

$$\Delta Y_{fb} = \omega_f + \beta \times \mathit{Private\ Bank\ Exposure}_b + \gamma \times \mathit{PSB\ Exposure}_b + \eta \times X_{fb} + \epsilon_{fb} \quad (9)$$

https://www.pradhanmantriyojana.co.in/agriculture-farmers-welfare-schemes.

[11] We exclude industries with the 2-digit National Industrial Classification code (NIC) codes between 01-03, 45 or 47, and 69-75, corresponding to agricultural, wholesale and retail trade or repair of motor vehicles and motorcycles, and professional, scientific and technical activities, respectively.

For the intensive margin tests, the dependent variable is the log change in (1+credit) for a firm-bank pair across the same periods. For the extensive margin, the main dependent variable of interest is relationship exit, which occurs if there is a recorded relationship between 2006 and 2008 but none in 2009-2011.[12] The exposure variables and bank controls are as in equations (4), (5), and (8). We cluster robust standard errors at the bank level.

Table VI reports the results. Columns (1) and (2) of Panel A show the intensive margin results, that is the log change in credit to firms. In column (1), we find that a one-SD increase in private bank run exposure results in a 17.7% contraction in credit but there is no such effect on PSB credit. For the results in column (2), we include firm fixed effects, following in spirit the Khwaja and Mian (2008) design that compares the same firm borrowing from different banks. For a firm borrowing from two private sector banks, there is a greater decline from the more exposed private sector bank relative to the private sector bank with lower exposure. The point estimates remain similar to those in column (1). Firms linked to exposed private sector banks appear to be more likely to exit banking relationships (columns (3) and (4)).

III.B Firm-Level Outcomes

To assess firm-level outcomes, we estimate:

$$\Delta Y_f = \alpha_{f(i)} + \beta \times \textit{Private bank exposure}_f + \gamma \times \textit{PSB exposure}_f + \epsilon_f \tag{10}$$

for a firm f in industry i. The dependent variables include the log change in (1+credit) from 2006-2008 to 2009-2011, the change in revenue and capital, scaled by pre-period

[12]For completeness, we also report results for entry, viz., new relationships formed in 2009-2011; these results are not significant.

assets, and foreshadowing the variables used in analyzing the aggregate reallocation effects, the ratio of sales to gross fixed assets. The public and private exposure variables are aggregated to the firm level using pre-run lending as weights. All regressions include 3-digit NIC industry fixed effects. Standard errors are clustered at the industry level.

Table VI, Panel B presents the results. In the first column (row (1)), we find that the estimate of β is negative. Thus, credit contracts for borrowers who rely on run-exposed private banks. From columns (3) and (4), we see that these firms experience a decline in capital and capital productivity. In row (2), the specification for PSBs, we find that the estimate of γ is positive, so credit flows more to borrowers of PSBs benefitting more from run flows. However, we do not see the capital or productivity impairment that we noted in private bank borrowers, nor any improvement in investment or productivity as a result of the increased borrowing from PSBs.

We analyze the heterogeneity in the results by interacting the exposure variables with an indicator *TOP* denoting whether the 2008 productivity of capital is in the top two terciles (we get similar results if we use the top tercile). Panel C of Table VI reports the results. The results in column (1), rows 1-4, show that the aggregate credit from private banks (PSBs) contracts (expands). However, as the results in rows 5-8 show, the contraction at private banks is less for the more productive firms, while the expansion of credit at PSBs is greater for the less productive firms. The upshot is the greater dispersion of productivity (MRPK).

The results in column (4) show that there is a 21 pp MRPK decline at high-productivity firms linked to exposed private sector banks. There is weaker (10% significance) evidence of gains at the PSB counterparts, but in any event, these firms get *less* credit relative to their less productive counterparts in the same bank (column (1)). Thus, the worse marginal lending decisions at the PSBs gaining run resources seem to drive the increases in non-performing assets shown earlier in Table V.[13]

III.C Aggregate Effects of Reallocation

In the previous section, we showed that the resource reallocation triggered by the run impacts bank borrowers. Is there an aggregate real effect? We examine this issue using the methods recently developed by Sraer and Thesmar (2023), in which the aggregate effect depends on three moments of log-MRPK (marginal productivity of capital): the variance of log-MRPK, the mean of log-MRPK, and the covariance of log-MRPK and sales. We estimate these as:

- $\Delta\Delta\sigma^2(s)$, the difference-in-differences estimate of the effect of an event on the variance of log-MRPK in a given industry s, or the change in MRPK variance for firms in the industry s relative to those in unaffected (or less affected) industries.

- $\Delta\Delta\mu(s)$ is the difference-in-differences estimate of the effect of the event on the mean log-MRPK in industry s.

- $\Delta\Delta\sigma_{MRPK,py}(s)$ is the difference-in-differences estimate of the effect of the event on the covariance between log output and log sales in the industry s.

Empirically, we proceed as follows. We have 100 unique industries identified by their 3-digit NICs, thus giving 200 before-after observations. As in Sraer and Thesmar (2023), the output-to-capital ratio, log-MRPK, at the firm level is the log of the ratio of sales to the gross book value of total assets, averaged over the pre- and post-periods, 2006–2008 and

[13] Internet Appendix Table D.5 shows that there is little difference in the *ex-ante* firm quality between PSBs and private banks.

2009-2011, respectively, in our case.

$$M_{ind,t} = \alpha_s + \beta_M \times \text{Private bank exposure}_s \times Post_t$$
$$+\gamma \times \text{PSB exposure}_s \times Post_t + \eta \times Post_t + \epsilon_{ind,t} \quad (11)$$

where s is the industry in period t. All specifications include industry-fixed effects, and standard errors are clustered at the industry level.

Table VI, Panel D presents the estimates of equation (11). In column (2), we find that industries with high exposure to run PSBs see an increase in the variance of log-MRPK, i.e., the dispersion in productivity, the usual indicator of inefficient capital allocation. Interestingly, this effect is not significant for private-sector bank exposure. Because we omit industry-fixed effects in column (1), we can compare exposed and unexposed industries in the pre-period. The insignificant coefficient for the exposure term without interactions shows that the differences are not significant. Columns (3), (5), and (6) show that the pre-period differences in other moments are not significant. In column (4), we note a weakly (10%) significant effect on average log-MRPK, whose aggregation we turn to next.

We estimate all three specifications required for the aggregation exercise.[14] For the approach to be well-specified, the distribution of log-MRPK should be normally distributed, which we verify in the Internet Appendix Figure C.3. Using the calibration parameters in David and Venkateswaran (2019) and Sraer and Thesmar (2023), we set the capital share in production to 0.33, the price elasticity of demand to 6.0 corresponding to $\theta = 0.83$. ϕ_s is the pre-period share of sales of industry s and κ_s is its pre-run period share of capital.

[14] The estimates are $\Delta\Delta\sigma^2(s) = 0.782 \times \text{PSB exposure}_s - 0.182\times$ Private bank exposure$_s$, $\Delta\Delta\mu(s) = 0.047 \times \text{PSB exposure}_s - 0.098 \times \text{Private bank exposure}_s$, and $\Delta\Delta\sigma_{MRPK,py}(s) = -0.071 \times \text{PSB exposure}_s + 0.070 \times \text{Private bank exposure}_s$.

The aggregation to obtain the overall change in total factor productivity (TFP) is:

$$
\begin{aligned}
\Delta \log(TFP) \approx & \underbrace{-\frac{\alpha}{2}\left(1+\frac{\alpha\theta}{1-\theta}\right)\sum_{s=1}^{S}\kappa_S\widehat{\Delta\Delta\sigma^2}(s)}_{\text{-4.91\%}} \\
& \underbrace{-\frac{\alpha}{2}\left(1+\frac{\alpha\theta}{1-\theta}\right)\sum_{s=1}^{S}(\phi_S-\kappa_S)\left(\widehat{\Delta\Delta\mu(s)}+\Delta\Delta\sigma_{\widehat{MRPK,py}}(s)+\frac{1}{2}\frac{\alpha\theta}{1-\theta}\widehat{\Delta\Delta\sigma^2}(s)\right)}_{\text{-0.08\%}} \\
& \approx -4.99\%
\end{aligned}
\tag{12}
$$

The effect on aggregate output can be calculated using the following equation:

$$
\Delta\log(Y) \approx -\frac{\alpha(1+\epsilon)}{1-\alpha}\sum_{s=1}^{S}\phi_S\left(\widehat{\Delta\Delta\mu(s)}+\frac{1}{2}\frac{\alpha\theta}{1-\theta}\widehat{\Delta\Delta\sigma^2}(s)+\Delta\Delta\sigma_{\widehat{MRPK,py}}(s)\right) \approx -5.23\%
\tag{13}
$$

where ϵ is the Frisch elasticity. Using $\epsilon = 0.2$, we estimate that aggregate output declined by 5.23% due to bank runs and credit reallocation from private to public banks.[15]

IV Exogeneity in Exposure to PSBs

Does the presence of PSBs in a district make private banks more vulnerable to panic runs? We present evidence from a regression discontinuity design (RD).

In India, the branch licensing policies are set by RBI, India's central bank. On September 8, 2005, the central bank moved to quantitative formulas for branch licensing. Entry

[15] In unreported results, we also consider an alternative aggregation approach used in Blattner, Farinha and Rebelo (2019) and Osotimehin (2019). This approach estimates an 11.2% decline in aggregate productivity due to the run. A different set of (reasonable) assumptions underlie this alternative approach. We conduct this exercise as a robustness check of the approach suggested by Sraer and Thesmar (2023). These results are available on request.

was allowed in underbanked districts, which were defined as ones in which the population per branch exceeded the national average. Following the reform, private sector banks were incentivized to enter – and did enter – underbanked areas while state-owned public sector banks did not, perhaps because the PSBs were already present in areas with underserved populations. Thus, the 2005 branching rules generate exogenous variation in private branch exposure to PSBs in ways that vary across districts. See Young (2017) and recently, Cramer (2020) and Khanna and Mukherjee (2020).

To examine whether deposits are impacted by the threshold, we estimate

$$\begin{aligned} \text{PSB share}_b &= \delta_s + \beta * \text{Banked}_d + \gamma * \text{Banked}_d * f(T_d) \\ &+ \phi * (1 - \text{Banked}_d) * f(T_d) + \kappa X_d + \eta_d \end{aligned} \tag{14}$$

where PSB share_b denotes the deposit share of state-owned banks, T_d denotes the running treatment variable, the population per branch minus its national average, Banked is an indicator for whether $T_d < 0$, i.e., the district is not underbanked. δ_s denotes state fixed effects while X_d denotes linear and squared terms (Gelman and Imbens, 2019). We estimate the regression for fiscal 2006-2008. This is prior to the run and also has a window after the 2005 policy change to allow for realized entry by private banks. As suggested in Imbens and Kalyanaraman (2012), the RD estimation uses a triangular kernel. We use a 4.5 persons per thousand bandwidth, but results are robust to other choices suggested in the literature (e.g., Calonico, Cattaneo and Titiunik (2014); Young (2017)). The regressions are weighted by the 2001 population estimates used to define underbanked thresholds.

The fitted value of the dependent variable estimates the exposure of private sector banks to PSBs in a district accounting for the threshold discontinuity generated by the

2005 policy change. Analyzing runs is then straightforward using an IV specification.

$$\text{Deposit Growth}_{jdst} = \alpha_{bt} + \delta_{st} + \beta \times \widehat{\text{PSB share}}_d + \eta \times X_{jdst} + \nu_{jdst} \tag{15}$$

The specification includes state-year and bank-year fixed effects and also covariates X_{jdst}, viz., an indicator for whether a branch is deposit poor (below median deposits in 2008), the percentage of skilled officers, and the credit to deposit ratio in 2008 and their interactions with time trends. We weight the regressions with 2007 deposits and cluster standard errors at the district level.

We turn to the main results. In Figure V, Panel (a), we find that there is a discontinuous increase in the number of private sector bank branches at the RD threshold in under-banked districts. Panel (b) confirms that this does not occur at state-owned banks, as discussed above. Panel (c) depicts the results for deposit shares around the RD threshold: state-owned banks see a discontinuous decrease in deposit shares, reflecting the expansion of private bank shares around the threshold after the 2005 rule change. The discontinuity is economically equivalent to about 28 private sector branches and 9.71 pp in terms of deposit share.[16]

The run period results are in Table VII. In column (1), we display the estimates of the first-stage equation (14). The F-statistic is 220, indicating that the instrument is strong. The second stage regression estimates are in Column (2). Private banks in districts with greater exposure to state-owned banks are more likely to witness runs.[17]

[16] For evidence on covariate balance, see the Internet Appendix Table D.6 and McCrary plots in Figure C.4 and Internet Appendixes Table D.6, Panel (b) and Table D.7 for additional evidence and the relative insensitivity to the empirical choices for implementing the RD.

[17] Placebo results for the pre-crisis periods in the Internet Appendix Table D.8 show no such effects or pre-trends. The run period flights are special.

V Heterogeneity Within PSBs

Following Acharya et al. (2017), we classify banks based on "MES," or marginal expected shortfall. Weaker banks that have greater leverage or are more exposed to aggregate risk have greater MES. One advantage of the Indian bank setting is while the government holds majority stakes in PSBs, the outside shareholdings are traded in the market, so we can compute the MES for PSBs and all major private banks. See the Internet Appendix Table D.9 for a list of private banks and PSBs for which we can compute MES.

We ask whether the more vulnerable banks, the high MES banks, attract panic flows. The intuition for the test is that the more vulnerable banks benefit more from the protection conferred by state ownership and thus have greater marginal benefit from taking in the panic flows. Figure VI depicts the evidence on deposit flows. The more vulnerable – weaker – private banks show lower deposit growth. In contrast, weaker state-owned banks had *greater* deposit growth. Table VIII provides estimates of Equation (8), replacing the bank exposure variable with the bank vulnerability. Columns (1) and (3) show that for private banks, MES is negatively related to deposit and credit growth. Thus, vulnerable private banks are *less* likely to attract deposit flows. In contrast, columns (2) and (4) show that for PSBs, the relation reverses, with greater growth for the more vulnerable PSBs. High-MES PSBs also have greater non-performing assets in non-agricultural loans, over which the banks have more discretion but the relationship is reversed for private banks.

We obtain additional data to speak to the deposit-acquisitive behavior of the more vulnerable PSBs. See Panel B of Table VIII. The branch-level BSR data give average deposit rates in different categories, viz., deposits paying less than 5%, and in 1% increments for 5 to 15%, and finally, a bucket for deposits above 15%. The weighted average is based on the two end-points and the multiple mid-points. Private bank deposit rates do not vary with MES (columns 1 and 2). Retail deposit rates are negatively related to MES for PSBs (column (3)). However, the relationship reverses for non-retail deposits. The depositors in this segment are more sophisticated and thus, exhibit more sensitivity to bank strength and state ownership. The more vulnerable PSBs appear to understand this feature in setting deposit rates.

While we cannot say much more formally given what data are available, we also collected anecdotal evidence on the deposit-acquisition strategies of the vulnerable state-owned banks. The increase in deposit rates by these banks during the crisis to chase deposit outflows from private sector banks became so rampant that the Indian Finance Ministry had to step in to curb the behavior (Business Line, 2008). In sum, the more vulnerable PSBs exploit the safety net provided by the government guarantee in crises when the government ownership umbrella becomes more valuable for both the banks and more salient for depositors. These results add texture to our baseline point that access to government support eases funding access for state-owned PSBs, especially in crises, making stabilization more difficult.[18] Ex-post events reveal that the safety-net perceptions of depositors concerning the state's implicit guarantee were not irrational.[19]

[18]Preliminary results from the Covid-19 period are supportive of this channel. Private sector banks, which received 55% of incremental deposits in the pre-Covid periods, saw their share shrink to 30% in the Covid period. We are developing and pursuing this analysis in future work.

[19]In February 2009, the government announced capital injections in 3 state-owned banks: UCO Bank, Central Bank of India and Vijaya Bank. As part of the 2010-2011 budget, the government announced additional capital infusion in five state-owned banks: IDBI Bank, Central Bank, Bank of Maharashtra, UCO Bank and Union Bank. These injections were based on capital needs, so they effectively recapitalized the worse-performing banks. These banks are among the highest MES banks in our sample.

VI Related Literature

Given the economic importance of (avoiding) bank runs, the literature on runs is vast.[20] We add to this literature by analyzing the resource reconfiguration triggered by runs from run banks to safe havens. Our study shows how the aggregate effects of runs require consideration of not only the banks subject to runs but also those gaining run surpluses, and the two-pronged nature of the safety nets provided by state-owned banks.

The nature and consequences of the state ownership of banks have been debated in the economics literature. Shleifer and Vishny (1994) point out that the developmental and market imperfection-correcting role of state-owned banks is impaired by the possibility of political capture. See also Banerjee (1997); Banerjee, Cole and Duflo (2005); Qian and Yeung (2015); Barth, Caprio and Levine (2001); Cole (2009*a*); Dinç (2005); Shleifer (1998). We develop a related point. When state-owned banks exist alongside private banks, as in our setting, the shelter provided by state ownership, which confers protection to state-owned banks, can distort resource flows and impair credit allocation.

The broader issue of resource misallocation is the subject of a thriving literature in economics. Hsieh and Klenow (2009) show that underperforming firms exist. Reallocating resources from them to more productive firms enhances economic growth. A natural question is why misallocation exists in the first place. Implicated are poor property rights, financial frictions, trade and competition, and government regulations [21]

[20] Theoretical models of runs include Diamond and Dybvig (1983); Chari and Jagannathan (1988); Calomiris and Kahn (1991); Diamond and Rajan (2001). For empirical evidence characterizing runs, see e.g., Bernanke (1983); Saunders and Wilson (1996); Calomiris and Mason (1997); Iyer and Puri (2012); Acharya and Mora (2015); Blickle, Brunnermeier and Luck (2022); Schumacher (1998); Monnet, Riva and Ungaro (2023), and more recently, in the wake of the 2023 failure of Silicon Valley Bank, Benmelech, Yang and Zator (2023); Caglio, Dlugosz and Rezende (2023); Jiang et al. (2023).

[21] See Restuccia and Rogerson (2017) for a discussion. Related work includes Adamopoulos and Restuccia (2014); Midrigan and Xu (2014); Buera, Kaboski and Shin (2011); Bau and Matray (Forthcoming); Pavcnik

State ownership of productive assets can contribute to resource misallocation, and policies to subsidize and protect state-owned firms (possibly due to political considerations) impact the better ones in the same businesses. [22] We join this literature by highlighting an alternate channel, the distortion created by the implicit protection of deposits for state-owned banks that is not available to private banks. In developed economies, such protection is associated with size, as especially large banks are "too big to fail" (Penas and Unal, 2004; Iyer et al., 2019). We do not rely on size but identify implicit protection through state ownership and control of banks and the related banking law.

Our evidence on resource reallocation adds to three streams of research. One is about banking systems without a safety net, e.g., Argentina in the 1990s (Schumacher, 1998). Here, runs move funds from weak to strong private banks with greater credit discipline, although see Baron, Schuralick and Zimmerman (2023) for a different viewpoint. We show that outcomes worsen when state-owned banks are safety nets. We also add to recent work on "silent" banking panics without accompanying bank failure (Baron, Verner and Xiong, 2020). Our study features exactly this type of run. We analyze the resulting resource reallocation and show its effects on both the banks experiencing runs and the banks receiving run flows. We find that even silent runs do have negative effects, supporting the conservative stance towards runs taken by central banks.

Finally, runs and the resulting resource flights are a key issue confronting U.S. policymakers in the wake of the runs on Silicon Valley Bank and other institutions in March 2023 (Acharya et al. (2023), Jiang et al. (2023), Caglio, Dlugosz and Rezende (2023)). Our study highlights some issues in assessing and responding to these runs. The flight to

(2002); Trefler (2004); Hopenhayn and Rogerson (1993); Guner, Ventura and Xu (2008).

[22] See Dollar and Wei (2007); Song, Storesletten and Zilibotti (2011); Brandt, Tombe and Zhu (2013) and Hsieh and Klenow (2009) for state ownership of firms, and Banerjee and Duflo (2005); Hsieh and Klenow (2009); Geng and Pan (2022); Sapienza (2004) and Dinç (2005) on the effects on private firms.

safety is not necessarily a flight to quality. Its aggregate effect depends not only on the banks facing deposit deficits or even failing but also on those gaining deposits, and the quality and direction of the reintermediation they offer for the windfall surpluses.

VII Conclusion

We study a significant bank run episode in India in which private sector bank branches face sudden and large losses in deposits that migrate to safe public sector banks (PSBs) owned by the state. A key feature of our analysis is that we observe outcomes for both the bank branches that face runs and the ones that gain from the flight-to-safety flows. Using data on bank-firm relationships, we also assess the onward impact on bank borrowers and estimate the aggregate impact of the run.

We find that runs propagate beyond the local geographies in which they occur. Banks facing runs cut lending and their credit discipline improves. Credit expands but quality worsens at the state-owned PSBs receiving windfall run surpluses. At the firm level, credit contracts for borrowers with relationships with run banks. While credit expands for firms borrowing from the run beneficiaries, these firms perform worse ex-post. The aggregate reallocation effect is negative, with productivity growth impaired by about 5%.

An important thread in our study is that while the banks facing runs and their clientele have been the principal focus of research and policy on bank runs, what also matters is how the flight-to-safety flows are re-intermediated back to the real economy. In our study, reintermediation occurs through state-owned bank branches, the weaker ones. They seem to bear greater responsibility for the negative aggregate effects of the run. A policy implication is that while government support is (correctly) seen as a source of financial stability during a crisis, its provision is not free of costs. In the instance we study, the support that lends stability also shelters banks from discipline in the funding market, leading to lax credit allocation.

In our specific setting, the variation in the ownership structure between state-owned and private banks results in a clear marker of differential government support. It seems interesting for further empirical inquiry to test the plausible hypothesis that our conclusions carry over to other settings with differential access to government support, such as for too-big-to-fail or too-systemic-to-fail banks vis-a-vis other banks, and for government-sponsored enterprises vis-a-vis private financial institutions.

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Figure I: Time Trends in Deposits of Private and State-Owned Public Sector Banks in India

This figure shows the quarterly deposits for private and state-owned public sector banks, respectively, from 2007 to 2012, where year is the fiscal year ending on March 31. Deposits are normalized to 1 as of December 2007 (i.e., quarter 3 of fiscal 2008). The solid vertical line represents the date of the Bear Stearns rescue in March 2008. The dashed vertical line dates the bankruptcy of Lehman Brothers in September 2008. Data for quarterly deposits are from the publicly available "Database on Indian Economy" provided by the Reserve Bank of India.

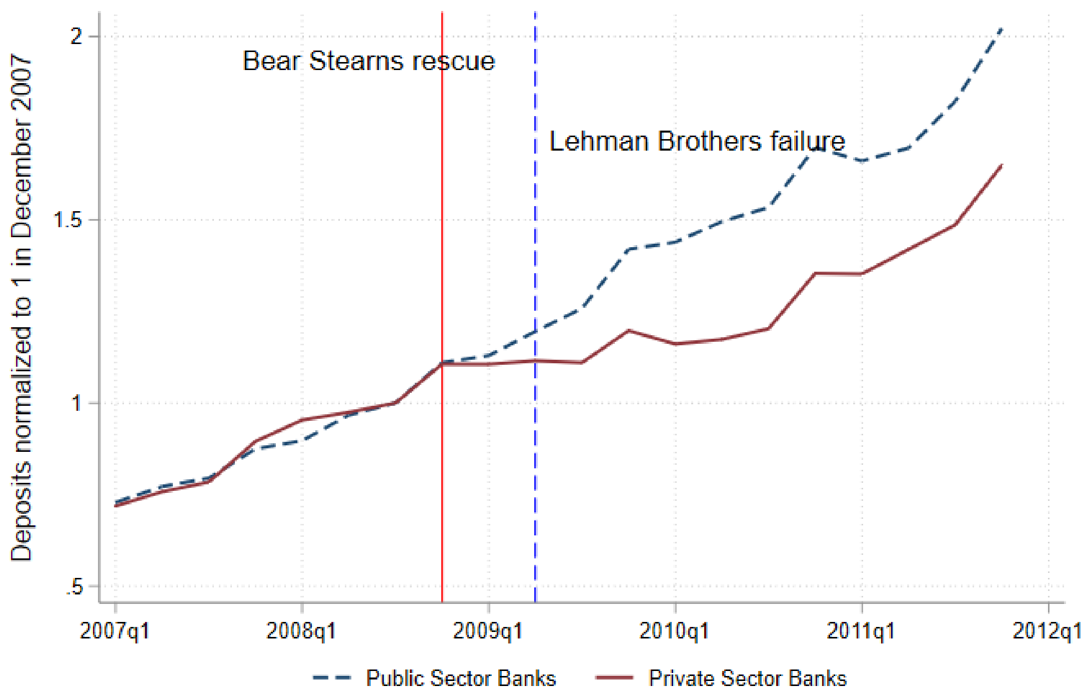


Figure II: Heat Map

This figure below shows the heat map for the deposit growth of private and public sector banks at the district level for 2009, where year refers to the fiscal year ending on March 31. Panel (a) shows the overall deposit growth. Panels (b) and (c) show the deposit growth for private sector and public sector banks, respectively. Districts with no available data are shaded in grey.

(a) All Banks (b) Private Sector Banks (c) Public Sector Banks

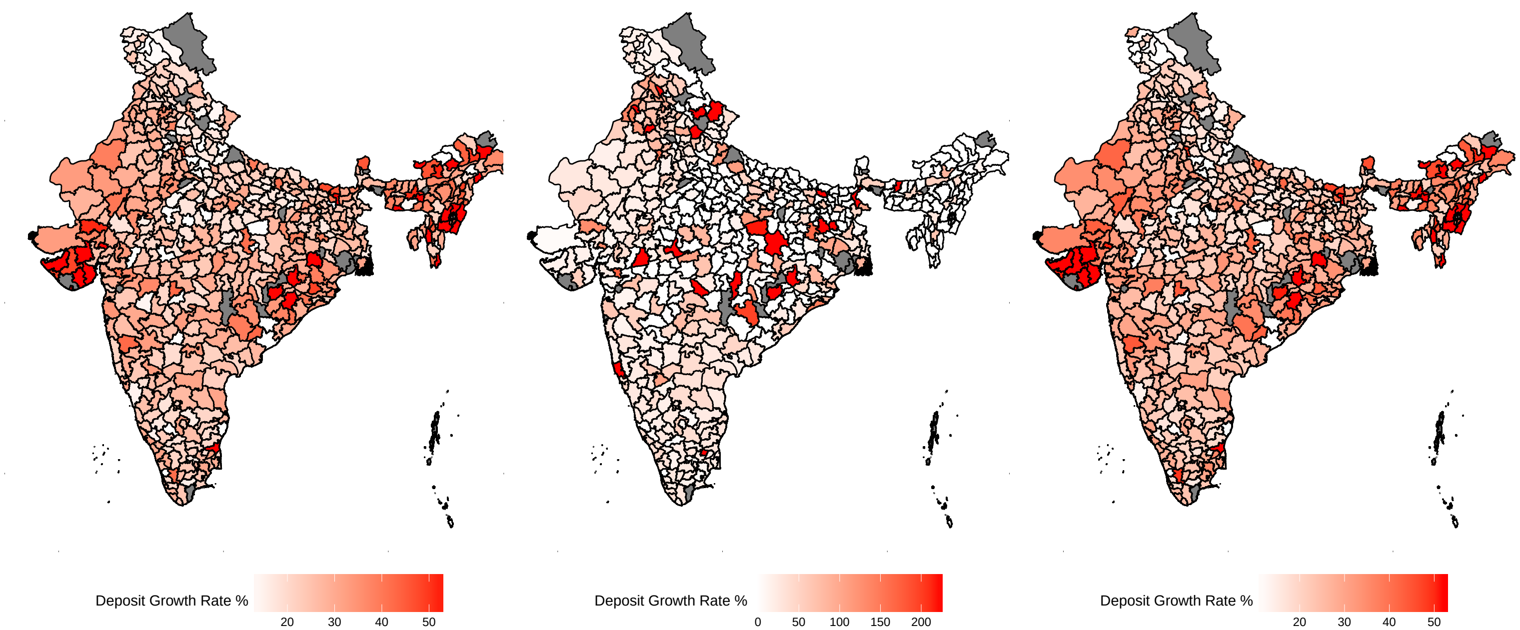
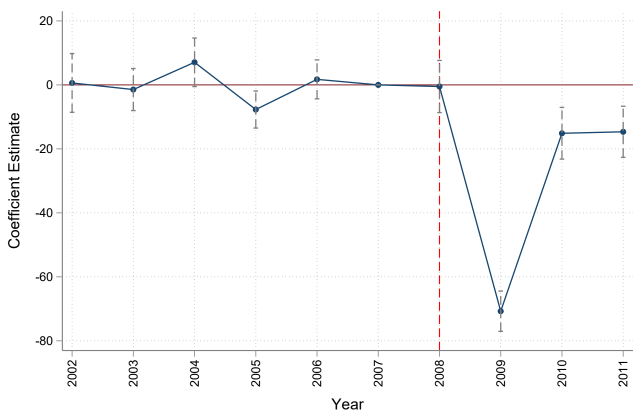


Figure III: Event Study Plots

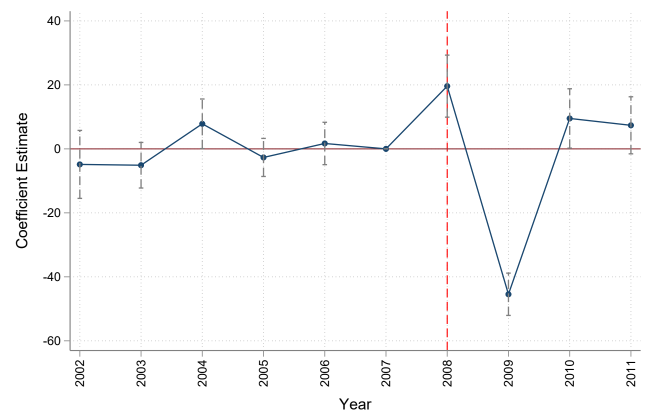
This figure shows the coefficients (η_τ) from an event study regression:

$$Y_{jbdt} = \alpha_j + \theta_{dt} + \gamma_{bt} + \sum_{\tau} \eta_\tau \times \mathbb{1}_\tau \times \mathbb{1}_{(Run_j)} + \epsilon_{jt}$$

where the dependent variable, Y_{jbdt} is the annual growth in deposit for branch j belonging to bank b in district d for time-period t (where t ranges from 2002 to 2011), α_j, γ_{bt} and θ_{dt} are branch, bank-time, and district-time period fixed effects respectively, and $\mathbb{1}_\tau = 1$ if the year is τ, with τ ranging from 2002 to 2011. The specification in Panel A does not include bank-time fixed effects but the one in Panel B does. The branch run variable ($\mathbb{1}_{(Run_j)}$) is an indicator for whether (i) the predicted deposit growth of private sector bank branches is more than the actual growth rate, where prediction is on an out-of-sample basis using a regression of deposit growth on size (lagged credit), age, whether rural, lagged credit to deposit ratio and whether public for the years between 2002 and 2006; (ii) the difference in growth rate between 2009 and 2008 is less than zero; and (iii) the branch does not appear in the bottom 5 percentiles of deposit growth in the year 2008 but does in 2009. Year refers to the fiscal year from April 1st to March 31st. Standard errors are clustered at the branch level. The figure plots the η_τ coefficients. Dashed grey lines depict the 5% confidence intervals.



(a) Without bank-time fixed effects



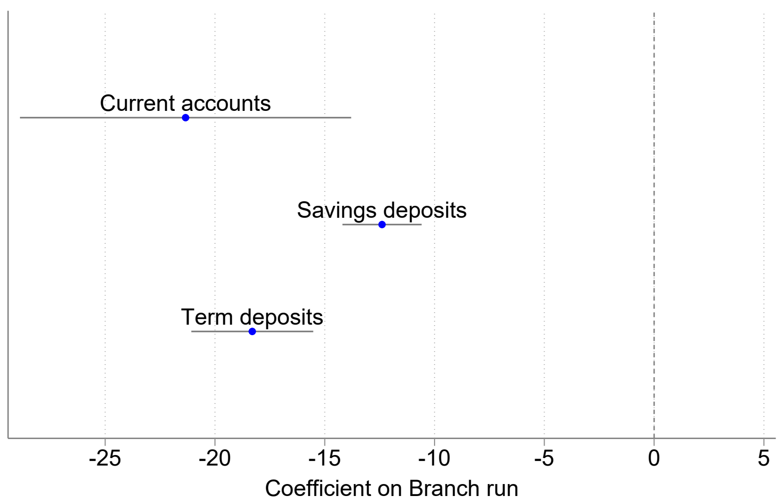
(b) With bank-time fixed effects

Figure IV: Runs By Deposit Type

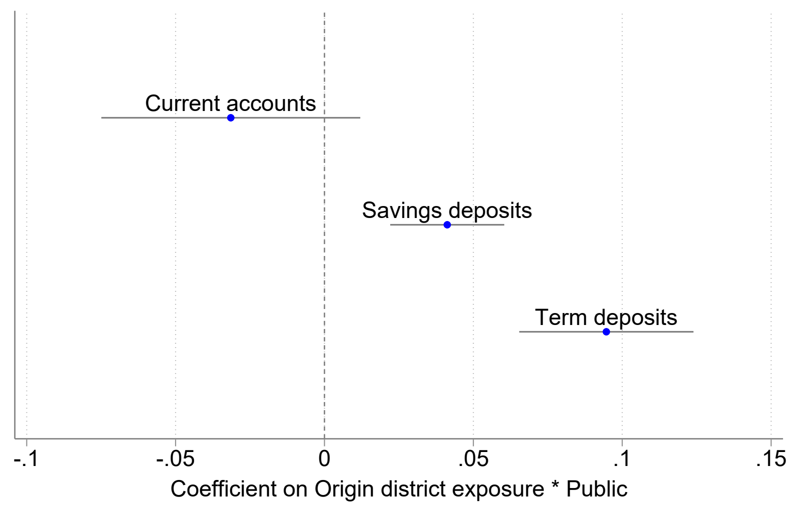
This figure shows the regression coefficients β and η for the deposit growth of branches of private banks facing a run (Panel (a)) and for public sector bank branches in the same district (Panel (b)) where deposits are classified by deposit type. The coefficients (β) are from the specification:

$$Y_{jbdt} = \alpha_{bt} + \gamma_{dt} + \beta \times \text{Branch run}_j + \eta \times X_{jbdt} + \epsilon_{jbdt}$$
$$Y_{jbdt} = \alpha_{bt} + \kappa_{dt} + \eta \times \text{District Exposure}_d \times \text{Public} + \gamma \times X_{jbdt} + \epsilon_{jbdt}$$

Y_{jbdt} is the annual deposit growth for current accounts, savings deposits, or term deposits for a given branch j of a bank b in district d for time t between 2009 to 2011. α_{bt} and γ_{dt} are bank-year and district-year fixed-effects respectively. X_{jbdt} are the control variables, which include branch characteristics and their interaction with a time trend from 2009 to 2011. The branch characteristics included are an indicator for whether a branch is deposit-poor (below-median deposits in 2008), the percentage of skilled officers, and the fiscal 2008 credit-to-deposit ratio. In Panel (a), Branch run$_j$ is an indicator for whether a branch j has a bank run, and robust standard errors are clustered at the branch level. In panel (b), District Exposure$_d$ is the district-level exposure, and standard errors are clustered at the district level. The remaining variables are as defined in Table B.1. The point estimates are represented by dots, and the 95% confidence intervals are represented by the lines passing through the point estimates.



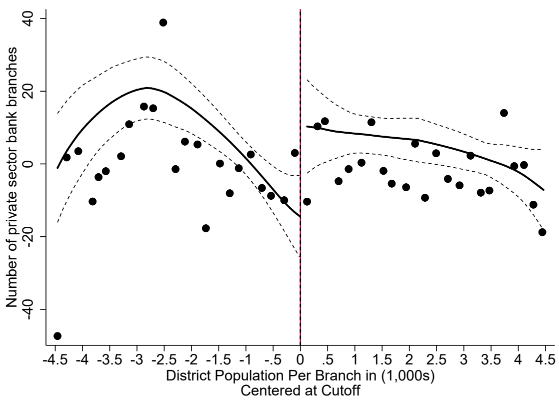
(a) Private sector bank branhces



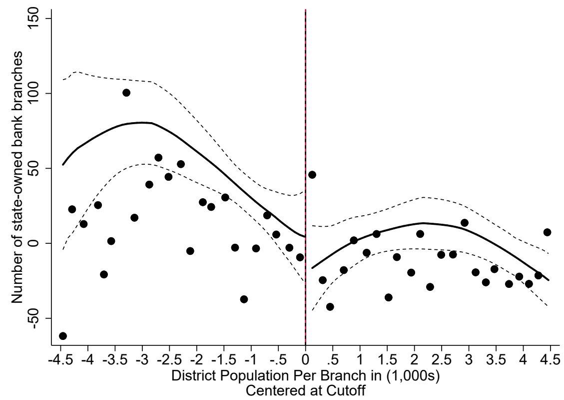
(b) Public sector bank branhces

Figure V: Regression Discontinuity: Share of State-Owned Bank Branches

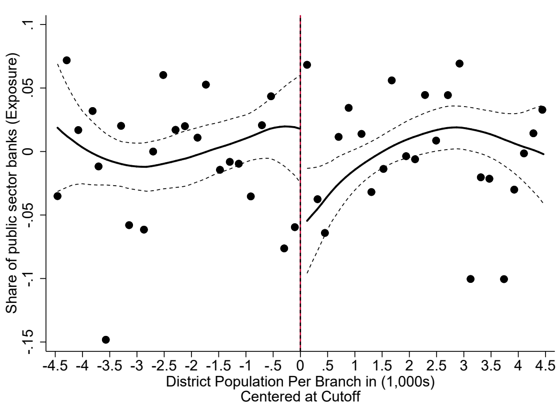
The table reports regression discontinuity (RD) plots for the number of private sector bank branches in 2006–08 (panel a), number of state-owned bank branches in 2006–08 (panel b), deposit share of state-owned banks in 2006–08 (panel c), and deposit share of state-owned banks in 2001–03 (panel d) at the district-level. Year refers to the fiscal year from April 1st to March 31st. The running variable on the horizontal axis is the national average population per branch subtracted from the district average population per branch. It is centered at zero and scaled to thousands of persons per district. Points to the right (left) of 0 are under-banked (banked) districts. Each point represents the average value of the outcome in 0.2 percentage point run variable bins. The solid line plots predicted values, with separate quadratic trends with triangular kernels estimated on either of 0. Bandwidth of (-4.5,4.5) is used. State-fixed effects have been partialed out. The dashed lines show 95 percent confidence intervals. Robust standard errors are shown. Population data used to construct the running variable is from the 2001 Census.



(a) Private sector bank branches in 2006–08

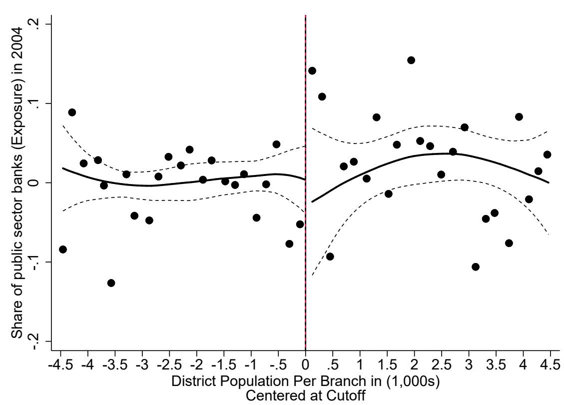


(b) State-owned bank branches in 2006–08



(c)

Deposit share of state-owned banks in 2006–08



(d) Deposit share of state-owned banks in 2001–03

Figure VI: Deposit Growth and Bank Vulnerability

This figure plots the deposit growth in fiscal 2009 against MES for private and state-owned banks where the fiscal year is the year ending on March 31. MES is defined as the negative of the average returns of a stock given that the market return is below its 5th- percentile during the period 1st January 2007 to 31st December 2007. Stock market data required to compute MES are from the National Stock Exchange and the Bombay Stock Exchange. MES is defined in Table B.1.

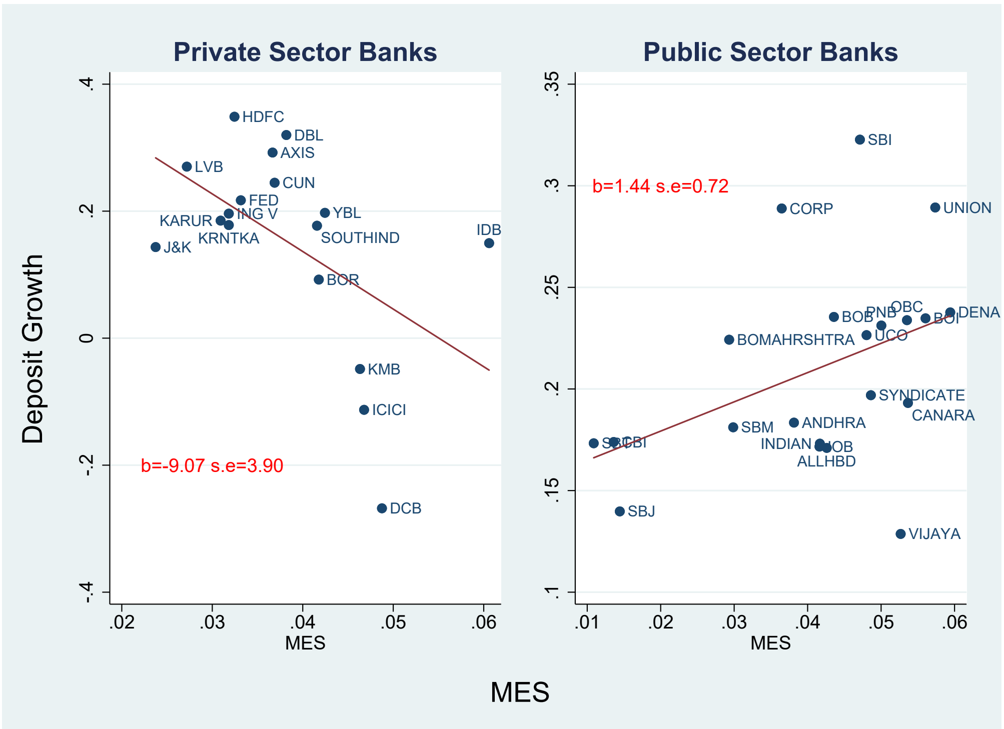


Table I: Descriptive Statistics

This table presents the summary statistics for all branches in our analysis. Panel A shows the summary statistics for the measures of exposure to runs. Panels B, C, D, and E show the summary statistics for variables at the branch, bank, firm, and industry levels, respectively. The variables Branch Run, District Exposure, Private Bank Exposure, and PSB Exposure are defined in Table I. The firm-level private bank (PSB) exposure is the loan-weighted private bank (PSB) exposure, aggregated to the firm level using prior total borrowing between 2002 to 2008 as weights. Industry-level private bank (PSB) exposure is the loan-weighted bank exposure, that is, the relevant bank exposure variable aggregated to the industry level using the total borrowing between 2002 and 2008 as weights. The data are for the post-run 2009-2011 period except in Panel E, which is for the pre-run 2006–2008 period where the year denotes the financial year from April 1st to March 31st. Deposit, credit, non-performing assets (NPA), and deposit rate growth are annual numbers between two consecutive fiscal years. The remaining variables are as defined in Table B.1.

Panel A: Measures of Exposure to Runs

	Obs.	Mean	SD	p10	p50	p90
Branch run (indicator)	62161	0.0070				
District exposure	560	8.40	18.76	0.00	0.00	36.94
Private bank exposure	22	.104	.096	.012	.0805	.234
PSB exposure	26	41.19	7.341	30.736	40.699	52.705

Panel B: Branch-Level Variables

Branch-level	All		Public Sector Banks		Private Sector Banks	
	Mean	SD	Mean	SD	Mean	SD
Deposit growth (in %)	21.50	27.30	20.70	26.10	26.60	33.90
(i) Demand deposit growth	50.10	138.10	50.50	140.30	47.30	122.60
(ii) Savings deposit growth	23.10	32.00	22.10	30.80	29.60	38.40
(iii) Term deposit growth	23.40	39.30	22.20	37.30	31.20	50.40
Credit growth (in %)	28.00	55.30	24.30	46.70	52.40	90.50
(ii) Agriculture credit growth	73.70	237.50	68.70	226.30	118.60	316.50
# Branch-Year Observations	168525		148580		19945	
NPA growth (in %)	56.10	166.90	56.70	165.80	46.90	184.10
(i) Agricultural NPA growth	107.10	336.40	108.40	335.90	85.60	345.20
(ii) Non-agricultural NPA growth	113.10	374.80	111.20	368.00	131.00	433.50
# Branch-Year Observations	64041		58203		5838	

Table I: Descriptive Statistics (contd)

Panel C: Bank-Level Variables

Bank-level	All		Public Sector Banks (PSBs)		Private Sector Banks	
	Mean	SD	Mean	SD	Mean	SD
Deposit growth (in %)	17.30	10.50	16.70	9.30	18.00	11.90
Credit growth (in %)	19.30	12.10	18.30	8.90	20.40	15.10
Deposit rate growth (in %)	1.10	0.50	1.10	0.60	1.10	0.50
# Bank-Year Observations	232		127		105	

Panel D: Firm-Level Variables

	Mean	SD	p10	p50	p90
Δ log(Credit) growth	0.01	7.65	-1.88	0.00	1.89
$\mathbb{1}_{Low-quality}$	0.24	0.43	0.00	0.00	1.00
Δ Log Sales	0.24	0.98	-0.29	0.02	0.98
Δ ROA	0.00	1.87	-0.13	0.00	0.11
Post-period MRPK	32.85	2080.00	0.22	1.22	3.26
Post-period MRPK	14.69	350.54	0.17	1.22	3.32
Pre-period Log Sales	5.25	2.41	1.89	5.36	8.21
Pre-period Tangibility	0.44	2.10	0.00	0.32	1.00
Pre-period $\mathbb{1}_{Low-quality}$	0.20	0.40	0.00	0.00	1.00
# Firms	12668				

Panel E: Industry-Level Moments of Log-MRPK Distribution

	Mean	SD	p10	p50	p90
Pre-period Var(log-MRPK)	2.58	1.41	1.59	2.28	3.20
Pre-period Mean(log-MRPK)	0.45	0.84	-0.04	0.44	0.96
Pre-period Cov(log-MRPK, log VA)	0.50	0.24	0.33	0.54	0.65
Post-period Var(log-MRPK)	2.66	1.64	1.47	2.34	3.32
Post-period Mean(log-MRPK)	0.51	0.80	0.05	0.44	0.95
Post-period Cov(log-MRPK, log VA)	0.44	0.22	0.30	0.47	0.57
# Industries	100				

Table II: Deposit Growth at Branches With Runs

This table reports estimates of a regression in which the dependent variable is the annual growth rate of deposits for 2009–2011. Column 1 includes all branches, and Column 2 restricts to private sector branches. Branch run is an indicator variable for bank run as defined in Table B.1. Year refers to the fiscal year from April 1st to March 31st. All columns include the branch covariates and their interaction with a time trend. The branch characteristics included are an indicator for whether a branch is deposit-poor (below-median deposits), the percentage of skilled officers, and the credit-to-deposit ratio in 2008. Standard errors are clustered at the branch level.

	(1)	(2)
Dependent variable:	Deposit growth	
	All branches	Private sector branches
Branch run	-17.677***	-17.848***
	(0.970)	(1.031)
R-squared	0.111	0.238
No. of Obs.	168690	19945
Bank × Year-FE	Y	Y
District × Year FE	Y	Y
Branch characteristics	Y	Y
Branch characteristics × t	Y	Y

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table III: Deposit Flights In Local Geography

The table shows the impact on deposit growth of runs on branches in the same district that do not face a run. The dependent variable in all columns is the annual growth rate of deposits for 2009–2011. Year refers to the fiscal year from April 1st to March 31st. District exposure is the negative deposit growth rate of all branches in a district with the branch run variable equal to 1, where branch run is as defined in Table B.1. PSB is an indicator variable for a state-owned bank. Columns 1–2 include all branches, column 3 includes only PSB branches, and column 4 includes only private sector bank branches with no run. All specifications include branch characteristics, district covariates, and their interaction with a time trend. The branch characteristics included are an indicator for whether a branch is deposit-poor (below-median deposits), the percentage of skilled officers, and the credit-to-deposit ratio in 2008. The district covariates from the 64th National Employment and Unemployment Survey for 2006–07 are the percentage of the urban population, unemployment rate, average age, and average weekly wages of households in a given district; each of the control variables is also interacted with a time trend component. Bank and district fixed effects are included as indicated. Standard errors are clustered at the district level.

	(1)	(2)	(3)	(4)
Dependent variable:	Deposit growth			
Sample	All Branches		PSB Branches	Private Bank Branches Without Runs
District Exposure	-0.028*		0.037***	-0.007
	(0.015)		(0.007)	(0.015)
PSB * District Exposure	0.066***	0.074***		
	(0.015)	(0.013)		
R-squared	0.069	0.100	0.047	0.135
# Observations	179487	179448	156256	21960
Bank × Year-FE	Y	Y	Y	Y
District × Year-FE	N	Y	N	N
District covariates	Y	Y	Y	Y
District covariates × t	Y	Y	Y	Y
Branch characteristics	Y	Y	Y	Y
Branch characteristics × t	Y	Y	Y	Y

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table IV: Credit Effects In and Beyond Run Geographies

This table shows the impact on credit growth of branches with different exposure to runs. The dependent variable is the annual growth rate of total credit for 2009–2011. Year refers to the fiscal year from April 1st to March 31st. Branch run is an indicator variable as defined in Table B.1. Private bank exposure, public bank exposure, district exposure, and branch run are as defined in Table B.1. Bank level controls included are gross NPA by gross advances in percentage, tier-1 capital adequacy ratio, and ATMs per capita in 2008 their interaction with a time trend component and indicator for bank type. The branch characteristics included are an indicator for whether a branch is deposit-poor (below-median deposits), the percentage of skilled officers, and the credit-to-deposit ratio in 2008. The district covariates from the 64th NSS Employment and Unemployment Survey for 2006–07 are the 2006–2007 percentage of the urban population, unemployment rate, average age, and average weekly wages of households in a given district; each of the control variables are also interacted with a time trend component. Fixed effects and samples are as indicated. Standard errors are clustered at the district level.

	(1)	(2)	(3)	(4)
Dependent variable:	Credit growth			
	Private sector banks		Public Sector Banks (PSBs)	
Private Bank Exposure	-2.254***			
	(0.732)			
Branch Run	-15.107***	-13.834***		
	(1.839)	(1.891)		
PSB Exposure			0.888***	
			(0.238)	
District Exposure				0.031**
				(0.015)
R-squared	0.135	0.175	0.044	0.036
No. of Obs.	18791	18791	146105	146150
Bank × Year-FE	N	Y	N	Y
District × Year FE	Y	Y	Y	N
Bank controls	Y	Y	Y	Y
Bank controls×t	Y	Y	Y	Y
District covariates	Y	Y	Y	Y
District covariates×t	Y	Y	Y	Y
Branch characteristics	Y	Y	Y	Y
Branch characteristics×t	Y	Y	Y	Y

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table V: Runs and Credit Quality

This table shows the relation between runs and loan performance. Observations are at the branch level. The dependent variable is the annual growth in non-performing assets (NPA) — for all credit (columns 1 and 4), agricultural credit (columns 2 and 5), and non-agricultural credit (columns 3 and 6) — for 2009–2011. Year refers to the financial year ending on March 31. The variables Branch run, district exposure, PSB exposure, and private bank exposure are as defined in Table B.1. Standard errors are clustered at the district level.

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. variable:	NPA growth					
Sample:	Private Sector Banks			Public Sector Banks (PSBs)		
Type:	All	Agri.	Non-agri.	All	Agri.	Non-agri.
Private bank exposure	-4.129***	-1.906	-2.451			
	(0.972)	(9.187)	(6.510)			
Branch run	2.072	3.317	29.56			
	(3.057)	(39.98)	(19.32)			
PSB exposure				1.924**	2.005	9.432***
				(0.807)	(5.755)	(2.528)
District Exposure				-0.144***	-0.356*	0.248**
				(0.0212)	(0.194)	(0.101)
R-squared	0.0144	0.0345	0.0113	0.0115	0.00630	0.0111
No. of Obs.	5838	1654	5412	58203	21340	51056
District-Year FE	Y	Y	Y	N	N	N
Bank controls	Y	Y	Y	Y	Y	Y
Bank controls × t	Y	Y	Y	Y	Y	Y
District covariates	Y	Y	Y	Y	Y	Y
District covariates × t	Y	Y	Y	Y	Y	Y
Branch characteristics	Y	Y	Y	Y	Y	Y
Branch characteristics × t	Y	Y	Y	Y	Y	Y

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table VI: Real Outcomes

The table reports loan, firm, and industry-level outcomes associated with a bank run in India in the 2009 financial year where year refers to the fiscal year from April 1st to March 31st. In Panel A, we aggregate loan-level data to the firm-bank level. The dependent variable in columns 1–2 is the log changes in credit calculated for the pre- and post-run periods, 2006-2008 and 2009-2011, respectively. The dependent variable in columns 3–4 and 5–6 is an indicator for exit and entry for a bank-firm pair. Exit is an indicator equal to 1 if no new loan is made in crisis years and at least one loan was made in the pre-crisis period. Entry is an indicator equal to 1 if a new loan is made in the crisis years, but no loan was made in the pre-crisis period for the bank-firm pair. Bank-level controls included are gross non-performing assets to advances, tier-1 capital adequacy ratio, and ATMs per capita as of 2008. Standard errors are clustered at the bank level. Observations in Panels B and C are at the firm level. The dependent variable in column 1 is the log changes in credit, as before for the pre- and post-run periods, 2006-2008 and 2009-2011, respectively. The remaining dependent variables in Panel B are the change in sales (column 2) and capital (column 3) to the pre-period total assets. In column 4, the change in the marginal productivity of capital (MRPK) as the total sales to capital (gross fixed assets). Panel C includes interacts ex-ante MRPK with private and public bank exposure, and the remaining variables are as defined in Panel B. The variable Top is an indicator equal to 1 if the firm is in the top two terciles of the 2008 MRPK. Standard errors are clustered at the 3-digit industry level. Observations in Panel D are at the industry level for the pre- and post-periods, 2006-2008 and 2009-2011, respectively, as before. The dependent variable is one of the three moments of the log-MRPK distribution: the cross-sectional variance of log-MRPK in an industry year (columns 1–2), the cross-sectional mean of log-MRPK (columns 3–4), and in columns 5–6, the correlation of log-MRPK and log VA (log sales), with average MRPK calculated for the pre-period and post-periods. Post is a dummy variable for the 2009-2011 period. Columns in Panel C include time and 3-digit industry fixed effects. Standard errors are clustered at the industry level. Public and private exposures at the bank, firm, and industry level are as defined in Table B.1.

Panel A: Changes in Credit Relationships

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	Δ log(Credit)		Exit		Entry	
Private bank exposure	-0.177***	-0.177***	0.012**	0.012**	0.007	0.007
	(0.051)	(0.052)	(0.006)	(0.006)	(0.006)	(0.006)
Public bank exposure	0.005	0.005	-0.003	-0.003	-0.005	-0.005
	(0.052)	(0.053)	(0.003)	(0.003)	(0.004)	(0.004)
R-squared	0.001	0.047	0.005	0.046	0.006	0.061
No. of Obs.	97128	97128	137233	137233	137233	137233
Firm FE	N	Y	N	Y	N	Y
Bank controls	Y	Y	Y	Y	Y	Y

Panel B: Firm-level Outcomes

	(1)	(2)	(3)	(4)
Dependent variable:	Change in			
	Debt	Revenue	Capital	MRPK
Private bank exposure$_{Firm}$	-1.416***	0.000	-9.286***	-0.020*
	(0.227)	(0.009)	(2.397)	(0.010)
Public bank exposure$_{Firm}$	0.587**	0.014*	-3.523	-0.001
	(0.286)	(0.008)	(3.821)	(0.007)
R-squared	0.016	0.181	0.003	0.010
No. of Obs.	12821	12821	12821	12669
Industry FE	Y	Y	Y	Y

Panel C: Heterogeneous Effects on Firm-Level Outcomes by Firms' Ex-ante MRPK

	(1)	(2)	(3)	(4)
Dependent variable:	Change in			
	Debt	MRPK	Revenue	Capital
Private bank exposure	-3.535***	0.128	-24.035***	-20.088***
	(0.594)	(0.100)	(8.247)	(7.551)
Public bank exposure	2.289***	-0.269*	-17.671	3.431
	(0.862)	(0.141)	(25.380)	(9.766)
Private bank exposure * Top	2.448***	-0.210**	23.299***	20.753**
	(0.665)	(0.101)	(8.587)	(8.238)
Public bank exposure * Top	-1.980**	0.247*	17.191	-3.293
	(0.886)	(0.145)	(25.823)	(10.230)
Top	-0.562***	0.143***	-76.954***	-66.109**
	(0.147)	(0.045)	(22.905)	(26.692)
R-squared	0.018	0.026	0.005	0.028
No. of Obs.	12812	12812	12812	12812
Industry FE	Y	Y	Y	Y

Panel D: Industry-Level Outcomes: Moments of Log-MRPK Distribution

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	Var(log-MRPK)		Mean(log-MRPK)		Cov(log-MRPK, log VA)	
Post * PSB exposure$_{industry}$	0.955**	0.782**	-0.038	0.047	-0.067	-0.071
	(0.433)	(0.393)	(0.142)	(0.111)	(0.072)	(0.072)
Post * Private bank exposure$_{industry}$	-0.371	-0.182	-0.004	-0.098*	0.065	0.070
	(0.297)	(0.229)	(0.103)	(0.053)	(0.080)	(0.081)
PSB exposure$_{industry}$	0.054		-0.173		0.013	
	(0.287)		(0.214)		(0.064)	
Private bank exposure$_{industry}$	0.527		0.023		-0.054	
	(0.336)		(0.187)		(0.073)	
R-squared	0.054	0.799	0.011	0.952	0.028	0.745
No. of Obs.	201	201	201	201	201	201
Industry FE	N	Y	N	Y	N	Y
Period FE	Y	Y	Y	Y	Y	Y

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table VII: Evidence From Regression Discontinuity Design

This table shows the estimates for deposit growth of private bank branches using a regression discontinuity design. The dependent variable is the annual growth rate of deposits for 2009–2011. Year refers to the financial year from April 1st to March 31st. We instrument the public sector bank (PSB) deposit share with whether a district is banked, that is, whether the population per branch minus its national average is less than zero, a running variable based on a new branching policy by the central bank' using a sharp cutoff based on branching density. The first- and second-stage results are shown in columns 1 and 2. Both specifications include state-year and bank-year fixed effects and the following covariates: the percentage of skilled officers, the credit-to-deposit ratio in 2008, and their interactions with time trends. Observations are weighted with 2007 deposits. Standard errors are clustered at the district level. Branch data is from the Reserve Bank of India. Population data to construct the running variable are from the 2001 Census.

	(1)	(2)
Dependent variable:	Deposit growth	
Sample:	Private sector bank branches	
	First stage	Second stage
Banked	0.0387***	
	(0.00305)	
Exposure to state-owned banks		-58.11**
		(22.74)
Exposure to private bank run		
F-stat	220	
R-squared	0.816	0.187
No. of Obs.	12098	12098
State-Year FE	Y	Y
Bank-Year FE	Y	Y
Controls	Y	Y

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table VIII: Heterogeneity Within Private and State-Owned Banks: Bank Vulnerability

This table shows the heterogeneity in the credit outcomes related to bank runs when banks are sorted by MES, a weakness measure.. The dependent variable in Panel A is the annual deposit growth (columns 1–2), credit growth (columns 3–4), and agricultural and non-agricultural non-performing assets (NPA) growth (columns 5–8) at the branch level for 2009–2011. Year refers to the fiscal year from April 1^{st} to March 31^{st}. MES is defined as the negative of the average returns of a stock given that the market return is below its 5^{th}- percentile during the period 1^{st} January 2007 to 31^{st} December 2007. The dependent variable in Panel B is the change in the weighted average deposit rate in basis points (BPS) for retail (columns 1 and 3) and non-retail (columns 2 and 4) depositors. Public and private sector bank branches are examined separately, as indicated in both panels. All columns include district-year fixed effects. Standard errors are clustered at the branch level.

Panel A: Deposit, Credit, and Non-performing Asset Growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	Deposit growth		Credit growth		NPA growth			
Sample:	Private	Public	Private	Public	Private		Public	
Type:					Agri.	Non-Agri.	Agri.	Non-Agri.
MES	-2.367***	0.182**	-2.112**	0.363***	8.064	-28.252***	7.702***	2.746**
	(0.487)	(0.077)	(0.826)	(0.134)	(15.042)	(7.405)	(2.581)	(1.348)
R-squared	0.099	0.049	0.078	0.037	0.235	0.116	0.108	0.028
No. of Obs.	18924	103966	18924	103966	2001	6900	17536	52589
District-Year FE	Y	Y	Y	Y	Y	Y	Y	Y

Panel B: Deposit Rates

	(1)	(2)	(3)	(4)
Dependent variable:	Change in Deposit Rates (in BPS)			
Sample:	Private		Public	
Type:	Retail	Non-retail	Retail	Non-retail
MES	1.157	-0.713	-6.392***	2.483***
	(0.765)	(2.085)	(0.186)	(0.657)
R-squared	0.752	0.370	0.539	0.060
No. of Obs.	9929	9651	40857	36736
District-Year FE	Y	Y	Y	Y

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix

Table B.1: Key Variables

Variable	Definition & Source
Branch Run	Indicator that equals 1 (and is zero otherwise) if all conditions below are satisfied. Year refers to the 12-month financial year ending on March 31. (i) The predicted deposit growth of private sector bank branches is more than the actual growth rate, where prediction is on an out-of-sample basis using a regression of deposit growth on size (lagged credit), age, whether rural, lagged credit to deposit ratio and whether public for the years between 2002 and 2006. (ii) The difference in deposit growth rate between 2009 and 2008 is less than zero. (iii) The branch is in the bottom 5th percentile of deposit growth in the year 2009 but not in 2008.
District Exposure	District exposure is the negative deposit growth rate of all branches in a district that with Branch run equal to 1.
Private Bank Exposure	Private bank exposure is the deposit weighted average of the branch run measure for every branch of a bank with the 2007 (measured as of March 31^{st}) deposits as weights.
PSB exposure	Public bank exposure is the average of the district exposure measure with the 2007 (measured as of March 31^{st}) deposits as weights.
Public (Private) Firm Exposure	Firm-level public bank exposure (private bank exposure) is the loan-weighted public bank exposure (private bank exposure) measure, aggregated to the firm level using prior total borrowing between years 2002 and 2008 as weights. Year refers to the financial year ending on March 31.
Public (Private) Industry Exposure	Industry-level public bank exposure (private bank exposure) is the loan-weighted bank exposure, that is, bank-level public bank exposure (private bank exposure) aggregated to the industry level using the total borrowing between 2002 and 2008 as weights. Year refers to the fiscal year from April 1^{st} to March 31^{st}.
MES	MES (Marginal Expected Shortfall) is the negative of the average returns of a stock given that the market return is below its 5^{th}- percentile during the period 1^{st} January, 2007 to 31^{st} December, 2007.
$\mathbb{1}_{Low-quality}$	Indicator for whether the interest coverage ratio in each of fiscal 2009, 2010, and 2011 is less than 1.

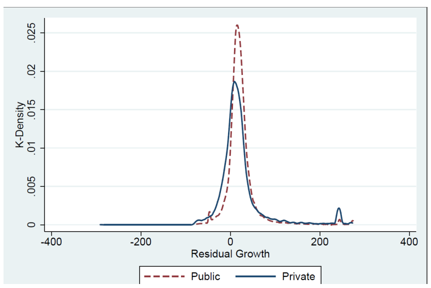
Table B.1: Key Variables (continued)

Variable	Definition & Source
Δ Log Sales	Growth in average sales from the years before the crisis(2006-2008) to the crisis years(2009-2011), measured as of March 31st each year.
ΔROA	Change in average return on assets(EBIT/Assets) from 2006-2008 to 2009-2011, measured as of March 31st each year.
MRPK	Ratio of sales to the gross book value of total assets.
Tangibility	Net fixed assets of a firm to its total assets.

Internet Appendix

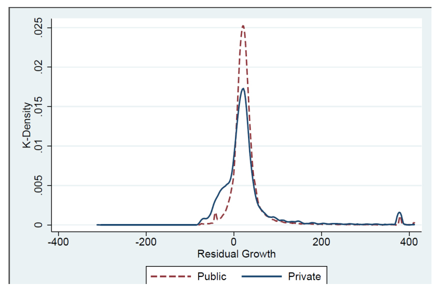
Figure C.1: Distribution of ΔDeposit Growth Rates

Panels (a) and (b) show the excess deposit growth in the year 2008 and year 2009. Year refers to the fiscal year from April 1st to March 31st. Residual deposit growth is the difference between the actual deposit growth rate and the predicted growth on an out-of-sample basis using a regression of deposit growth on size (lagged credit), age, whether rural, lagged credit to deposit ratio and whether public for the years between 2002 and 2006. Panels (c) and (d) show the distribution of the change in growth rates of deposits. Panel (c) shows the difference in growth rates for the year 2007 and year 2008 (Δ of growth rates). Panel (d) shows the difference in growth rates for the year 2008 and year 2009. Panel (e) and (f) show the distribution of deposit growth rates for years 2008 and 2009 for public sector banks and private sector banks and restrict to branches with deposit growth rates below zero.



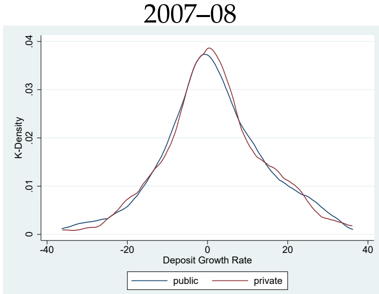
(a)

2007–08



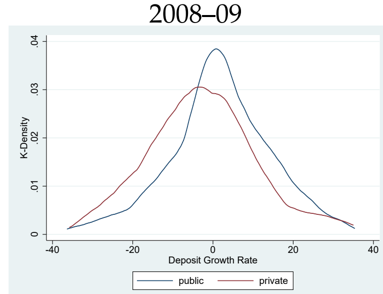
(b)

2008–09



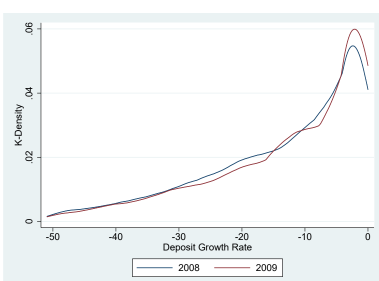
(c)

2007–08



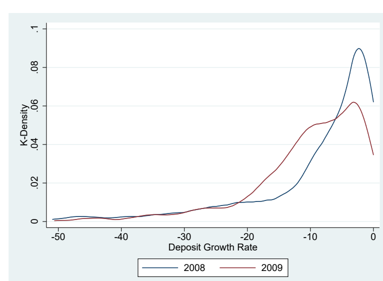
(d)

2008–09



(e)

2007–08



(f)

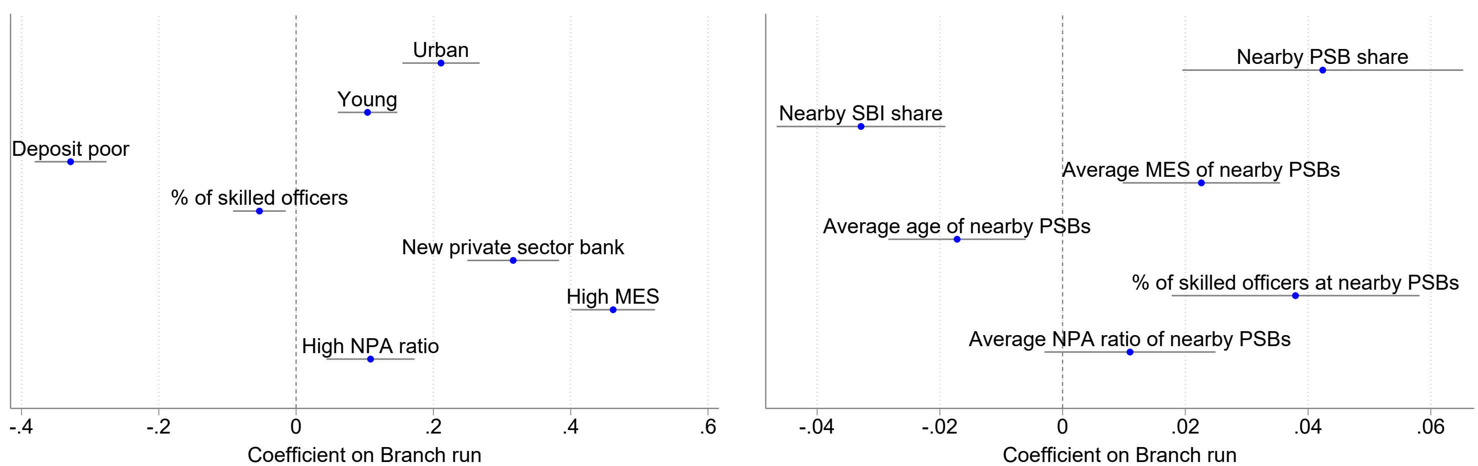
2008–09

Figure C.2: Characteristics of Branches With Runs

The figure shows the characteristics of branches with runs and the characteristics of the public sector bank branches in these districts. The correlates of the branch run variable and branch and district characteristics are examines using the specification:

$$\text{Branch run}_j = \alpha + \beta \times \text{Char}_j + \epsilon_j$$

Branch run is an indicator variable as defined in Table B.1. Char_j are branch-level and district-level characteristics. The branch-level characteristics in panel (a) are an indicator for deposits below the median deposits of all bank branches i.e. deposit poor branch, the percentage of skilled workers in the branch, an indicator for branch less than five years old i.e. Young, an indicator for the branch being in an urban area, an indicator for the branch belonging to a new private bank, indicator for branch with non-performing asset (NPA) ratio is higher than the median ratio, an indicator for the branch belonging to a bank with high marginal expected shortfall. The RHS variable in panel (b) are the district-level characteristics of the public sector bank branches in the district where the run branch is located. The district-level characteristics are the share of SBI and its associates in deposits, the average age of nearby PSBs, the average marginal expected shortfall (MES) of nearby PSBs, the percentage of skilled workers in nearby PSBs and finally, the share of nearby PSBs. The coefficient from each regression using different branch-level and district-level characteristics are shown. The dot represents the mean coefficient, and the line along the dot represents the 95 percent confidence interval.

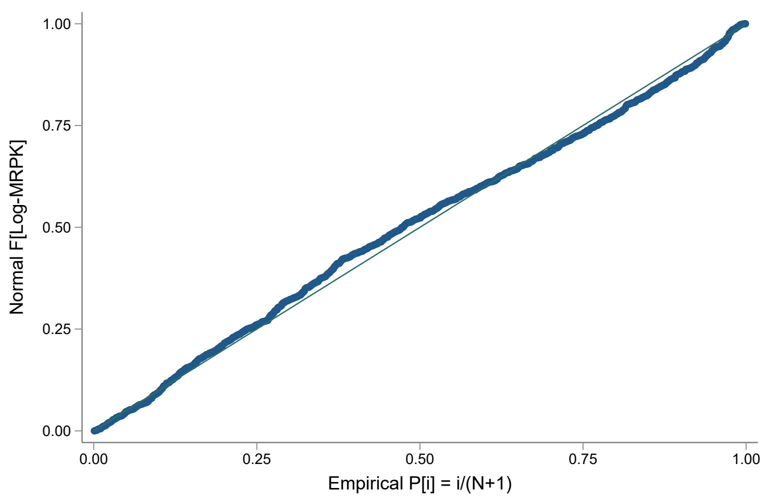


(a) **Characteristics of branches with runs**

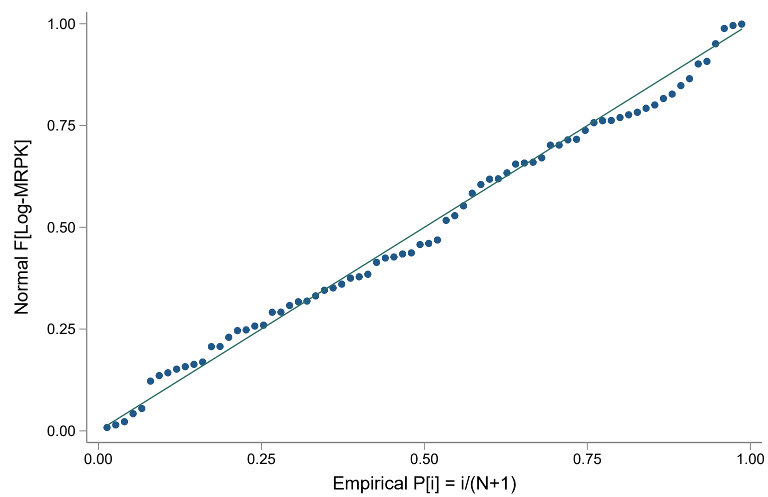
(b) **Characteristics of nearby PSB branches**

Figure C.3: Log-Normality of MRPKs in the Data

The figure shows the quantiles of log-MRPK against quantiles of normal distribution. MRPK is as of 2008 and computed as the ratio of sales to the gross book value of total assets and is then standardized (z-scored by subtracting the mean value and dividing by the standard deviation). Panel (a) shows the figure for the sample of manufacturing firms and panel (b) is for the remaining sample of non-manufacturing firms.



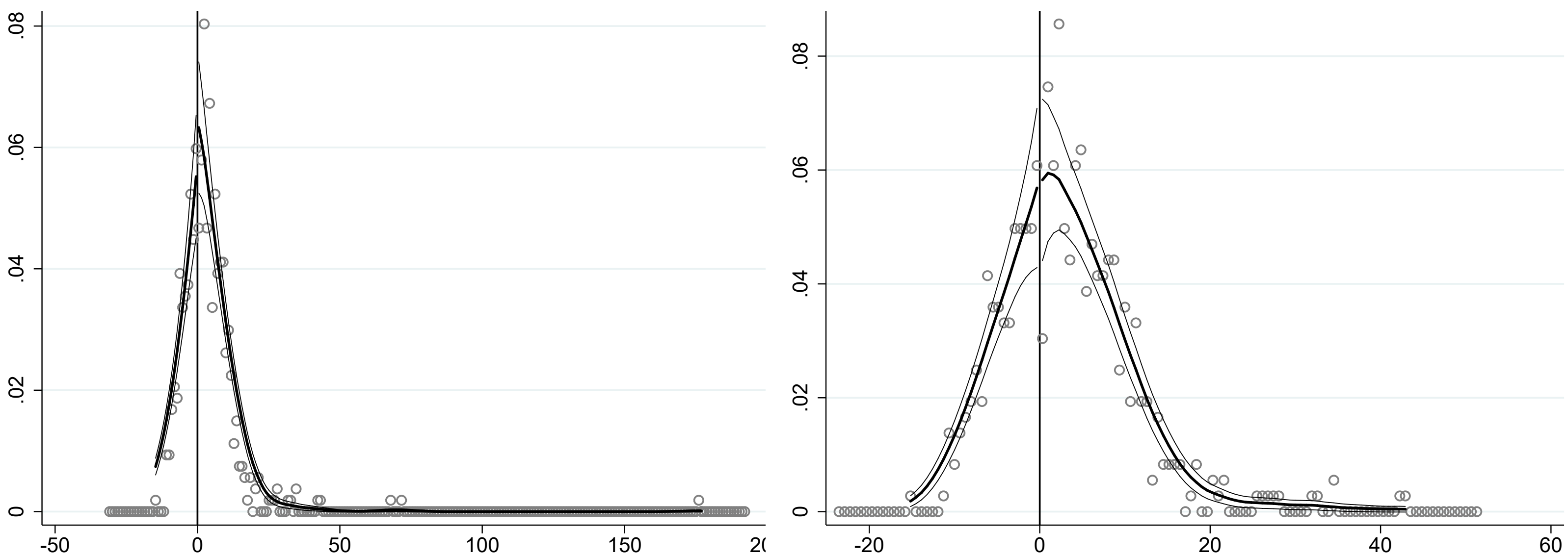
(a) Manufacturing firms



(b) Non-manufacturing firms

Figure C.4: Regression Discontinuity: McCrary Test

This figure plots the McCrary graphs. It graphs the density of the running variable. The running variable on the horizontal axis is the national average population per branch subtracted from the district average population per branch. It is centered at zero and scaled to thousands of persons per district. Points to the right (left) of 0 are under-banked (banked) districts. Panel (a) is the full sample and Panel (b) removes outliers above 60. Branch-level data is from the Reserve Bank of India. Population data used to construct the running variable is from the 2001 Census.



(a) Full sample

(b) Without outliers

Table D.1: Deposit Growth at Branches With Runs: Placebos

This table reports the results for several placebo tests. In Panel A, the dependent variable is the annual deposit growth rate and "Branch Run" is as defined in Table II. In Panels B and C, the dependent variables are the annual growth rate of deposits for 2005–2008 and 2009–2011, respectively. Column 1 includes all branches, and column 2 includes only the private sector bank branches. In both panels, the variable "Branch Run" is a 1/0 indicator variable that is positive if (i) the actual private branch deposit growth rate is less than the predicted rate on an out-of-sample basis using a regression of deposit growth on size (lagged credit), age, whether rural, lagged credit to deposit ratio and whether public for the years between 2002 and 2005; (ii) the difference in growth rate between 2004 and 2005 is less than zero; (iii) the branch does not appear in the bottom 5 percentiles of deposit growth in the year 2004 but does in 2005. Year refers to the fiscal year from April 1st to March 31st. All columns include branch covariates and their interaction with a time trend. The branch characteristics included are the percentage of skilled officers and the credit-to-deposit ratio in 2008. Standard errors are clustered at the branch level.

Panel A: Baseline Branch Run Measure and Deposit Growth during the Crisis Years

	(1)	(2)	(3)
Dependent variable:	Deposit growth		
Sample:	2004–05	2005–06	2006–07
Branch run	-0.411	3.208	0.981
	(1.925)	(2.443)	(2.765)
R-squared	0.119	0.134	0.108
No. of Obs.	49930	51143	51955
Bank × Year-FE	Y	Y	Y
District × Year FE	Y	Y	Y
Branch characteristics	Y	Y	Y
Branch characteristics × t	Y	Y	Y

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Panel B: Placebo Branch Run Measure and Deposit Growth During the Pre-crisis Years

	(1)	(2)
Dependent variable:	Deposit growth	
Sample:	All branches	Private sector branches
Branch run_{2005}	-0.888	-0.931
	(1.922)	(1.926)
R-squared	0.094	0.210
No. of Obs.	49867	4738
Bank $\times$ Year-FE	Y	Y
District $\times$ Year FE	Y	Y
Branch characteristics	Y	Y
Branch characteristics $\times$ t	Y	Y

Panel C: Placebo Branch Run Measure and Deposit Growth During the Crisis Years

	(1)	(2)
Dependent variable:	Deposit growth	
Sample:	All branches	Private sector branches
Branch run_{2005}	0.246	0.103
	(0.783)	(0.817)
R-squared	0.090	0.200
No. of Obs.	148324	13928
Bank $\times$ Year-FE	Y	Y
District $\times$ Year FE	Y	Y
Branch characteristics	Y	Y
Branch characteristics $\times$ t	Y	Y

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table D.2: Bank-Level Regressions

This table reports regressions in which the dependent variable is a bank's annual growth in deposits (Panel (a)) or credit (Panel (b)) for 2009–2011 where a year refers to the fiscal year ending on March 31. The sample in column 1 includes only private-sector banks while that in column 2 includes only public-sector banks. The variable "Private Bank Exposure" is the deposit weighted average of "Branch Run" across all private bank branches using the 2007 deposits as weights. "PSB Exposure" is the average of the "District Exposure" for PSB branches using 2007 deposits as weights. "Branch Run" and "District Exposure" are as defined in Table B.1. Bank level controls included are gross NPA by gross advances in percentage, tier-1 capital adequacy ratio, and ATMs per capita in 2008 their interaction with a time trend component and indicator for bank type. Standard errors are clustered at the bank level.

Panel A: Deposit growth

	(1)	(2)
Dependent variable:	Deposit growth	
Sample:	Private sector banks	Public sector banks
Private bank exposure	-8.098***	
	(2.104)	
PSB exposure		1.542**
		(0.626)
R-squared	0.389	0.289
No. of Obs.	53	74
Year-FE	Y	Y
Bank controls	Y	Y
Bank controls × t	Y	Y

Panel B: Credit growth

Dependent variable:	Credit growth	
Sample:	Private sector banks	Public sector banks
Private bank exposure	-8.484***	
	(2.694)	
Public bank exposure		0.863
		(0.553)
R-squared	0.389	0.289
No. of Obs.	53	74
Year-FE	Y	Y
Bank controls	Y	Y
Bank controls × t	Y	Y

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table D.3: Run Effects Within Bank

This table relates the credit effects of a run on branches classified by the branch credit-to-deposit ratio. The dependent variable is the annual credit growth rate from 2009–2011 where the year denotes the fiscal year ending on March 31. The variables Private bank exposure, PSB exposure, district exposure, and branch run are as defined in Table B.1. The key coefficients of interest are the interactions of the bank-level exposure variables with the branch-level credit-to-deposit ratio. Bank level controls included are gross NPA by gross advances in percentage, tier-1 capital adequacy ratio, and ATMs per capita in 2008 their interaction with a time trend component and indicator for bank type. The branch characteristics included are an indicator for whether a branch is deposit-poor (below-median deposits), the percentage of skilled officers, and the credit-to-deposit ratio in 2008. District-level covariates are from the 64th NSS Employment and Unemployment Survey for 2006-2007 include the percentage of the urban population, unemployment rate, average age, and average weekly wages of households in a given district; each of the control variables is also interacted with a time trend component. Fixed effects and samples are as indicated. Standard errors are clustered at the district level.

	(1)	(2)	(3)	(4)
Dependent variable:	Credit growth			
	Private		Public	
Private bank exposure	-2.744***			
	(0.746)			
Branch run	-14.962***	-13.728***		
	(1.841)	(1.891)		
Credit-to-deposit ratio * Private bank exposure	0.503**	0.477**		
	(0.212)	(0.210)		
Public bank exposure			0.892***	
			(0.238)	
Origin District Exposure				0.030**
				(0.015)
Credit-to-deposit ratio * Public bank exposure			-0.001	-0.002***
			(0.001)	(0.000)
Credit-to-deposit ratio	-0.464**	-0.442**	0.000***	-0.002*
	(0.194)	(0.192)	(0.000)	(0.001)
R-squared	0.135	0.175	0.044	0.036
No. of Obs.	18791	18791	146105	146150
Bank × Year-FE	N	Y	N	Y
District × Year FE	Y	Y	Y	N
Bank controls	Y	Y	Y	Y
Bank controls×t	Y	Y	Y	Y
District covariates	Y	Y	Y	Y
District covariates×t	Y	Y	Y	Y
Branch characteristics	Y	Y	Y	Y
Branch characteristics×t	Y	Y	Y	Y

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table D.4: Bank-Level Stressed Assets

The table relates the bank-level stressed assets to bank-run exposure. The dependent variable is the annual growth in stressed assets, defined as the sum of non-performing and restructured assets, between fiscal 2009 and 2013 where fiscal year denotes the year ending as of March 31. Private Bank Exposure and PSB exposure are as defined in Table B.1. Bank level controls included are gross NPA by gross advances in percentage, tier-1 capital adequacy ratio, and ATMs per capita in 2008 their interaction with a time trend component and indicator for bank type. Standard errors are clustered at the bank level.

	(1)	(2)
Dep. variable:	Stressed assets growth	
Sample:	Private	Public
Private bank exposure	-10.944**	
	(5.077)	
PSB exposure		-3.472
		(4.820)
R-squared	0.492	0.515
No. of Obs.	49	74
Year-FE	Y	Y
Bank controls	Y	Y
Bank controls × t	Y	Y

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table D.5: Ex-ante MRPK and Firm-Level Run Exposure

This table relates a firm's ex-ante marginal productivity of capital (MRPK) to its exposure to bank runs. PSB is an indicator equal to 1 if a firm borrows from a state-owned bank between 2002 and 2008. Year refers to the fiscal year ending on March 31. Public and private exposures at the firm level are as defined in Table B.1. The variable "Top" is an indicator equal to 1 if the firm's MRPK is in the top two terciles across all firms for fiscal 2008. All columns include 3-digit industry fixed effects. Standard errors are clustered at the 3-digit industry level.

	(1)	(2)
Dependent variable:	Top (High ex-ante MRPK)	
PSB	22.138	
	(17.488)	
PSB exposure$_{Firm}$		7.506
		(9.252)
Private bank exposure$_{Firm}$		-8.633
		(7.600)
R-squared	0.010	0.010
No. of Obs.	3219	3219
Industry-FE	Y	Y

Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table D.6: RD Results: Under-Banked Status and PSB Deposit Share

This table shows results from a regression discontinuity (RD) test using a 2005 banking reform act to generate the discontinuity. Panel A examines covariate balance with a standard RD specification. Panel B shows the RD estimates. The running variable that generates the discontinuity is the national average population per branch subtracted from the district-level average population per branch. Banked takes a value of 1 if the running variable is negative. All regressions use second-degree polynomials and triangular kernels with a bandwidth of 4.5 around the cut-off. Observations are weighted by the population in 2001. Controls include population and population squared. Standard errors are clustered at the district level. Population data to construct the running variable is from the 2001 Census.

Panel A: Covariate Balance

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:	Ln (Wages)	Age	Fraction rural population (in %)	Fraction female (in %)	Fraction high-school (in %)	Unemp. rate (in %)	Deposit share of public sector branches in 2001–03
Banked	0.0915	0.0481	-5.335	0.00834	0.0242	0.0531	0.0844
	(0.174)	(0.0509)	(8.009)	(0.0106)	(0.0159)	(0.0327)	(0.0505)
R squared	0.580	0.705	0.551	0.264	0.466	0.214	0.579
No. of Obs.	247	247	247	247	247	247	247
State-FE	Y	Y	Y	Y	Y	Y	Y

Panel B: Share of State-Owned Banks in 2006–08

	(1)	(2)	(3)	(4)
Dependent variable:	Number of private sector bank branches	Number of PSB bank branches	Fraction of PSB bank branches	Deposit share of PSB bank branches
Banked	-27.76**	20.84	0.118**	0.0971**
	(10.97)	(13.19)	(0.0578)	(0.0411)
R squared	0.630	0.926	0.456	0.547
No. of Obs.	265	265	265	265
State-FE	Y	Y	Y	Y

Table D.7: RD Results: Robustness

This table shows the robustness of the regression discontinuity (RD) estimates that use a 2005 banking reform act to generate the discontinuity. The dependent variable is the deposit share of state-owned banks in 2006–08 at the district level. Year refers to the fiscal year ending on March 31. Column 1 uses the Imbens and Kalyanaraman (2012) bandwidth. Column 2 uses the Calonico, Cattaneo and Titiunik (2014) bandwidth. Columns 3 and 4 use a bandwidth of (-4,+4) and (-5, +5) around the cut-off. Column 5 uses a bandwidth of (-3.5, +3.5). The running variable is the national average population per branch subtracted from the district-level average population per branch. Population data to construct the running variable from India's 2001 Census. The variable "Banked" is an indicator for whether the running variable is negative. Regressions in columns 1-4 use a second-degree polynomial and a triangular kernel with a bandwidth of 4.5 around the cut-off. Column 5 uses a local linear polynomial. All regressions include state-fixed effects and are weighted by the 2001 population. Controls include population and population squared. Standard errors are clustered at the district level.

	(1)	(2)	(3)	(4)	(5)
Dependent variable:			Deposit growth		
Bandwidth Type:	Imbens-Kalyanaraman bandwidth	Calonico, Cattaneo, and Titiunik bandwidth	Bandwidth=4	Bandwidth=5	Bandwidth=3.5, Linear polynomial
Banked	0.101*	0.100*	0.104**	0.0782*	0.0726**
	(0.0574)	(0.0497)	(0.0491)	(0.0434)	(0.0300)
R squared	0.556	0.556	0.559	0.484	0.538
No. of Obs.	220	247	229	285	207
State-FE	Y	Y	Y	Y	Y

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table D.8: RD Placebo

This table shows the regression discontinuity (RD) estimates for deposit growth for placebo years 2005–2006, 2006–2007, and 2007–2008. The dependent variable in all columns is the annual growth rate of deposits. Year refers to the fiscal year ending on March 31. PSB Exposure is the firm-level share of loans and advances from PSBs (state-owned public sector banks). Standard errors are clustered at the district level. Population data to construct the running variable is from the 2001 Census.

	(1)	(2)	(3)
Dependent variable:	Deposit growth		
Sample:	2005–06	2006–07	2007–08
Exposure to PSBs	53.58	97.26	22.35
	(80.82)	(70.91)	(63.78)
F-stat	17	24	30
R-squared	0.265	0.176	0.295
No. of Obs.	1990	1973	1923
State-Year FE	Y	Y	Y
Bank-Year FE	Y	Y	Y
Controls	Y	Y	Y

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table D.9: Banks and MES During 2007–2009

This table shows the bank vulnerability measure for the 21 state-owned banks and 17 private-sector banks in our analysis. All stock market data are from the National Stock Exchange and the Bombay Stock Exchange.

State-owned Public Sector Banks (PSBs)		Private sector banks	
Bank Name	MES	Bank Name	MES
Allahabad Bank	0.04	Axis Bank	0.04
Andhra Bank	0.04	Bank of Rajasthan	0.04
Bank of Baroda	0.04	City Union Bank	0.04
Bank of India	0.06	Development Credit Bank	0.05
Bank of Maharashtra	0.03	Dhanalakshmi Bank	0.04
Canara Bank	0.05	Federal Bank	0.03
Central Bank of India	0.01	HDFC Bank	0.03
Corporation Bank	0.04	ICICI Bank	0.05
Dena Bank	0.06	IndusInd Bank	0.06
Indian Bank	0.04	ING Vysya Bank	0.03
Indian Overseas Bank	0.04	Jammu & Kashmir Bank	0.02
Oriental Bank of Commerce	0.05	Karnataka Bank	0.03
Punjab National Bank	0.05	Karur Vysya Bank	0.03
State Bank of Bikaner and Jaipur	0.01	Kotak Mahindra Bank	0.05
State Bank of India	0.05	Lakshmi Vilas Bank	0.03
State Bank of Mysore	0.03	South Indian Bank	0.04
State Bank of Travancore	0.01	Yes Bank	0.04
Syndicate Bank	0.05		
UCO Bank	0.05		
Union Bank of India	0.06		
Vijaya Bank	0.05		