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 bank branch-level balance sheet and firm-bank lending data. The flight to safety is *not* a flight to quality. Lending shrinks and credit quality improves in run banks, but worsens in PSBs receiving the flight-to-safety flows. The reallocation of resources is not efficient in the aggregate.

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A bank run occurs when many depositors suddenly withdraw their deposits in a short period of time. Because runs can cause bank failures and cascading domino effects that threaten financial stability, a major focus of bank regulations and policies is to avoid runs (Calomiris and Mason, 1997). In addition, when runs do occur, policies have included aggressive measures to stop them. For example, the 2023 runs at Silicon Valley Bank (Acharya et al., 2023) were met with an unprecedented policy response that effectively guaranteed all deposits, even above the $250,000 insurance threshold in the US.

Although banking instability has (appropriately) been a focus of research and policy on runs, we study a different dimension of runs, viz., the *resource reallocation* triggered by runs. As motivation, consider the March 2023 runs in the US at three major banks – Silicon Valley Bank, First Republic Bank, and Signature Bank. The runs caused a flight to safety of deposits from regional banks to larger banks perceived as safe havens (Caglio, Dlugosz and Rezende, 2023). The central question in our study is the onward consequence of such a deposit migration – for banks, bank borrowers, and the real economy.

We develop insights on these issues from a bank run episode in India during the 2008 global financial crisis. Panicked depositors fled from private banks. Deposits migrated to state-owned public sector banks (PSBs) that served as credible safe havens. We characterize the resulting reallocation and the real-side effects for both the banks experiencing runs and the PSBs receiving the run flows. For the real side-effects, we trace the changes in credit quantity and quality. We also provide estimates of aggregate effects using proprietary bank branch data and bank-firm matched lending data from statutory filings.

A key lesson that emerges from our analysis is that the resource reconfiguration from runs is not necessarily neutral, as might be expected if the reallocation is a simple one-for-one gap-filling exercise by the recipients of run flows. Credit quality improves at the run banks but worsens at the PSBs receiving run surpluses, consistent with research on state-owned banks (Shleifer and Vishny, 1994; Shleifer, 1998). Using techniques recently proposed by Sraer and Thesmar (2023), we find a negative aggregate effect in which productivity is impaired. Thus, the run does not only reallocate, but *misallocates* resources, so a flight to *safety* need not be a flight to *quality*. The reintermediation quality matters.

The run we study occurs after the 2008 global financial crisis, when some branches of private banks in India experience panic outflows in the form of a sudden and rather extreme loss of deposits. State-owned "public sector" banks (PSBs) serving as safe havens witness a deposit surge. A proprietary branch-level dataset, the annual "Basic Statistical Returns" (BSR), which India's central bank shared with us, lets us identify run branches, the related deposit flows, the PSBs gaining flows, credit quantity and quality and conduct placebo tests. We supplement it with bank-firm relationship data from statutory filings at India's Ministry of Corporate Affairs.

Two features help frame our analysis. One, formal protection for private bank depositors was very limited and thus offered little comfort to panicked depositors (Iyer and Puri, 2012). The second is the presence of state-owned public sector banks (PSBs) in India. The PSBs are credible safe havens for multiple reasons. The Indian government holds large direct stakes in them — 70% on average. In addition, it 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 1949 Banking Regulation Act obliges the government to fulfill the obligations of PSBs in the event of bank failure, adding comfort to the perceptions about PSB safety. Thus, depositors could view PSBs as safe repositories for their funds.

In our setting, runs occur at the bank-branch level. We thus have a variety of "silent" runs (Baron, Verner and Xiong, 2020) that branch-level data help identify. Bank financial years end on March 31, so fiscal year *t* is 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). Empirically, we require that the branch deposit growth rate is (1) less than out-of-sample predicted growth rates; (2) below the 5$^{\text{th}}$ percentile of growth rates in 2007 and 2008; and (3) transitions from above the 5% left tail cutoff in 2008 to below this cutoff in 2009.

Simple descriptive statistics show that our filters identify extreme deposit losses in fiscal year 2009. The median growth in deposits for run branches flips from +25% to -25% in one year. The 99$^{\text{th}}$ and 1$^{\text{st}}$ percentiles of deposit losses are -14% and -89%, respectively. We show that the run deposit losses flow to PSB branches in the same geography. We also show that run flows do *not* accrue to non-run private bank branches in the run geographies, consistent with PSBs having a unique role as safe havens for worried depositors.

To further assess the role of PSBs as safe havens, we consider an instrumental variables approach. The idea is that the propensity to run at a private bank branch increases if there is a nearby PSB branch, which eases access to a safe haven for panicked depositors. We use pin codes (akin to US zip codes) to identify co-location, using data provided to us by the Indian central bank. The approximately 19,000 pin codes are far more granular than the 593 districts (which are like counties), and thus credibly identify nearby branches salient for deposit runs. The co-location instrument is strong. The IV estimates show that co-located PSB branches gain deposit flows from run branches.

We find that runs impact both credit quantity and quality and do so in asymmetric ways across run banks and PSBs. The direct impact of runs is on the run branches. They contract credit. The results suggest that banks face frictions in raising external finance

(Kashyap and Stein, 1995, 2000) that prevent seamless replenishing of lost resources. Because the banks in our sample operate nationally, runs could have repercussions beyond geographies experiencing runs. To assess this possibility, we construct bank-level run exposure variables that are aggregates using as weights resources in the run geographies. For private banks, the weights are based on the size of the branches facing runs, while for PSBs, they are based on the geographies with runs. Our specifications account for areas with multiple PSB branches that could split run flows. Table 1 has the exact definitions.

For banks facing runs, credit shrinks significantly both within and beyond run geographies. Conversely, credit grows at state-owned PSBs that receive run flows. Interestingly, and in contrast to private bank branches, PSBs tend to grow credit primarily outside run geographies. The result likely reflects more centralized, HQ-centered decision making in state-owned entities. The result is of interest from another viewpoint: they show PSBs do not passively gap-fill credit reductions suffered by borrowers of run branches, as indicated by the asymmetry between the credit cutbacks at run branches and its dispersion by PSBs across their networks.

We find a similar asymmetry in the changes in credit quality. Non-performing assets (NPAs) diminish at the run bank branches, consistent with models in which runs are disciplinary (Calomiris and Kahn, 1991; Diamond and Rajan, 2001). However, NPAs increase at PSBs that receive run surpluses. Another feature of interest is that PSB NPA increases are significant with 3-year lag, a pattern that we do not see in private banks. The result likely reflects a combination of the natural time lags needed for credit issues to become visible and deferred NPA recognition by PSBs exercising the latitude in NPA recognition granted by the Indian central bank.[1]

[1] The central bank (RBI) allowed "forbearance" that could be used to delay NPA recognition. See, e.g., a December 2024 interview by the then RBI governor https://tinyurl.com/4zjnnc3k.

The results can be viewed as the outcome of a natural experiment in which organizations obtain sudden influxes of surpluses (Lamont, 1997). An interesting feature here is the simultaneous resource contraction at private banks and its expansion at PSBs. Misallocation is traditionally viewed as being due to insufficient managerial ownership (Jensen, 1986). Here, we have a converse problem of *excessive* ownership. The imprimatur of state ownership that makes PSBs safe havens can also shelter them from market discipline that can curb inefficient allocation.

We provide firm-level evidence using a database on bank-firm relationships maintained by India's Ministry of Corporate Affairs (MCA) based on lender security interest filings. We match the MCA data with firm accounting data in the CMIE Prowess database. We find across multiple specifications at the loan- and firm-level, that credit in the post-run period is more likely to flow when the lender is a PSB, both at the extensive and intensive margin. The credit increases at the PSBs are, however, of weaker quality. Firms in the credit-receiving group are more likely to have future interest coverage ratios below 1.0 and lower sales and capital growth, supporting the evidence of lower credit quality in lending of run flows by state-owned banks.

We turn to the aggregate consequences of the run. The dispersion of marginal productivity of capital is an indicator of allocative inefficiency (Hsieh and Klenow, 2009). 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 18% and appear to reflect within-sector effects rather than credit reallocation across industries.

Two additional tests expand on and clarify the above findings. In one, we consider a natural experiment that generates variation in co-location. In 2005, India's central bank liberalized branch licensing rules with new branches permitted based on a cutoff using per-capita bank branch density (Young, 2017; Cramer, 2020). Using branch density as the running variable, the policy cutoff generates a discontinuous private bank exposure to PSBs after delicensing takes effect. The evidence that private banks exposed to PSBs have more flighty deposits. A second test is based on variation within the state-owned PSBs. As weaker state-owned banks benefit more from the implicit put due to state ownership, we conjecture that these banks are more likely to attract flows. Acharya et al. (2017) suggest a measure of a bank's weakness, the Marginal Expected Shortfall (MES).[2] We find that this is the case. Weaker PSBs offer higher deposit rates, expand lending, and their loans have weaker ex-post performance.[3] The results, alongside those on the lack of deposit migration to other private banks indicates that state ownership makes PSBs safe havens but also results in weaker reintermediation of run surpluses.

We proceed as follows. Section 1 describes institutional details and the data. Section 2 and Section 3 examine run-related deposit and credit flows, respectively. Section 4 analyzes firm-level outcomes and aggregate effects. Sections 5 gives additional robustness evidence and Section 6 discusses the related literature. Section 7 concludes.

1 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

[2]MES is measured in our implementation as the negative of the average returns of a stock given that the market return is below its 5$^{\text{th}}$- percentile during the period 1$^{\text{st}}$ January 2007 to 31$^{\text{st}}$ December 2007.

[3]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.

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 event 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 panic led depositors to move from private to public sector banks as reflected in the aggregates in Figure 1. Stark differences emerged as the GFC took root with the Bear Stearns collapse in March 2008.[4]

1.1 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 supports PSBs through capital injections from time to time through budgetary appropriations. For example, it infused about INR 31 billion (approximately $0.5 billion) in 2009 (World Bank, 2009). These features make PSBs credible safety nets for depositors.

India's Deposit Insurance and Credit Guarantee Corporation (DICGC) insures bank deposits. The 2008 coverage (INR 0.1 million or about $2000) per depositor per bank was meager 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).[5] PSBs were essentially the only accessible safe havens for depositors as Indian

[4]While not critical for our analysis, panic seems to drive the run in our sample as Indian banks had little exposure to U.S. mortgages that were at the root of the 2008 crisis (Acharya and Richardson, 2008). Note that the figure is at the bank level and not for individual branches that faced deposit flights.

[5]Private banks blamed state support as being responsible for the 2008 runs and lobbied for an increase in deposit insurance for greater parity in the provision of safe deposits. (LiveMint, 2011). On February 4, 2020, a decade after the run episode we analyze, the deposit insurance coverage was increased to INR 500,000.

sovereign paper was available only for banks and other large institutions.

1.2 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. We use two geographical markers. One is a district, which is roughly comparable to a US county and available as part of the BSR dataset. The other marker is pin code, which was obtained from a dataset compiled by the central bank. We retain branches for which the pin code information is available for the baseline analysis but briefly expand on both markers to highlight the distinctions between the two.

Pin codes are far more granular as they reflect geographical proximity, familiarity with local service providers, and ease of transportation and travel. In our view, this level of granularity is relevant for panicked depositors looking for a different bank branch. Districts are larger economically integrated regions, typically spanning large areas of 2,000 square miles.[6] In India, districts are the units of governance, with "collectors" appointed to run all administrative matters on behalf of elected politicians. Economic data are also compiled at the district level. Thus, local economic conditions or spillovers are better assessed or controlled for at the district level. We use the districts demarcated by the Indian Census in 2001, which are relevant for the time period covered by our sample.

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). We use this data for financial

[6]The typical district spans end to end distances of 40-50 miles, often with poor connectivity. During our sample period, there are 593 districts and over 19,000 pin codes.

variables in the firm-level analyses. Please see Appendix Table 1 for more details on variables used in our analysis. A loan-level dataset compiled by the Ministry of Corporate Affairs, which identifies firm-bank relationships using security interest filings (Chopra, Subramanian and Tantri, 2021) that are akin to UCC filings in the U.S. analyzed by Gopal and Schnabl (2022). Table 2 provides summary statistics for our dataset.

2 The Deposit Run

Empirically, we identify a branch as facing 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 size (lagged log credit), 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 whether the deposit growth is in the extreme left tail. 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: 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 $g_{2009} < p_5$ where p_5 as the 5^{th} percentile of the deposit growth rate for private banks in 2008, one year before the run.

Figure 2 is a heat map in which whites correspond to regions with more runs as per the above definition. We have more regions with low deposit growth for private banks (Panel (a)) than for PSBs (Panel (b)). Panels (c) through (f) depict related time series evidence. 6.6% of private bank branches are classified as run branches and Figure 3 shows that in particular, more concentrated in new private banks, weaker banks with greater MES

(Acharya et al., 2017), and branches in regions with more PSB presence, a point that we will shortly exploit in instrumental variables models.

Figure 4 reports estimates of a formal event-study specification

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

where the 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 $\mathbb{1}_\tau$ and $\mathbb{1}_{Run_j}$ are fiscal year and run indicators, respectively. The pre-2009 estimates of η_τ are insignificant, indicating no parallel trends. The run-year coefficient η_{2009} is negative and significant both statistically and economically, whether we have district-time (panel a) or pin code-time (panel (b)) fixed effects.[7]

2.1 State-owned PSBs As Safe Havens

Panicked depositors seek shelter in safe havens. In India, state-owned PSBs serve as credible safety nets, an observation that leads to an instrumental variables design in which exogenously determined location serves as an instrument for panic flows. The instrument ($\mathbb{1}_{\text{Coloc. PSB}}$) is motivated by two observations. First, the presence of nearby PSB branches makes private branch deposits more flighty. Second, depositors in metropolitan areas are more likely to be aware of events such as the GFC and assess its relevance to financial conditions. Moreover, deposit accounts in metros are larger than those in rural branches, making (the lack of) government guarantees more salient. Based on the above reasoning, we propose as an instrument based on co-located PSB branches. The indicator switches

[7] In unreported results, we find that branches in the left tail of fiscal 2005 (as placebo) show no extreme deposit losses in 2009. The results are also robust in models that use the pre-period data to control for parallel trends (Alencar, 2016; Drechsler, Savov and Schnabl, 2021).

on if a branch (a) belongs to a private sector bank; (b) is located in a metropolitan area; and (c) has a PSB branch in the same pin code.

Figure 5 shows the aggregate deposits (normalized to 1 in March 2007) for co-located and other private bank branches (aggregates are in Appendix Figure A.2). Reassuringly, co-location does not seem to matter pre-run period but a stark divergence emerges between co-located and other private branches after the run.

The first and stage equations of the IV specification using co-location are

$$\mathbb{1}_{\text{Branch run } jbd} = \alpha_b + \gamma_d + \beta \times \mathbb{1}_{\text{Coloc. PSB } j} + \epsilon_{jbd} \tag{2}$$

$$Y_{jbd} = \alpha_b + \gamma_d + \beta \times \mathbb{1}_{\widehat{\text{Branch run}}\ j} + \epsilon_{jbd} s \tag{3}$$

Table 3 reports the results. Columns (1) and (2) report the first-stage estimates with district or pincode fixed effects, respectively. Co-location predicts runs with F-statistics above the Angrist and Kolesár (2024) thresholds for instrument strength. The second stage IV estimates in columns (3)-(4) are significant and indicate the virtually complete erosion of deposits in run branches. Non-IV reduced form estimates, which may be of interest to the reader but are not reported here for brevity, are in Appendix Tables A.3 and A.4. Co-location explains deposit declines in 2008–2009, and in particular, it does not in earlier placebo years between 2001–2008.

Flows to PSBs Do run-flows from private banks accrue to PSBs? We first present reduced-form evidence that this is the case. Consider Pvt. Dep. $\text{Loss}_{\text{RUN PIN}}$, the greater of 0 or the negative of the deposit growth rate in pin code p with runs. The interaction of this proxy for run deposit losses with a PSB indicator should capture gains accruing to PSBs.

Thus, we estimate

$$Y_{jbp} = \alpha_b + \kappa_p + \eta \times \text{Pvt. Dep. Loss}_{\text{RUN PIN }jp} \times PSB_b + \epsilon_{jbp} \tag{4}$$

where Y_{jbp} is the run year deposit growth of branch j of bank b in pin code p, α_b and κ_p are bank and pin code fixed-effects, respectively, and Pvt. Dep. $\text{Loss}_{\text{RUN PIN }jp}$ denotes run deposit losses. Robust standard errors are (conservatively) clustered at the district level.

The columns (2) and (3) in Table 4 report reduced-form estimates of PSB gains. In both specifications, the coefficient η for the interaction term is significant and show that private branch deposit losses accrue to PSBs (for convenience, we report 100* η).[8] Columns (4)-(5) present instrumental variables estimates using Pvt. Dep. $\text{Loss}_{\text{COLOC PIN}}$ as an instrument for runs (the first stage in column 1 indicates a strong instrument) and the interaction between PSB and Pvt. Dep. $\text{Loss}_{\text{COLOC PIN}}$, the specifications already estimated in columns (3–4). The second stage IV estimates in columns (5–6) for the PSB interaction term remain positive and significant, indicating that the PSBs are beneficiaries of run flows.[9]

2.2 Private Banks Are Not Safety Nets

Our next tests consider variations within private banks. As Mishra, Prabhala and Rajan (2022) point out, virtually all Indian PSBs were formed through nationalization programs. However, these programs left in place some old private banks as old as PSBs and as familiar to depositors. Do these old banks act as recipients for run flows? Does familiarity

[8]In column (2), Pvt. Dep. $\text{Loss}_{\text{RUN PIN}}$ has – not surprisingly – a negative coefficient, indicating that run branches lose deposits. Of course, with geography fixed effects, this variable is absorbed and thus does not appear in column (3).

[9]Note that including bank fixed effects absorbs the bank exposure variable and geography fixed effects absorb run flows. The results are robust to excluding the run private sector bank branches and conducting comparisons within PSBs and private banks. See Internet Appendix Table A.5.

breed faith and safe haven status? Or, alternatively, does state ownership matter?

Panel A in Table 5 considers deposit losses at old and new private banks. The two are statistically indistinguishable. In Panel B, we include an indicator for co-location of a new private bank branch in the same pin code with an old private bank branch and ask if the old one acts as a surrogate for PSBs. Columns 1–2 show that old private co-location is insignificant and does not predict deposit losses in runs (columns 3–4). The IV estimates using both co-location variables as instruments gives the same message (columns 5–6). Collectively, the results suggest that government ownership of PSBs is critical in making them safe havens for panic flows.

3 Credit

Runs at a branch deplete its deposit resources. The loss of deposits translate into credit losses when banks face frictions in accessing external finance (e.g., Kashyap, Stein and Wilcox (1993); Kashyap and Stein (2000)). Credit cutbacks can be local, impacting just the branches facing runs. Ripple effects across branches are possible when banks have national franchises, as in is the case in our study. Runs could also have quality effects. For instance, Diamond and Rajan (2001) posit that runs are disciplinary, so run banks could tighten credit standards. Conversely, while PSBs gaining windfall surpluses could increase lending, locally or nationwide, what is the quality of the new lending? We consider these questions next.

A brief remark helps motivate the tests. It is possible that the PSBs receiving surpluses step in to mitigate credit impacts in a gap-filling exercise, resulting in (close to) no impact on borrowers relying on credit from run banks. However, this would not be the case if there are asymmetries in credit lost at run banks and credit disbursal by the banks gaining surpluses. Which of the two effects do we see? We develop evidence on this issue next and in the next section, consider its aggregate effects.

Credit Quantity It is relatively straightforward to model deficits created or surpluses gained by individual bank branches losing or gaining run flows if the transfers are local. However, if the surpluses lost or gained spread across the bank network. the analysis demands bank-wide metrics of run flows. We propose two bank-level "exposure" variables that denote outflows (for private banks) and inflows (for recipient PSBs).

$$\text{Pvt. Dep. Pct.}_{\text{COLOC PIN }b} = \sum_{j \in b} \frac{\text{Deposit}_j}{\text{Deposit}_b} \times \mathbb{1}_{\text{Coloc. PSB }j} \tag{5}$$

$$\text{PSB Dep. Pct.}_{\text{COLOC PIN }b} = \sum_{j \in b} \frac{Deposit_j}{\text{Deposit}_{bp}} \times \text{Pvt. Dep. Loss}_{\text{COLOC PIN }jp} \times \text{PSB Sh}_{bp} \tag{6}$$

where b denotes a bank, $\text{Pvt. Dep. Loss}_{\text{COLOC PIN }jp}$ is (as before) the negative of the deposit flows at co-located private sector bank branches, $\mathbb{1}_{\text{Coloc. PSB }j}$ is the branch-level co-location instrument, and PSB Sh_{bp} is the PSB deposit share of bank b in geography p. The exposure variables essentially weight deposits based on run exposure with an adjustment in equation (6) for the presence of multiple PSBs in a region that could share run flows.

To assess the outside-run geography effects for private banks, we estimate

$$\begin{aligned} Y_{jbd} &= \alpha_d + \gamma \times \mathbb{1}_{\text{Coloc. PSB }j} + \beta \times \text{Pvt. Dep. Pct.}_{\text{COLOC PIN }b} + \epsilon_{jbd} \\ Y_{jbd} &= \alpha_d + \theta_b + \gamma \times \mathbb{1}_{\text{Coloc. PSB }j} + \epsilon_{jbd} \end{aligned} \tag{7}$$

For PSBs, the analogous specification is

$$
\begin{aligned}
Y_{jbd} &= \theta_b + \gamma \times \text{Pvt. Dep. Loss}_{\text{COLOC PIN } d} + \epsilon_{jbd} \\
Y_{jbd} &= \alpha_d + \gamma \times \text{PSB Dep. Pct.}_{\text{COLOC PIN } b} + \epsilon_{jbd}
\end{aligned} \tag{8}
$$

where, Y_{jbd} denotes credit growth in branch j of bank b in district d in the run year and the exposure variables are as defined in equations (5) and (6). District fixed effects α_d are strong controls for local heterogeneity while θ_b, the bank fixed effect, differences out the bank. Standard errors are robust and clustered at the district level.

Table 6 reports the estimates of specifications (7)-(8). Let us consider the effects for private banks first. In column (1), the coefficient for $\mathbb{1}_{Coloc.\ PSB}$ is negative and significant, indicating contraction in the local geography by colocated run branches. The direct effect is about -22 percentage points (pp) for a one-SD increase in the run exposure. Column (2) shows that the estimates are similar with bank fixed effects, so the effect is significant within the same bank between run branches and non-run branches. The outside-run region estimates are also interesting. The coefficient for Pvt. Dep. Pct.$_{\text{COLOC PIN}}$, denoting effects beyond the run geography, is insignificant. Thus, the primary effect for private bank branches experiencing runs is within the run region.

Columns (3) and (4) in Table 6 turn to credit granted by PSBs. In contrast to private banks, we find that PSBs expand credit disperse credit beyond run regions. Rather, their credit expansion is outside the run geography. The asymmetry in credit reallocations between private banks and PSBs is not consistent with PSBs passively stepping in to fill in private lending gaps created by the run.[10]

[10] In unreported results, we find similar results with alternate "leave-one-out" measures. However, these measures do not capture private-to-PSB flows, our focus, and raise other concerns (Angrist, 2014).

Credit Quality Analogous to the approach used for credit quantity, we define two bank-level flow measures

$$\begin{aligned} \text{Pvt. Cred. Pct.}_{\text{COLOC PIN } b} &= \sum_{j \in b} \frac{\text{Credit}_j}{\text{Credit}_b} \times \mathbb{1}_{\text{Coloc. PSB } j} && (9) \\ \text{PSB Cred. Pct.}_{\text{COLOC PIN } b} &= \sum_{j \in b} \frac{Credit_j}{\text{Credit}_b} \times \text{Pvt. Dep. Loss}_{\text{COLOC PIN } jp} && (10) \end{aligned}$$

where b denotes a bank, $\mathbb{1}_{\text{Coloc. PSB } j}$ is a co-location indicator, $\text{Pvt. Dep. Loss}_{\text{COLOC PIN } jp}$ is the negative of the deposit flows at co-located private bank branches. These weights use the pre-crisis year credit (recognizing that NPAs originate from credit extended) and the measure is standardized (z-scored) for easy interpretation.

The analogous specifications for credit quality follow

$$\begin{aligned} Y_{jbp} &= \alpha_p + \beta \times \text{Pvt. Cred. Pct.}_{\text{COLOC PIN } b} + \epsilon_{jbp} \\ Y_{jbd} &= \alpha_p + \gamma \times \text{PSB Cred. Pct.}_{\text{COLOC PIN } b} + \epsilon_{jbp} && (11) \end{aligned}$$

for branch j of bank b in pin code p in 2008–2009 and the exposure variables are as defined in equation (10). Empirically, Y_{jbd} denotes the change in non-performing assets over 3 years between 2009 and 2011 – and also between 2012 and 2016 for reasons that we discuss shortly. We control for credit growth and scale the NPA change by the beginning of period assets, e.g., the 2009-2011 changes are relative to credit in 2009, to account for the private bank-PSB differences in credit growth due to the run-related reallocation. District fixed effects α_p (pin codes give similar results) control for local economic conditions. Standard errors are robust and clustered at the geography level.[11]

[11] NPAs are defined as loans that are substandard (delinquent for between 90 days and two years), doubtful (no repayments for more than two years), or outright losses.

Table 7 reports the NPA results. For private banks that experienced runs, NPAs shrink at the 3-year horizon, consistent with tightening of credit standards after the run. For PSBs, NPAs show little change over the first 3 years but increase markedly in later years (column 4). The deferred emergence of NPAs for PSBs has interesting economics. Some of the slowness could reflect delays in emergence of asset quality problems. While worsening macro conditions, e.g., due to stress after the 2008 GFC, is a possibility, we note that private banks do not show similar effects. A third force at play is central bank pressure for timely NPA recognition. The central bank tightened norms, leading to a system-wide asset quality review (AQR) program in 2015. In fact, the PSB NPA issue was so serious that it led to a complete makeover of the domestic bankruptcy code in 2016.[12]

Summarizing, we find that the run has both credit quantity and quality effects. Private banks facing runs contract credit, primary locally, and improve quality. The state-owned PSBs receiving run flows increase credit but disperse it across geographies and exhibit worse quality with delayed recognition. This characterization is not consistent with runs as neutral events in which safe-haven PSBs passively gap-fill credit losses at run banks. The results are more consistent with a version of bank "specialness" of banks in which lending relationships are not readily fungible across banks (James, 1987; Billett, Flannery and Garfinkel, 1995; Gande and Saunders, 2012). We next analyze the aggregate effects of the resource reallocation due to runs.

4 Aggregate Effects

In this section, we attempt to estimate the aggregate effects of the resource reconfiguration resulting from the run, using data on bank-firm linkages derived from security interest

[12] See the Insolvency Board Website https://ibbi.gov.in//en/legal-framework/act

filings with India's Ministry of Corporate Affairs (MCA). We combine these data with firm-level financial data from the CMIE Prowess database.

4.1 Evidence from Bank-Firm Lending Data

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

$$Y_{fb} = \omega_f + \beta \times \text{Public Sector Bank}_b + \eta \times X_{fb} + \epsilon_{fb} \tag{12}$$

We assess both the existence of a borrowing relationship and the amount borrowed, so the dependent variable Y_{fb} is weakly positive. Following Chen and Roth (2023), we model it using a Poisson specification. We also provide separate models for the extensive and intensive margins, so the dependent variable is whether there is a borrowing or the total loan amount for a firm-bank pair between fiscal 2009 and 2011. Controls X are explained below. The pre-period is 3 years prior to the run, with zeros if there is no relationship in the relevant period. Standard errors are robust and clustered at the bank level.[13]

Table 8 reports the estimates of equation (12) with firm fixed effects as controls. At the extensive margin, the results in columns (1)–(2) show that firms are more likely to receive credit from a PSB. In particular, the column (2) estimates use fixed firm effects as demand controls (Khwaja and Mian, 2008), suggesting that heterogeneity in demand does not appear to drive increased credit from PSBs (Jimenez et al., 2020). The estimates in column (3) indicate that firms borrow more from PSBs. The point estimate is INR 547 million (about \$10 million at the 2008 exchange rate of US\$1=INR 50) and INR 930 million (US\$ 18 million) when we add firm fixed effects. The combined extensive-intensive Poisson

[13] 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.

specifications of Chen and Roth (2023) in columns (5) and (6) give similar results.

Firm-level estimates in Panel B of Table 8 serve two purposes. They verify the quantity results and shed light on the quality of PSB allocations. We use the specification

$$\Delta Y_f = \alpha_{i(f)} + \beta \times \text{Pre-Run PSB Exposure}_f + \gamma \times \text{Pre-Run PSB Exposure}_f \times \text{Top}_f + \epsilon_f \tag{13}$$

for a firm f in industry i. The dependent variables include an indicator for whether a firm borrows in the 2009-2011 post-period and the amount borrowed. We include 3-digit NIC industry fixed effects and cluster standard errors at the industry level. The independent variables of interest are *Pre-Run PSB Exposure*, an indicator for whether a firm borrows from a PSB in the pre-run period and especially its interaction with an indicator TOP_f, which denotes whether the firm's 2008 productivity of capital is above median.

The results in the first row of Table 8, Panel B show that pre-run PSB borrowers are more likely to be post-run borrowers and get more credit. The results in row (3) show that the *less* productive firms are likely to get more credit including in the preferred Chen and Roth (2023) Poisson regression that combines the extensive and intensive margins.

The results are consistent with the quantity and quality effects reported earlier in Section 3. We note that the two sets of results come from disjoint datasets, from the MCA security interest filings on firm-bank relationships and the other from branch-level BSR data. Both suggest that PSBs expanded lending and towards weaker firms in the post-run period. What are the aggregate effects of this reallocation? We turn to this issue next.

4.2 Aggregate Industry Effects

We use the Sraer and Thesmar (2023) approach to assess the aggregate impact of the resource reallocation due to the runs. Of importance are three moments of log-MRPK (marginal productivity of capital) distribution drive the reallocation effects, viz., the variance of log-MRPK, the mean of log-MRPK, and the covariance of log-MRPK and sales

- $\Delta\Delta\sigma^2(s)$, 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.

As in Sraer and Thesmar (2023), a firm's output-to-capital ratio, log-MRPK, is the log of the ratio of sales to the gross book value of total assets. For the before-after comparison, we consider average log MRPK over 3 years prior to and after the run. The estimates are at the 2-digit NIC industry level. which gives us 100 industry observations each before and after the run. We estimate the difference-in-difference specification

$$\begin{aligned} M_{ind,t} &= \alpha_s + \beta_M \times \text{Industry exposure}_s \times Post_t \\ &+ \gamma \times \text{Industry exposure}_s + \eta \times Post_t + \epsilon_{ind,t} \end{aligned} \tag{14}$$

where s is the industry in period t and industry exposure is the loan-weighted firm exposure. We include industry fixed effects and cluster standard errors at the industry level.

We note two results of economic interest ahead of the aggregation exercise. The first is an estimate of the dispersion of productivity. As Gopinath et al. (2017) note, it is an indicator of inefficient capital allocation. Column (2) in Table 9, which presents the estimates of equation (14), shows that industries with high exposure to PSBs see an increase in the variance of log-MRPK, i.e., the dispersion in productivity. The results are significant at the 10% level.[14] We also note that omitting industry-fixed effects in column (1), lets us compare exposed and unexposed industries in the pre-run period. The insignificant coefficient for the exposure term without interactions shows that the differences are not significant. We obtain similar conclusions for the other moments in columns (3)–(6).

The three estimates required for estimating the aggregate effects are are $\Delta\Delta\sigma^2(s) = 1.305 \times \text{Industry exposure}_s$, $\Delta\Delta\mu(s) = -0.032 \times \text{Industry exposure}_s$, and $\Delta\Delta\sigma_{MRPK,py}(s) = 0.244 \times \text{Industry exposure}_s$. Internet Appendix Figure A.3 shows that the distribution of log-MRPK is approximately normal, as required for the approach.

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

$$\begin{aligned}\Delta \log(TFP) \approx & \underbrace{-\frac{\alpha}{2}\left(1+\frac{\alpha\theta}{1-\theta}\right)\sum_{s=1}^{S}\kappa_S\widehat{\Delta\Delta\sigma^2}(s)}_{\text{-17.68\%}} \\ & \underbrace{-\frac{\alpha}{2}\left(1+\frac{\alpha\theta}{1-\theta}\right)\sum_{s=1}^{S}(\phi_S-\kappa_S)\left(\widehat{\Delta\Delta\mu(s)}+\Delta\Delta\sigma_{\widehat{MRPK,py}}(s)+\frac{1}{2}\frac{\alpha\theta}{1-\theta}\widehat{\Delta\Delta\sigma^2}(s)\right)}_{\text{-0.09\%}} \\ \approx & -17.8\% \end{aligned} \tag{15}$$

[14] The significance level is likely conservative due to the numerous approximations that go into the computation, e.g., the flows out of private banks into PSBs, their aggregation at the bank level, and the relatively small number of industries.

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

$$\Delta \log(Y) \approx -\frac{\alpha(1+\epsilon)}{1-\alpha} \sum_{s=1}^{S} \phi_S \left(\widehat{\Delta\Delta\mu(s)} + \frac{1}{2}\frac{\alpha\theta}{1-\theta}\widehat{\Delta\Delta\sigma^2}(s) + \Delta\Delta\sigma_{\widehat{MRPK,py}}(s) \right) \approx -23.6\% \tag{16}$$

where ϵ is the Frisch elasticity. Using $\epsilon = 0.2$, we estimate a negative effect of about 23.6% due to bank runs and credit reallocation from private to public banks.[15]

We close this section with one remark. The economically significant estimates due to the run-related resource reallocation are entirely consistent with the aggregates that reveal a stark and surprisingly large NPA portfolio at state-owned Indian PSBs in the post-run period. For instance, Mohan and Ray (2021) (see especially their Table 6) show that the gross (net) NPAs of the PSBs steadily increased after the 2008-2009 run, peaking at 14.6% (8.0%) of assets when the asset quality recognition (AQR) program of India's central bank triggered NPA recognition. The gross and net NPAs are almost or more than three times the ratios of private banks.[16]

5 Robustness Evidence

We provide evidence from two robustness tests. One exploits the central bank's 2005 deregulation of branch licensing norms, which results in new variation in PSB co-location. A second test examines variation within PSBs. We test whether weaker PSBs have a greater tendency to chase deposit flows in the run.

[15] In Appendix Table A.6 and the related discussion, we also consider an alternative aggregation approach used in Blattner, Farinha and Rebelo (2019) and Osotimehin (2019) that is based on different assumptions. This approach estimates an 16% decline in productivity.

[16] Misallocation of surpluses and resources by PSBs is plausible due to multiple forces that feed on each other, e.g., culture, fraud, political pressures, creditor rights, slow courts, or delays in insolvency resolution. A press article by Bandopadhyay, 2022 has an informative discussion.

5.1 Natural Experiment: 2005 Branch Deregulation

The first robustness test uses a shift to quantitative licensing formulas for branch openings, announced by RBI (the central bank) on September 8, 2005. RBI allowed entry into underbanked "banking deserts" using a cutoff based on the population served per branch. Private banks entered underbanked areas ((Young, 2017; Cramer, 2020; Khanna and Mukherjee, 2020). The 3-year run up between 2006 and 2008 occurs before the run year and gives a reasonable window for realized entry prior to the fiscal 2009 run, features that generate a unique convergence of circumstances for this test.

We use the population per branch as the running treatment variable subject to a threshold discontinuity in a regression discontinuity design. The first stage dependent variable is the pre-run PSB branch share in a district between 2006 and 2008, which generates the instrument for the subsequent deposit growth. The specifications are

$$\begin{aligned}
\text{PSB share}_{bd} &= \delta_s + \beta * \text{Banked}_d + \gamma * \text{Banked}_d * f\left(T_d\right) \\
&+ \phi * (1 - \text{Banked}_d) * f\left(T_d\right) + \kappa X_d + \eta_d \qquad (17) \\
\text{Deposit Growth}_{jdst} &= \alpha_{bt} + \delta_{st} + \beta \times \widehat{\text{PSB share}}_d + \eta \times X_{jdst} + \nu_{jdst} \qquad (18)
\end{aligned}$$

where PSB share$_{bd}$ denotes PSB share in district d, 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). The RD uses a triangular kernel with 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 post-period is from 2009-2011. We include 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.

Panel (a) of Figure 6 shows a discontinuous increase in the number of private sector bank branches at the RD threshold in under-banked districts, which is not seen in PSBs (Panel (b)). Panel (c) shows a discontinuous decrease in PSB deposit shares, consistent with deposit migration 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.[17] The run period results are in Table 10. Column (1) has the first-stage estimates of equation (17). 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.[18]

5.2 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 A.10 for a list of private banks and PSBs for which we can compute MES.

[17] For evidence on covariate balance, see the Internet Appendix Table A.7 and McCrary plots in Figure A.4 and Internet Appendixes Table A.7, Panel (b) and Table A.8 for additional evidence and the relative insensitivity to the empirical choices for implementing the RD.

[18] Placebo results for the pre-crisis periods in the Internet Appendix Table A.9 show no such effects or pre-trends. The run period flights are special.

We hypothesize that the more vulnerable PSBs with greater MES should attract more panic flows. The intuition is that these banks gain more from the protection conferred by state ownership and thus the panic flows. Figure 7 shows some results. The figure on the left shows that while flow losses are greater at weaker *private* banks, the line in the right panel is upward sloping. That is, the weaker PSBs attract more deposit flows. Table 11 provides estimates of Equation (8), replacing the bank-level 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. We also find that the 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 vulnerable PSBs. See Panel B of Table 11. 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)) but the relation reverses for non-retail deposits that come from more sophisticated investors who are more sensitive 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.[19] Consistent with this view, there have been significant ex-post capital injections for several PSBs, indicating that depositor perceptions about state support were not unfounded.[20]

6 Related Literature

The literature on runs is vast.[21] We add to this literature by focusing on the resource reallocation that occurs after runs. Unless safe-havens passively gap-fill for banks losing funds, runs are not neutral. In our study, surpluses migrate outside run regions. Credit quality worsens and the aggregate effect is negative.

In our setting, state-owned public sector banks (PSBs) are the safe-havens. Shleifer and Vishny (1994) point out that state ownership of banks can distort credit when political capture outweighs developmental and market imperfection-correcting benefits. See also

[19] Preliminary results from the Covid-19 period are supportive of this channel. Private banks received 55% of incremental deposits in the pre-Covid periods but only 30% after.

[20] 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.

[21] See, e.g., Diamond and Dybvig (1983); Chari and Jagannathan (1988); Calomiris and Kahn (1991); Diamond and Rajan (2001) for theory; Bernanke (1983); Saunders and Wilson (1996); Calomiris and Mason (1997); Iyer and Puri (2012); Acharya and Mora (2015); Blickle, Brunnermeier and Luck (2022); Schumacher (2000); Monnet, Riva and Ungaro (2023) offer empirical evidence. Research on the 2023 Silicon Valley Bank run includes Benmelech, Yang and Zator (2023); Caglio, Dlugosz and Rezende (2023); Jiang et al. (2024).

Banerjee (1997); Banerjee, Cole and Duflo (2005); Qian and Yeung (2015); Barth, Caprio and Levine (2001); Cole (2009); Dinç (2005); Shleifer (1998). We develop a complementary point: the imprimatur of state ownership creates a safe haven safety net that depositors value and access in a panic but that worsens resource allocation.

Resource misallocation is the subject of a thriving literature in economics. Hsieh and Klenow (2009) show that reallocating resources from underperforming firms 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.[22] State ownership of productive assets contributes to resource misallocation through subsidies, possibly due to political considerations. [23] We join this literature by highlighting an alternate channel, the role of the implicit protection of liabilities for state-owned entities, which are PSBs in our setting.

We also add to the research on banking systems without a safety net, e.g., Argentina in the 1990s (Schumacher, 2000). Here, runs can move funds from weak to strong private banks in disciplining ways, although see Baron, Schuralick and Zimmerman (2023) for a different viewpoint. Our study offers a contrasting scenario. Panicked depositors do not migrate to other private bank branches even in the same geography but place funds in state-owned PSBs that disperse funds outside run geographies and make weak loans that become visible with central bank pressures on asset quality recognition. Relatedly, in developed economies, state protection typically generates a "too big to fail" effect (Penas and Unal, 2004; Iyer et al., 2019). In our setting, size does not confer protection but state

[22]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 (2023); Catherine et al. (2022); Pavcnik (2002); Trefler (2004); Hopenhayn and Rogerson (1993); Guner, Ventura and Xu (2008).

[23]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 (2024); Sapienza (2004) and Dinç (2005) on the effects on private firms.

ownership does, through managerial control over PSBs and related banking law.

We also add to recent work on "silent" banking panics that are panic events without accompanying realized 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. (2024), Caglio, Dlugosz and Rezende (2023)). Our study highlights some issues in assessing and responding to these runs. A key issue we highlight is that the reintermediation of run surpluses matters. Unless recipients of flows passively step in one for one for banks losing surpluses, runs will result in resource reallocation. Its aggregate impact depends not only on the banks facing runs and the impacted customers but also on the banks attracting surpluses. The effects can arise in multiple ways. For instance, if runs move funds from banks in special geographies or with niche expertise to banks with different expertise or geographical focus – for instance, out of banks specializing in high tech lending to startups to different sectors – they have real consequences. Quality is of course important, as poor resource allocation by the safety nets can replace today's run problem with a future non-performing assets problem.

7 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 both the resource flights at the individual bank branches that face runs and the banks that gain flight-to-safety flows. We assess the resulting credit effects and provide estimates of the aggregate consequences of the resource reallocation.

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 18%.

An important thread in our study is that while much research and policy has focused on the instability created by runs on the banks facing them, what also matters is how the flight-to-safety flows are reintermediated back to the real economy. In our study, reintermediation occurs through state-owned bank branches, the weaker ones, which seem to bear responsibility for the negative 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 as the shelter from the discipline in the funding market can lead 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 1: 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 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.

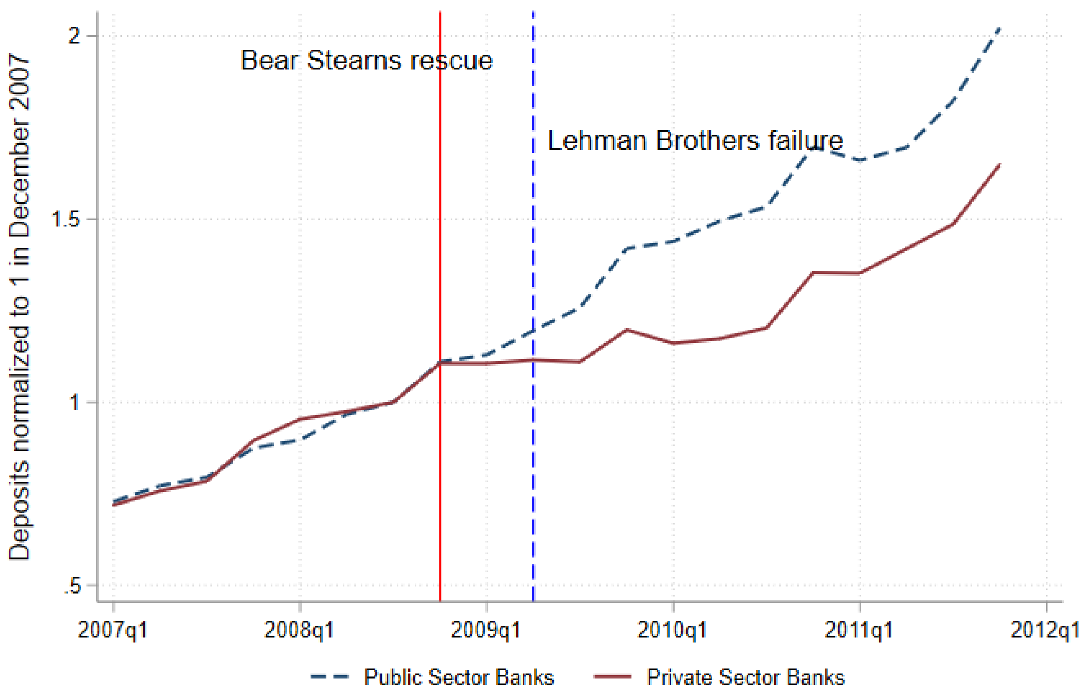


Figure 2: Heat Map

This figure 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. Panels (a) and (b) correspond to the private and public bank deposit growth, respectively. Districts with no available data are shaded in gray.

(a) Private Sector Banks

(b) Public Sector Banks

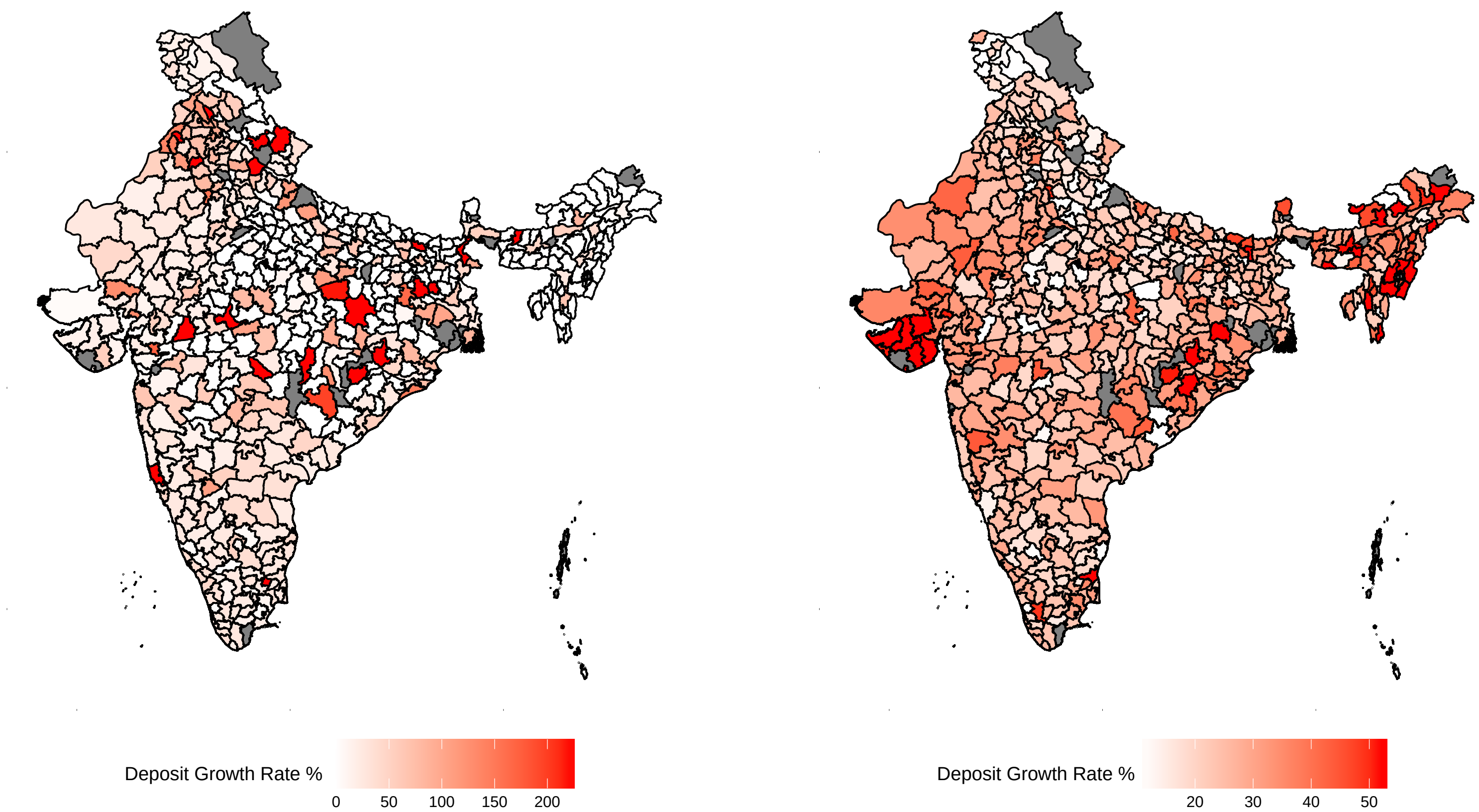
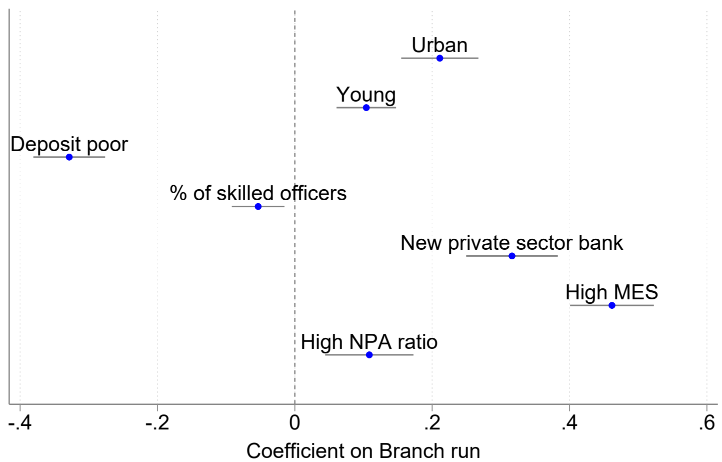


Figure 3: Characteristics of Branches With Runs

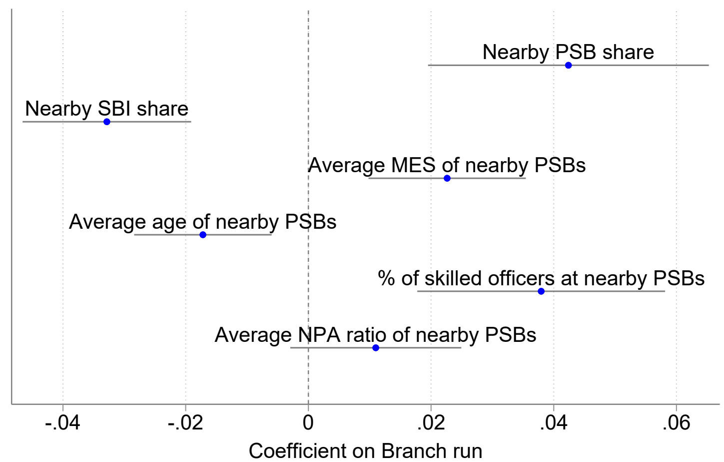
The figure shows the characteristics of branches with runs and the characteristics of the public sector bank branches in these districts. The correlates of the branch run variable and branch and district characteristics are examines using the specification:

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

Branch run is an indicator variable as defined in Table 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**



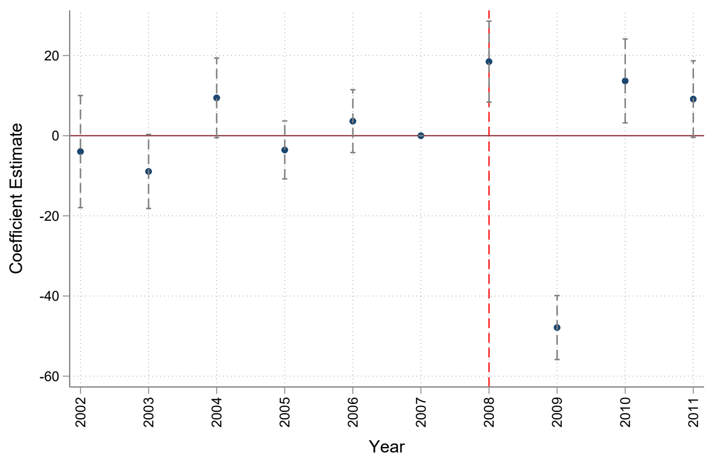
(b) **Characteristics of nearby PSB branches**

Figure 4: Event Study Plots

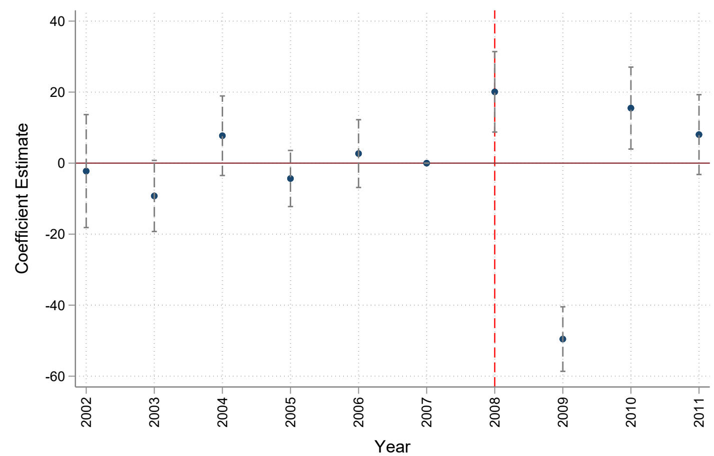
This figure shows the coefficients (η_τ) from an event study regression:

$$Y_{jbdpt} = \alpha_j + \theta_{dt} + \gamma_{bt} + \sum_{\tau} \eta_\tau \times \mathbb{1}_\tau \times \mathbb{1}_{\text{Branch run}} + \epsilon_{jbdpt}$$

where the dependent variable, Y_{jbdpt} is the annual growth in deposit for branch j belonging to bank b in district d in pin code p for time-period t (where t ranges from 2002 to 2011). α_j, γ_{bt} and θ_{dt} are branch, bank-time, and pin code-time period fixed effects respectively in panel A. In Panel B, θ_{dt} is replaced with pin code-time fixed effect. $\mathbb{1}_\tau = 1$ if the year is τ, with τ ranging from 2002 to 2011. The branch run variable, $\mathbb{1}_{\text{Branch run}}$, is as defined in Table 1. Year refers to the fiscal year from April 1$^{\text{st}}$ to March 31$^{\text{st}}$. Standard errors are clustered at the branch level. The figure plots the η_τ coefficients. Dashed grey lines depict the 5% confidence intervals.



(a) With district FE



(b) With pin code FE

Figure 5: Deposits at Co-located Branches

This figure shows the annual deposits for private sector bank branches co-located from 2004 to 2012, where year is the fiscal year ending on March 31. Co-located branch takes a value of 1 for $\mathbb{1}_{\text{COLOC. PSB}}$, as defined in Table 1, and 0 otherwise. Deposits are aggregated to the national annual level and shown as the solid red line for co-located branches and as the dashed blue line for remaining private sector bank branches. Deposits are normalized to 1 as of March 2007 for each category. The solid vertical line is shown for March 2008.

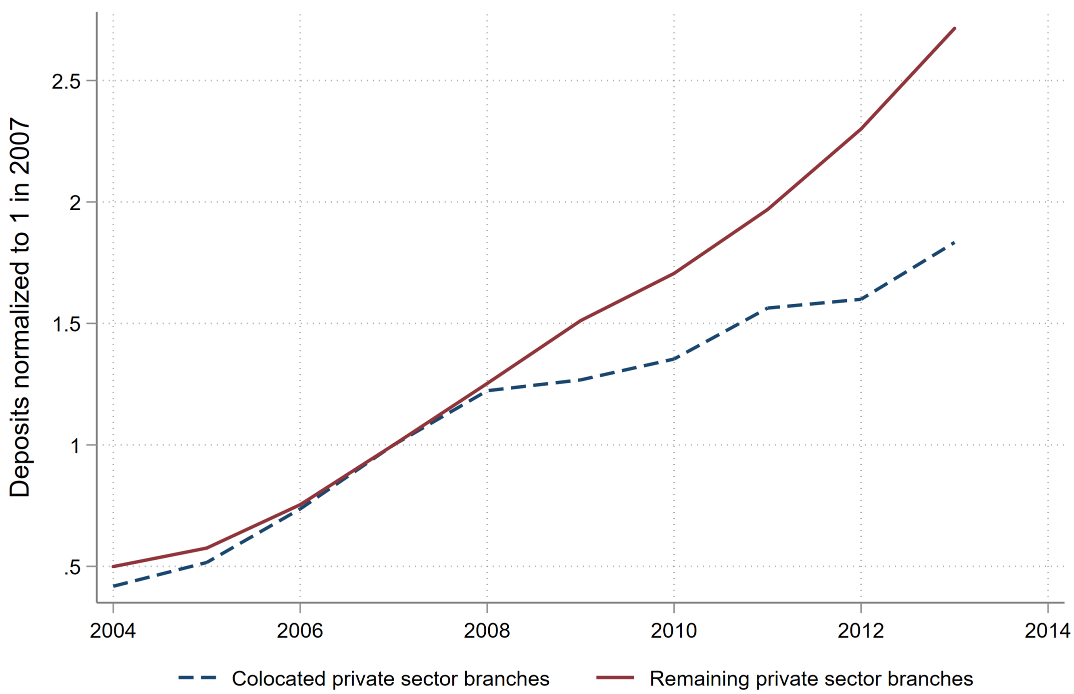
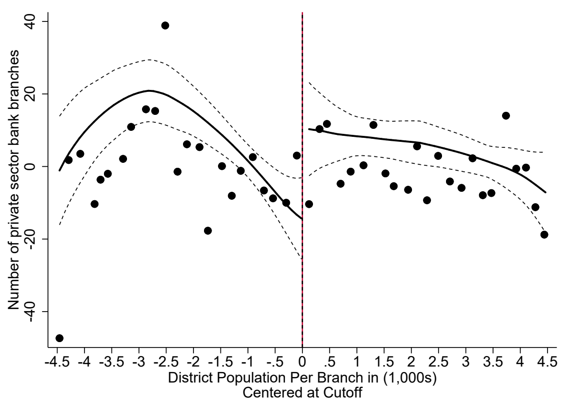
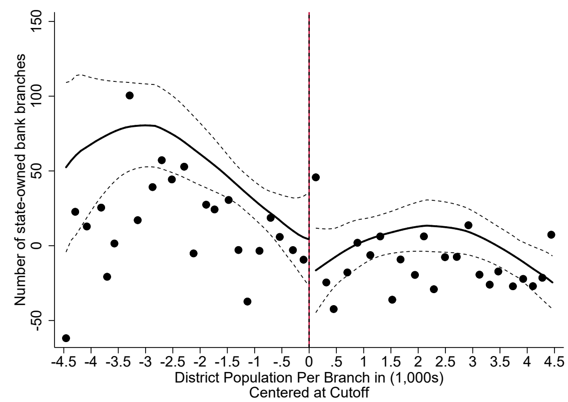


Figure 6: Regression Discontinuity: Share of State-Owned Bank Branches

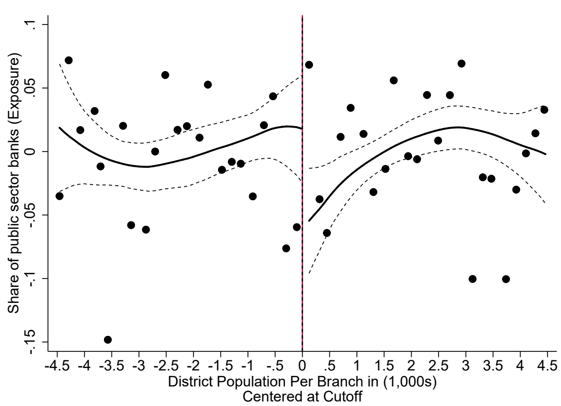
The table reports regression discontinuity (RD) plots for the number of private sector bank branches in 2006–08 (panel a), number of state-owned bank branches in 2006–08 (panel b), deposit share of state-owned banks in 2006–08 (panel c), and deposit share of state-owned banks in 2001–03 (panel d) at 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 partialled 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

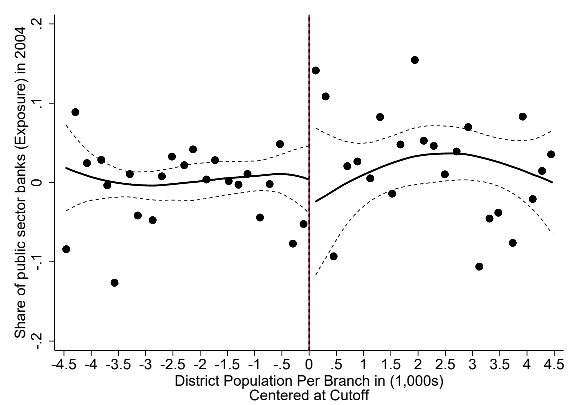


(b) State-owned bank branches in 2006–08



(c)

Deposit share of state-owned banks in 2006–08



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

Figure 7: 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 1.

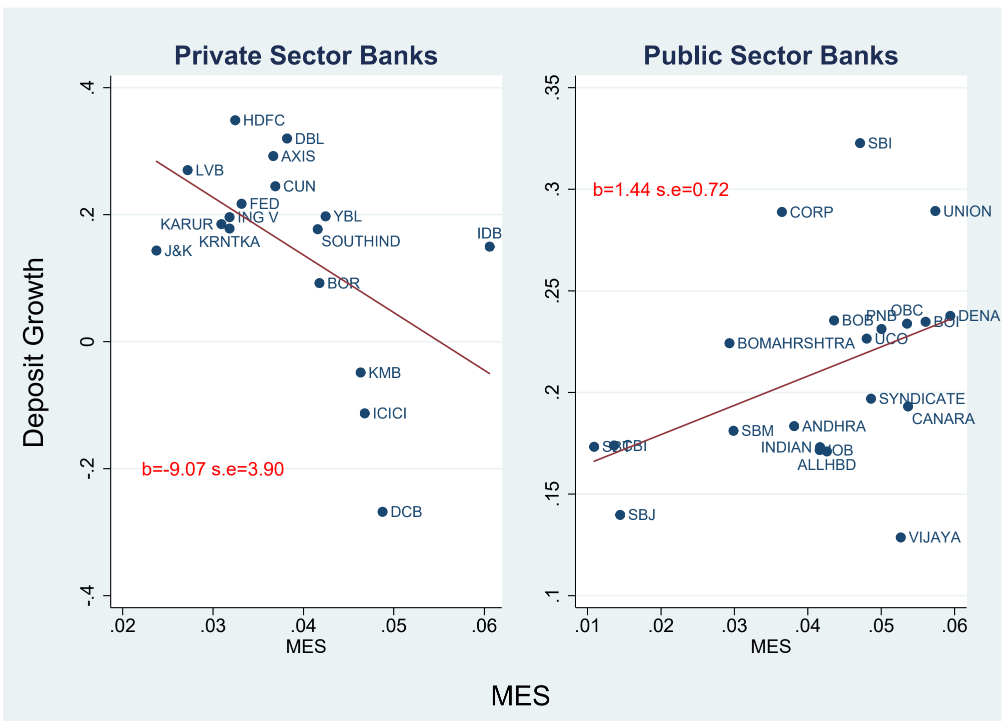


Table 1: Key Variable Definitions

Variable	Definition & Source †
(1) Year	Fiscal year t is the 12-month period ending on March 31 of calendar year t.
(2) $\mathbb{1}_{\text{Branch run}}$	Branch-level indicator that equals 1 if (a) private sector bank branches if all conditions below are satisfied and 0 for all other branches. (i) Deposit growth is less than predicted based on a regression of annual deposit growth on size (lagged credit), age, whether rural, lagged credit to deposit ratio and whether public using BSR branch data from 2002 to 2006. (ii) Deposit growth falls in 2008–2009 (post-period) is less than that in 2007–2008. (iii) The branch is in the bottom 5th percentile of deposit growth in the year 2009 but not in 2008.
(3) $\mathbb{1}_{\text{Coloc. PSB}}$	Branch-level indicator that equals 1 for a private sector branch in a metro, which has another metro public sector bank branch in the same pin code and 0 otherwise.
(4) Pvt. Dep. $\text{Loss}_{\text{RUN PIN}}$	Pin code-level variable that is the maximum of 0 and the negative total deposit growth rate from 2008 to 2009 of branches in a district with Branch Run (defined above) equal to 1.
(5) Pvt. Dep. $\text{Loss}_{\text{COLOC PIN}}$	Pin code-level variable that is the maximum of 0 and the negative deposit growth rate from 2008 to 2009 of branches in a district with $\mathbb{1}_{\text{Coloc. PSB}}$ (defined above) equal to 1.
(6) Pvt. Dep. $\text{Pct.}_{\text{COLOC PIN}}$	Private bank-level variable that is the deposit weighted average of the $\mathbb{1}_{\text{Coloc. PSB}}$ for all bank branch in the sample with the March 31^{st}, 2008 deposits as weights. The measure is standardized (z-scored).
(7) PSB Dep. $\text{Pct.}_{\text{COLOC PIN}}$	Public bank-level variable that is the deposit weighted average of the pin code exposure Pvt. Dep. $\text{Loss}_{\text{COLOC PIN}}$ for each bank branch multiplied by the share of deposits of metro public sector branch as of March 31^{st}, 2008. The measure is standardized (z-scored).
(7) Pvt. Cred. $\text{Pct.}_{\text{COLOC PIN}}$	Private bank-level variable that is the credit weighted average of $\mathbb{1}_{\text{Coloc. PSB}}$ with credit as of March 31^{st}, 2009. The measure is standardized (z-scored).
(8) PSB Cred. $\text{Pct.}_{\text{COLOC PIN}}$	Public bank-level variable that is the credit weighted average of the pin code exposure Pvt. Dep. $\text{Loss}_{\text{COLOC PIN}}$ with credit as of March 31^{st}, 2009. The measure is standardized (z-scored).
(9) Firm Exposure	Firm-level exposure measure of the loan-weighted exposure to whether a firm borrows from public sector bank, with the loan weights calculated using loans between March 2006 to March 2008.
(10) Industry Exposure	Industry exposure is the loan-weighted Firm Exposure, with the loan weights calculated using loans for 2006–2008.
(11) 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.
(12) $\mathbb{1}_{\text{Coloc. Old. Pvt.}}$	Branch-level indicator that equals 1 for a private sector branch in a metro, which has another metro old private sector bank branch in the same pin code and 0 otherwise.

Table 2: Descriptive Statistics

This table presents summary statistics. Panel A reports statistics for the exposure measures described in Table 1. Pvt. Dep. Pct.$_{\text{COLOC PIN}}$ and PSB Dep. Pct.$_{\text{COLOC PIN}}$ are shown before z-score standardization. Panels B, C, D, and E show the summary statistics for variables at the branch, loan, firm, and industry level, respectively. Deposit and credit growth are for fiscal 2009. Δ NPA$_{2009-2011}$ (Δ NPA$_{2012-2016}$) is the change in non-performing assets for 2009–2011 (2012–2016) relative to credit in 2009 in pp. Observations in Panel C (Panel D) are from a balanced panel of bank-firm (firm) borrowings in the MCA data for the pre- and post-run periods. $\mathbb{1}_{Loan}$ is an indicator for a loan between a bank-firm pair. Loan amount is in INR million. Marginal productivity of capital (MRPK) is sales to gross fixed assets. Panel E shows the summary statistics for three moments of the log-MRPK distribution at the 3-digit industry: the cross-sectional variance of log-MRPK in an industry period, the cross-sectional mean of log-MRPK, and the correlation of log-MRPK and log VA (log sales) with average MRPK for the pre-period and post-periods. Pre(post)-period refers to the 3 years from 2006 to 2008 (2009 to 2011).

Panel A: Exposure measures

	Obs	Mean	SD
$\mathbb{1}_{\text{Branch run}}$	30,806	0.01	0.11
$\mathbb{1}_{\text{Coloc. PSB}}$	30,806	0.05	0.21
Pvt. Dep. Loss$_{\text{RUN PIN}}$	10,015	0.59	4.71
Pvt. Dep. Loss$_{\text{COLOC PIN}}$	10,015	0.36	4.30
Pvt. Dep. Pct.$_{\text{COLOC PIN}}$	19	0.297	0.429
PSB Dep. Pct.$_{\text{COLOC PIN}}$	20	52.740	29.474
PSB Dep. Pct.$_{\text{COLOC PIN}}$	20	52.740	29.474
Firm Exposure	8,272	0.799	0.239
Industry Exposure	57	0.672	0.434

Panel B: Branch-level Variables

	All		Public		Private	
	Mean	SD	Mean	SD	Mean	SD
Deposit growth 2008–2009 (in %)	30.96	38.84	29.58	36.62	37.48	47.45
Credit growth 2008–2009 (in %)	33.72	71.67	30.13	64.28	50.75	97.71
Obs. (Branch)	30,806		58,203		5,273	
Δ NPA$_{2009-2011}$ (in %)	1.23	5.00	1.42	4.93	0.35	5.23
Δ NPA$_{2012-2016}$ (in %)	6.38	12.73	6.99	13.04	3.51	10.68
Obs. (Branches)	30,648		25,375		5,368	

Panel C: Loan-level Variables

	All		Public		Private	
	Mean	SD	Mean	SD	Mean	SD
$\mathbb{1}_{Loan}$	0.02	0.14	0.03	0.18	0.01	0.11
Loan amount (in INR million)	27	930	54	1366	11	504
Obs. (Loans)	636,918		240,996		395,922	

Panel D: Firm-Level Variables

	Mean	SD	p25	p50	p75
$\mathbb{1}_{Loan}$	0.57	0.49	0.00	1.00	1.00
Loan amount (in INR million)	1699	10,483	0.00	23	450
Obs. (Firms)			12,668		

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

	Mean	SD	p25	p50	p75
Pre-period Var(log-MRPK)	2.39	1.28	1.60	1.96	2.88
Pre-period Mean(log-MRPK)	0.59	0.51	0.28	0.61	0.92
Pre-period Cov(log-MRPK, log VA)	0.56	0.21	0.51	0.58	0.70
Post-period Var(log-MRPK)	2.19	1.25	1.37	1.89	2.75
Post-period Mean(log-MRPK)	0.67	0.52	0.29	0.70	1.01
Post-period Cov(log-MRPK, log VA	0.52	0.20	0.41	0.52	0.66
Obs. (Industry)			57		

Table 3: 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 fiscal 2009 (the financial year ending on March 31, 2009) Observations are at the branch level. The branch run variable, $\mathbb{1}_{\text{Branch run}}$, and the branch-level instrument, $\mathbb{1}_{\text{COLOC. PSB}}$, are defined in Table 1. Fixed effects included are as indicated. Columns (1)-(2) show the first-stage using the instrument for branch run, and columns (3)-(4) show the instrumented variable estimates. Standard errors are clustered at the branch level.

	(1)	(2)	(3)	(4)
Dependent variable:	Branch Run		Deposit growth	
$\mathbb{1}_{\text{Branch run}}$			-105.309***	-108.728***
			(29.687)	(35.851)
$\mathbb{1}_{\text{Coloc. PSB}}$	0.055***	0.049***		
	(0.010)	(0.010)		
R-squared	0.178	0.269	0.009	0.010
No. of Obs.	30,784	25,501	30,784	25,501
F-statistic	31.46	24.73		
Bank FE	Y	Y	Y	Y
District FE	Y	Y	Y	Y
Pincode FE	N	Y	N	Y
Type	First Stage	First Stage	IV	IV

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

Table 4: Safe-Haven Flights of Deposits to PSBs

The table shows the deposit growth of PSB branches in the run district. Observations are at the branch level. The dependent variable is the annual growth rate of deposits for fiscal 2009 (the financial year ending on March 31, 2009). Pvt. Dep. Loss$_{\text{RUN PIN}}$ and Pvt. Dep. Loss$_{\text{COLOC PIN}}$ (instrument) are pin code-level measures defined in Table 1. Public is an indicator variable for public sector banks. Column 1 is the first stage of the instrumental variables estimate and confirms that run losses are related to co-location. Columns (2)-(3) and (4)-(5) show reduced form and IV estimates, respectively, of run bank losses (row (3)) and flows accruing to PSBs (row (4)). District, pin code and bank fixed effects are included as shown. Standard errors are clustered at the district level.

	(1)	(2)	(3)	(4)	(5)
Dependent variable:	Pvt. Dep. Loss$_{\text{RUN PIN}}$	Deposit growth			
Pvt. Dep. Loss$_{\text{COLOC PIN}}$	0.733***				
	(0.0798)				
Pvt. Dep. Loss$_{\text{RUN PIN}}$		-0.280***		-0.325***	
		(0.0555)		(0.0838)	
Public $\times$ Pvt. Dep. Loss$_{\text{RUN PIN}}$		0.413***	0.375***	0.505***	0.494***
		(0.0634)	(0.0661)	(0.100)	(0.107)
R-squared	0.459	0.0698	0.255	0.00370	0.00352
No. of Obs.	30806	30806	25501	30806	25501
F-statistic	84.43				
Bank FE	Y	Y	Y	Y	Y
District FE	N	N	Y	N	Y
Pincode FE	N	N	Y	N	Y
Type	First Stage	OLS	OLS	IV	IV

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

Table 5: Private Banks Are Not Safety Nets

This table presents two sets of results to test whether old private sector banks serve as safety nets. The dependent variable is deposit growth in fiscal 2009, the financial year ending on March 31, 2009. $\mathbb{1}_{\text{Coloc. PSB}}$ and $\mathbb{1}_{\text{Coloc. Old. Pvt.}}$ are as defined in Table 1. The sample for Panel A comprises all private sector bank branches and that for Panel B includes all bank branches. In the instrumental variables specification in Panel B, the first stage estimates are in columns (1)-(2), reduced form estimates are in columns (3)-(4), and the 2SLS IV estimates are in columns (5)-(6). Fixed effects included are as indicated. Standard errors are clustered at the branch level.

Panel A: Within-private bank variation

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	Deposit growth					
Sample:	Private Sector Banks					
	All		New private		Old private	
$\mathbb{1}_{\text{Branch run}}$	-56.984***	-58.468***	-64.209***	-64.932***	-54.692***	-58.907***
	(1.802)	(2.512)	(2.322)	(4.377)	(2.492)	(3.861)
R-squared	0.293	0.453	0.241	0.449	0.372	0.518
No. of Obs.	5307	3948	2877	1771	2378	1755
Bank FE	Y	Y	Y	Y	Y	Y
District FE	Y	Y	Y	Y	Y	Y
Pincode FE	N	Y	N	Y	N	Y

Panel B: Including instrument for co-location with urban old private bank

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	Branch Run		Deposit growth			
$\mathbb{1}_{\text{Coloc. Old. Pvt.}}$	0.008	0.003	4.032	2.508		
	(0.016)	(0.017)	(2.769)	(2.944)		
$\mathbb{1}_{\text{Coloc. PSB}}$	0.052***	0.048***	-7.290***	-6.261***		
	(0.012)	(0.012)	(2.184)	(2.308)		
$\mathbb{1}_{\text{Branch run}}$					-101.346***	-107.444***
					(28.902)	(35.453)
R-squared	0.178	0.269	0.104	0.253	0.011	0.011
No. of Obs.	30784	25501	30784	25501	30784	25501
F-statistic	129.0	82.25				
Bank FE	Y	Y	Y	Y	Y	Y
District FE	Y	Y	Y	Y	Y	Y
Pin code FE	N	Y	N	Y	N	Y
Type	First Stage	First Stage	RF	RF	IV	IV

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

Table 6: Credit Effects of Runs

This table shows credit growth of branches as a function of exposure to runs. The unit of observation is a branch. The dependent variable is the annual growth rate of total credit for fiscal 2009, the financial year ending on March 31, 2009. The remaining variables are defined in Table 1. Columns (1)-(2) report estimates for private banks while columns (3)-(4) report estimates for state-owned public sector banks. Fixed effects are included as indicated.

	(1)	(2)	(3)	(4)
Dependent variable:	Credit growth			
Sample:	Private Sector Banks		Public Sector Banks	
$\mathbb{1}_{\text{Coloc. PSB}}$	-22.052**	-21.863**		
	(9.365)	(9.046)		
Pvt. Dep. Pct.$_{\text{COLOC PIN}}$	0.005			
	(3.105)			
Pvt. Dep. Loss$_{\text{COLOC PIN}}$			0.030	
			(0.044)	
PSB Dep. Pct.$_{\text{COLOC PIN}}$				1.573***
				(0.325)
R-squared	0.129	0.175	0.019	0.059
No. of Obs.	5307	5307	25438	25409
Bank FE	N	Y	Y	N
District FE	Y	Y	N	Y

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

Table 7: NPA Effects In and Beyond Run Geographies: Long difference

This table reports regression results to explain non-performing assets (NPAs) associated with runs. The unit of observation is a branch. For columns (1) and (2), the dependent variable is the change in non-performing assets from 2009 to 2011 scaled by credit in 2009. Columns (3) and (4) report similar results for the change in non-performing assets from 2012 to 2016 scaled by 2012 credit. A year refers to the financial year ending on March 31. Pvt. Cred. $\text{Pct.}_{\text{COLOC PIN}}$ and PSB Cred. $\text{Pct.}_{\text{COLOC PIN}}$ are the bank-level exposure measures as defined in table 1. Both measures are standardized (z-scored). Standard errors are clustered at the pin code level.

	(1)	(2)	(3)	(4)
Dependent variable:	Δ $\text{NPA}_{2009-2011}$		Δ $\text{NPA}_{2012-2016}$	
Sample:	Private	Public	Private	Public
Pvt. Cred. $\text{Pct.}_{\text{COLOC PIN}}$	-0.601***		-0.168	
	(0.132)		(0.280)	
PSB Cred. $\text{Pct.}_{\text{COLOC PIN}}$		0.037		0.913***
		(0.035)		(0.100)
R-squared	0.186	0.185	0.253	0.257
No. of Obs.	25259	25259	25146	25146
Pincode FE	Y	Y	Y	Y

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

Table 8: Loan-Level and Firm-level Outcomes

This table reports the extensive and intensive margins of lending before and after the bank run based on firm-bank borrowing data from filings at the Ministry of Corporate Affairs in India. The dependent variable for the extensive margin specification (columns (1)-(2)) is whether a loan exists for a bank-firm pair. In the intensive margin specification in columns (3)-(4), the dependent variable is the total loan amount in INR million for a bank-firm pair conditional on a loan being made. Columns (5)-(6) report the combined extensive plus intensive margin results using a Poisson regression. In Panel A, PSB is an indicator for a public sector bank lender. The pre(post)-period denote the three years prior to (after) 2009. All columns include pre-period variables as control variables. Observations are a balanced panel at the bank-firm level for the pre- and post-period in the extensive or extensive plus intensive specifications in columns (1)-(2) and (5)-(6) and for only bank-firm pairs with a post-period loan in columns (3)-(4). Even numbered columns include firm fixed effects. The firm-level specification in Panel B models quantity and quality effects in the post-period. The dependent variables are as in Panel A, but for the post period only. Firm exposure is as defined in Table 1. Top is an indicator equal to 1 if the average MRPK (calculated as total sales to gross fixed assets) in the pre-period is above median, and the specifications include industry fixed effects. In both panels OLS estimation is used in columns 1–4 and Poisson regression in columns 5–6. Standard errors are clustered at the bank-level in Panel A and at the industry-level in Panel B.

Panel A: Loan-level

	(1)	(2)	(3)	(4)	(5)	(6)
	Extensive		Intensive		Extensive+Intensive	
Dependent variable:	$\mathbb{1}_{Loan}$		Amount (in INR million)			
PSB	0.017***	0.017***	547.277**	929.954**	1.540***	1.512***
	(0.005)	(0.005)	(242.402)	(362.439)	(0.475)	(0.443)
R-squared	0.078	0.108	0.040	0.296		
No. of Obs.	636918	636918	13256	9368	636918	479372
Firm FE	N	Y	N	Y	Y	Y
Type	OLS	OLS	OLS	OLS	Poisson	Poisson

Panel B: Firm-level

	(1)	(2)	(3)	(4)	(5)	(6)
	Extensive		Intensive		Extensive+Intensive	
Dependent variable:	$\mathbb{1}_{Loan}$		Amount (in INR million)			
Firm Exposure	0.347***	0.365***	1965.382***	2615.190**	1.592***	1.890***
	(0.014)	(0.021)	(541.246)	(1031.352)	(0.146)	(0.197)
Top		0.170***		-981.922**		0.147
		(0.015)		(432.743)		(0.235)
Top $\times$ Firm Exposure		-0.073***		-1022.016		-0.581**
		(0.025)		(1159.230)		(0.286)
R-squared	0.106	0.130	0.033	0.038		
No. of Obs.	8272	8272	2962	2962	8272	8272
Industry FE	Y	Y	Y	Y	Y	Y
Type	OLS	OLS	OLS	OLS	Poisson	Poisson

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

Table 9: Industry-level Outcomes

This table shows the industry-level estimates that are relevant for computing aggregate productivity effects of the run. Observations are at the industry level for the pre- and post-periods, 2006-2008 and 2009-2011, respectively. Industry exposure is defined in Table 1. Marginal productivity of capital (MRPK) equals total sales divided by gross fixed assets. 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. Time and 3-digit industry fixed effects are included as shown. Standard errors are clustered at the industry level.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	Var(log-MRPK)		Mean(log-MRPK)		Cov(log-MRPK, log VA)	
Post * Industry exposure	1.305*	1.305*	-0.032	-0.032	0.244	0.244
	(0.741)	(0.737)	(0.160)	(0.159)	(0.161)	(0.160)
Industry exposure	-0.105		0.715		-0.068	
	(1.134)		(0.583)		(0.187)	
R-squared	0.036	0.866	0.041	0.974	0.063	0.831
No. of Obs.	114	114	114	114	114	114
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 10: Regression Discontinuity Results

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 between fiscal 2009 and 2011, the financial year ending on March 31 of the relevant year. The running variable used for the discontinuity is whether the population per branch minus its national average is less than zero, a sharp cutoff used by the central bank in the changed branching policy in 2005. The first- and second-stage results are shown in columns (1) and (2). Both specifications include state-year and bank-year fixed effects and covariates that include the percentage of skilled officers, the credit-to-deposit ratio in 2008, and their interactions with time trends. The observations are weighted with fiscal 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 Indian 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)
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 11: 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, which is greater for weaker banks. The dependent variable in Panel A is the annual deposit growth for columns (1)-(2), credit growth for columns (3)-(4), and agricultural and non-agricultural non-performing assets (NPA) growth for columns (5)-(8), which are recorded at the branch level. Data are for three years after the run in the 2009 fiscal year, where year denotes the financial 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. The dependent variable in Panel B is the change in the weighted average deposit rate in basis points (BPS) for retail (columns (1)-(3) and non-retail (columns (2)-(4)) depositors. We estimate results separately for private banks and PSBs, 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

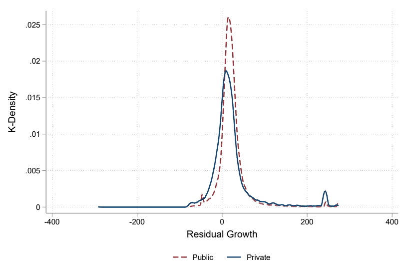
	(1)	(2)	(3)	(4)
Dependent variable:	Change in Deposit Rates (in BPS)			
Sample:	Private		Public	
Type:	Retail	Non-retail	Retail	Non-retail
MES	1.157	-0.713	-6.392***	2.483***
	(0.765)	(2.085)	(0.186)	(0.657)
R-squared	0.752	0.370	0.539	0.060
No. of Obs.	9929	9651	40857	36736
District-Year FE	Y	Y	Y	Y

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

Internet Appendix

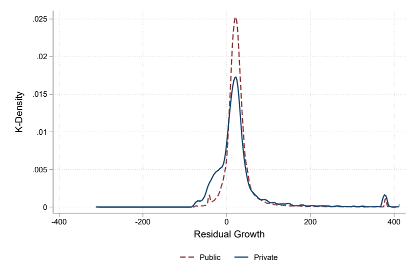
Figure A.1: Distribution of ΔDeposit Growth Rates

Panels (a) and (b) show the excess deposit growth in the year 2008 and year 2009. Year refers to the fiscal year from April 1^{st} to March 31^{st}. 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.



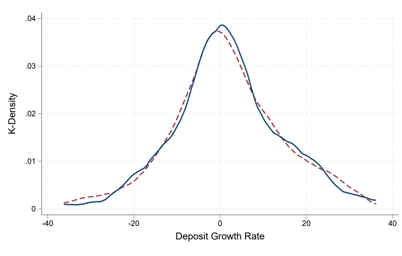
(a)

2007–08



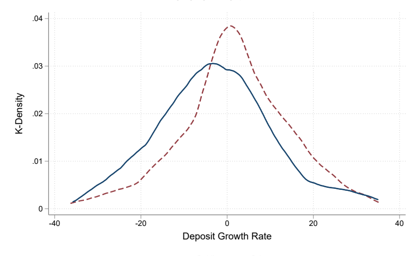
(b)

2008–09



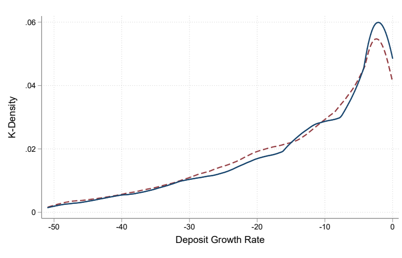
(c)

2007–08



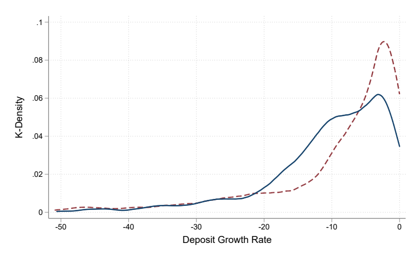
(d)

2008–09



(e)

Public Sector Banks

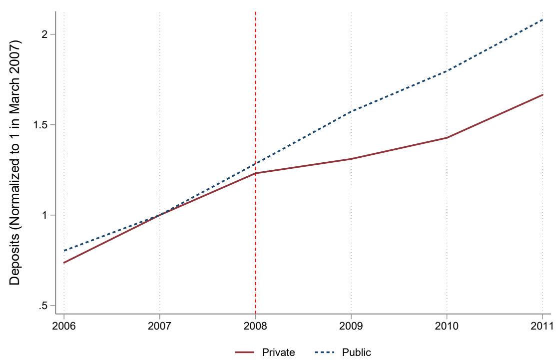


(f)

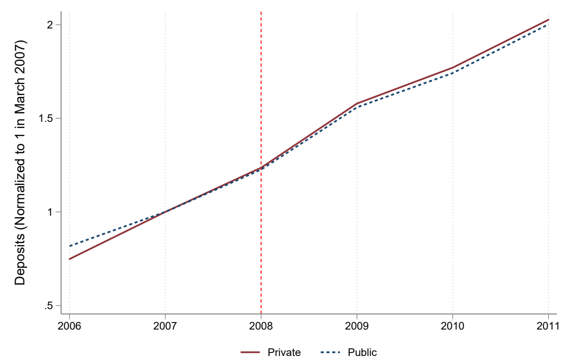
Private Sector Banks

Figure A.2: Deposits by region: Metro, urban, semi-urban and rural

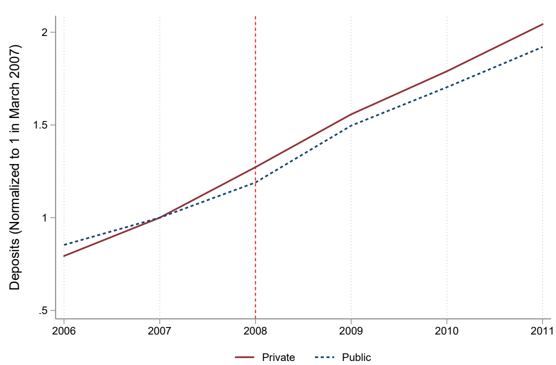
This figure shows the annual deposits (normalized to deposits in 2007) separately for public and private sector banks in metro, urban, semi-urban and rural branches aggregated to the national level for the years 2006 to 2011. Year refers to the fiscal year ending March 31.



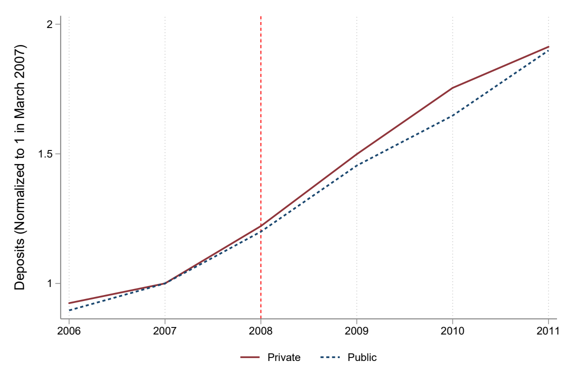
(a) **Metro**



(b) **Urban**



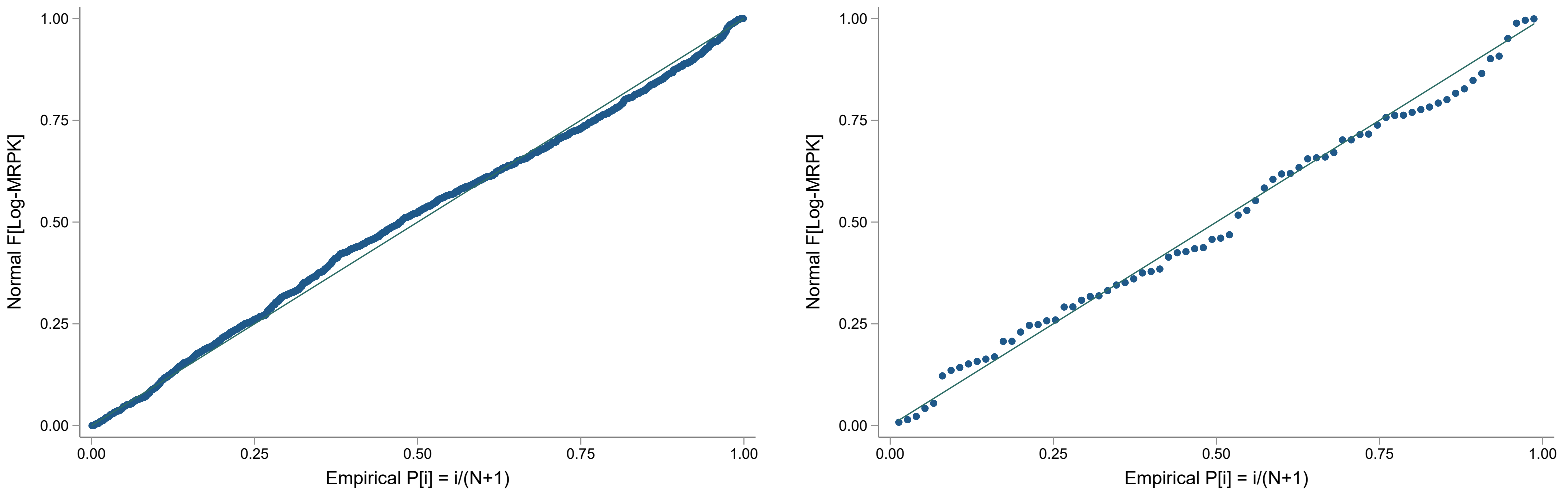
(c) **Semi-urban**



(d) **Rural**

Figure A.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.

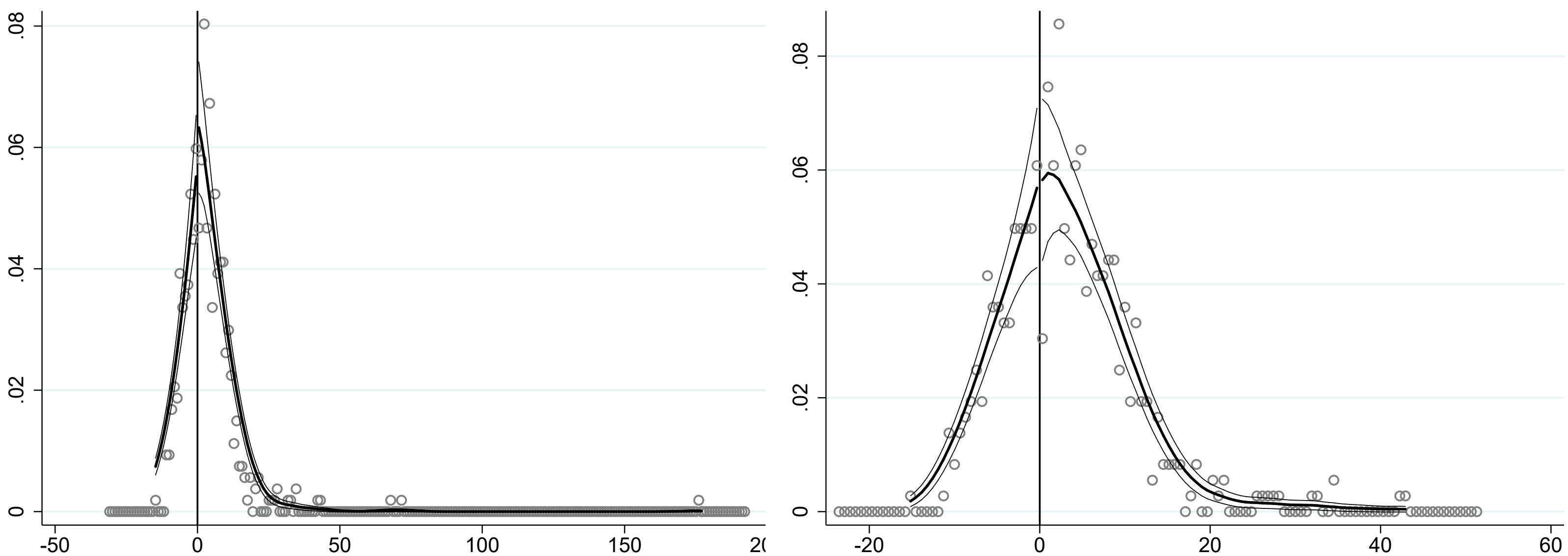


(a) Manufacturing firms

(b) Non-manufacturing firms

Figure A.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

Tables A.1 and A.2: Alternative and Placebo Specifications For Run Losses

We report two sets of results that are useful in showing the robustness of our run definitions.

In Table A.1, we estimate a model in which the post-period is the focus of the primary analysis and the pre-period is used to control for parallel trends, on the lines of Alencar (2016) and Drechsler, Savov and Schnabl (2021). We analyze deposit growth in the post-run period using the following specification:

$$Y_{jbd} = \alpha_b + \gamma_d + \beta \times \mathbb{1}_{\text{Branch run } j} + \epsilon_{jbd}, \tag{19}$$

where Y_{jbd} is the annual deposit growth rate for a given branch j of a bank b in district d for fiscal year 2008-2009. The variable $\mathbb{1}_{\text{Branch run } j}$ is an indicator for whether a branch j has a run. α_b and γ_{dt} are bank and geography fixed-effects respectively.[24]

Table A.1 reports the estimates of equation (19). The coefficient of interest, β which estimates deposit growth for run branches relative to other branches of the *same* bank, are negative and significant. Note that the number of observations differ across columns in Table 3 (and in subsequent tables) because singletons, i.e., observations that appear only once within a fixed effect category, are not reported.

In Table A.2, we show that the extreme deposit losses for run branches observed in the run years are atypical, as they are not exhibited in several years before the run.

Both sets of results follow next.[25]

[24] In unreported results, we find similar results using pre-period data as controls.

[25] In even more unreported results, we show that there is no difference in deposit growth between run and non-run branches in fiscal 2005, 2006, and 2007. Moreover, branches in the left tail of fiscal 2005 (as placebo) show no extreme deposit losses in 2009. These results are available for the interested reader.

Table A.1: 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 2008–2009. Year refers to the fiscal year from April 1st to March 31st. Observations are at the branch level. The branch run variable, $\mathbb{1}_{\text{Branch run}}$, and the branch-level instrument, $\mathbb{1}_{\text{COLOC. PSB}}$, are defined in Table 1. Fixed effects included are as indicated. Columns 1–2 show the OLS estimates, columns 3–4 show the first-stage using the instrument for branch run, and columns 5–6 show the instrumented variables 2SLS IV estimates. Standard errors are clustered at the branch level.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	Deposit growth		Branch Run		Deposit growth	
$\mathbb{1}_{\text{Branch run}}$	-58.453***	-60.070***			-105.309***	-108.728***
	(1.572)	(1.744)			(29.687)	(35.851)
$\mathbb{1}_{\text{Coloc. PSB}}$			0.055***	0.049***		
			(0.010)	(0.010)		
R-squared	0.125	0.274	0.178	0.269	0.009	0.010
No. of Obs.	30784	25501	30784	25501	30784	25501
F-statistic			31.46	24.73		
Bank FE	Y	Y	Y	Y	Y	Y
District FE	Y	Y	Y	Y	Y	Y
Pincode FE	N	Y	N	Y	N	Y
Type	OLS	OLS	First Stage	First Stage	IV	IV

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

Table A.2: Deposit Growth at Branches With Runs: Robustness Placebo Years

This table reports placebo tests for annual deposit growth in fiscal years between 2002–2009. The dependent variable in each columns is the annual deposit growth rate. Year refers to the fiscal year from April 1^{st} to March 31^{st}. Observations are at the branch level. Branch-level variable $\mathbb{1}_{\text{Branch run}}$ is defined in Table 1. Fixed effects included are as indicated. Standard errors are clustered at the branch level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	Desposit Growth							
	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009
$\mathbb{1}_{\text{Branch run}}$	1.086	-5.746	9.724**	-3.295	2.638	-0.111	17.050***	-54.637***
	(4.937)	(3.793)	(4.044)	(3.437)	(3.875)	(3.212)	(3.018)	(1.541)
R-squared	0.279	0.249	0.278	0.267	0.291	0.259	0.269	0.278
No. of Obs.	17812	18313	18970	19582	20635	21343	22833	25501
Bank FE	Y	Y	Y	Y	Y	Y	Y	Y
District FE	Y	Y	Y	Y	Y	Y	Y	Y
Pincode FE	Y	Y	Y	Y	Y	Y	Y	Y

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

Table A.3: Reduced Form for 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 2008–2009. Year refers to the fiscal year from April 1st to March 31st. Observations are at the branch level. Branch-level variables $\mathbb{1}_{\text{Coloc. PSB}}$ is as defined in Table 1. Fixed effects included are as indicated. Standard errors are clustered at the branch level.

	(1)	(2)
Dependent variable:	Deposit growth	
$\mathbb{1}_{\text{Coloc. PSB}}$	-5.828***	-5.365***
	(1.777)	(1.895)
R-squared	0.104	0.253
No. of Obs.	30784	25501
Bank FE	Y	Y
District FE	Y	Y
Pincode FE	N	Y
Type	RF	RF

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

Table A.4: Deposit Growth at Branches With Runs (co-location instrument): Robustness Placebo Years

This table reports placebo tests for annual deposit growth in fiscal years between 2002–2009. The dependent variable in each columns is the annual deposit growth rate. Year refers to the fiscal year from April 1^{st} to March 31^{st}. Observations are at the branch level. Branch-level variable $\mathbb{1}_{\text{Coloc. PSB}}$ is defined in Table 1. Fixed effects included are as indicated. Standard errors are clustered at the branch level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	Deposit Growth							
	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009
$\mathbb{1}_{\text{Coloc. PSB}}$	-2.336	1.490	-2.755	-0.518	2.756	1.506	-2.031	-5.365***
	(2.203)	(1.932)	(2.241)	(2.146)	(1.995)	(1.897)	(1.678)	(1.895)
R-squared	0.279	0.249	0.278	0.267	0.291	0.259	0.267	0.253
No. of Obs.	17812	18313	18970	19582	20635	21343	22833	25501
Bank FE	Y	Y	Y	Y	Y	Y	Y	Y
District FE	Y	Y	Y	Y	Y	Y	Y	Y
Pincode FE	Y	Y	Y	Y	Y	Y	Y	Y

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

Table A.5: Deposit Flights In Local Geography: Examining public and private sector banks separately

The table shows the impact on deposit growth of runs on branches in the same district. Observations are at the branch level. Columns 1, 3, 5 subset to the public sector bank branches and columns 2, 4, and 6 subset to private sector bank branches excluding the run branches (that is $\mathbb{1}_{\text{Branch run}}$ equal to 1). $\mathbb{1}_{\text{Branch run}}$, The district run variable measures the propensity of bank runs among the private sector branches at the district level., Pvt. Dep. $\text{Loss}_{\text{COLOC PIN}}$ are as defined in Table 1. The dependent variable in all columns is the annual growth rate of deposits for 2008–2009. Year refers to the fiscal year from April 1^{st} to March 31^{st}. Fixed effects are included as shown. Standard errors are clustered at the district level.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:			Deposit growth			
Sample:	Public	Private excl. run branches	Public	Private excl. run branches	Public	Private excl. run branches
Pvt. Dep. $\text{Loss}_{\text{RUN PIN}}$	0.134***	-0.316**			0.181***	2.163
	(0.0245)	(0.132)			(0.0345)	(3.202)
Pvt. Dep. $\text{Loss}_{\text{COLOC PIN}}$			0.135***	1.157		
			(0.0250)	(0.755)		
R-squared	0.0388	0.134	0.0385	0.130	0.00195	-0.319
No. of Obs.	25438	3895	25438	3895	25438	3895
F-statistic					89.12	1.125
Bank FE	Y	Y	Y	Y	Y	Y
District FE	N	N	N	N	Y	Y
Pincode FE	N	N	N	N	Y	Y
Type	OLS	OLS	RF	RF	IV	IV

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

Table A.6: Reallocation Evidence Based on Capital Wedge

As an alternative approach to estimate aggregate effects, we consider the results from a second approach. As the computations are different, we discuss the approach before showing the results.

If capital is efficiently allocated, its productivity MRPK (sales to assets) across enterprises should be equal. Thus, reallocation that increase the variation in capital productivity increase inefficiencies. We examine the evidence for the bank run event and estimate the gains from better capital allocation.

Table A.6 below examines the MRPK for firms in a specification analogous to equation 13. The MRPK in the pre- and post-periods is the average output-to-capital ratio in 2006–2008 and 2009-2011 respectively. The specification allows the elasticity to depend on the ex-ante differences in capital wedge, which reflects the degree of financial constraints faced by a firm. See,for instance, the example in Hsieh and Klenow (2009). As before, we proxy for the pre-run period capital wedge by the 2008 MRPK. Top denotes whether a firm's MRPK is above median.

Column (1) in Table A.6 shows that exposed PSBs see an overall decline in MRPK. On examining heterogeneity by MRPK, the triple interaction term in Column (2) shows that high MRPK firms that were exposed public sector banks in the pre-period experienced an *increase* in MRPK. The result that high (low) MRPK firms have greater (lower) post-changes in MRPK is consistent with the one on increased dispersion of capital productivity increases. The cutback by private sector banks (as indicated by the coefficient on the uninteracted Pre-Run PSB Exposure) and the related improvement in discipline as well as the increase by public sector banks in less productive ways combines to lower allocative efficiency.

Blattner, Farinha and Rebelo (2019) and Osotimehin (2019) show how the above estimates can be used to estimate aggregate effects. Under the assumption that the changes in technical efficiency and in entry and exit are negligible, the changes in allocative efficiency are the channel for aggregate effects. These assumptions appear to be stark but are not unreasonable. In unreported results, we find no effect of runs on firm entry and exit. Blattner, Farinha and Rebelo (2019) and Osotimehin (2019) find that the contribution of the technical efficiency term to aggregate productivity is negligible for Portugal and France. Column 2, table A.6 indicates a similar pattern in our data. Under this assumption, we estimate an 16% decline in aggregate productivity due to the run. We interpret it as a robustness check on the baseline estimates based on Sraer and Thesmar (2023) and view the similarity of the results as a source of comfort and robustness in understanding the aggregate effects of the run.

The relevant table A.6 follows below.

Table A.6: Aggregate Effects Using The Capital Wedge Approach

This table shows the impact on firm-level borrowing on MRPK growth. Post-period (pre-period) is the 3-year fiscal period between 1st April 2009 to March 31st 2011 (April 2006 to March 2008). Firm exposure is as defined in Table 1. Top is an indicator equal to 1 if the average MRPK (calculated as total sales to gross fixed assets) in the pre-period is above median. All columns include industry fixed effects. Observations are for firms that borrow in the post-period. Standard errors are clustered at the industry-level.

	(1)	(2)
Dependent variable:	MRPK growth	
Pre-Run PSB Exposure	-0.093***	-0.126***
	(0.031)	(0.042)
Top		0.072
		(0.050)
Top × Pre-Run PSB Exposure		0.103*
		(0.060)
R-squared	0.026	0.033
No. of Obs.	5414	5414
Industry FE	Y	Y
Type	OLS	OLS

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

Table A.7: 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 A.8: 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 A.9: 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 A.10: 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		