Bank Branch Density and Bank Runs

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ABSTRACT

Bank branch density, defined as the number of bank branches to total deposits, has significantly declined over the past decade, fueled by a confluence of branch closings and the almost doubling of deposits between 2016 and 2022. During this period, banks with low branch density benefited from large deposits inflows, leading to even lower density. But the virtuous cycle of deposits growth in these banks stopped spinning when investors became wary about their financial health. Stock prices of banks with low branch density plummeted during the 2023 Banking Crisis as these banks experienced larger outflows of uninsured deposits. Our results suggest that digital banking enabled banks to grow faster and attract uninsured deposits, but those large deposits inflows took the form of "hot money" that changed its course when economic conditions worsened.

JEL : E44, E52, G20, G21, G28.
Keywords: bank runs, bank branch density

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Bank branch density, defined as the number of bank branches to total deposits, has declined significantly over the past decade. This decline was fueled by a confluence of a 14% reduction in the number of bank branches and the almost doubling of banks' total deposits between 2016 and 2022. During this period, banks with low branch density benefited from large deposits inflows, which led to even lower branch density. But the virtuous cycle of deposits growth in banks with low branch density stopped spinning when investors became wary about their financial health. In this paper we study the relation between branch density, deposits flows, and bank performance during the U.S. Banking Crisis of 2023.

All three bank failures in March and May 2023 involved banks with low branch density. Silicon Valley Bank (SVB) failed on March 10, 2023; it was ranked as the 15th largest in the United States, with $175 billion in deposits, but it had just 17 branches. Similarly, Signature Bank of New York, which state regulators closed on March 12, 2023, was the 32nd largest bank in the country, with total deposits of $104 billion and only 38 branches; First Republic Bank, which failed on May 1, 2023, had only 87 branches but was ranked as the nation's 19th largest bank, with a total of $166 billion in deposits.[1] The branch densities of Silicon Valley Bank, Signature Bank, and First Republic Bank were 0.10, 0.36, and 0.53, respectively—well below the 10th percentile of the branch density distribution, which was 0.7 in 2022.

This paper provides systematic evidence about the relation between low branch density, stock returns, and deposits inflows. Using an event study methodology, we find that stock prices of banks with low branch density declined around the failures of Silicon Valley Bank, Signature Bank, and First Republic Bank. Furthermore, using bank regulatory financial data, we show that during the first quarter (Q1) of 2023, banks with low branch density suffered large withdrawals of deposits—in particular, large, uninsured deposits. Our results also suggest that digital banking enables banks with low branch density to grow faster and attract uninsured deposits during relatively calm times. But when interest rates increased and economic conditions worsened, those large deposits inflows took the form of "hot money" that changed its course.

Traditionally, brick-and-mortar branches played a key role in the deposits taking and lending model of banks, which offered customers a host of financial services through a local branch (Becker (2007)). Recent technological advances in online banking enabled banks to attract deposits

[1] The rank is calculated based on total assets. The total assets, number of branches, and total deposits are obtained from Summary of Deposits as of June 30, 2022.

from nonlocal customers. On the lending side, banks used to specialize in collecting information on local borrowers, and branches played an important role in the production of local "soft" information (Petersen and Rajan (2002), Liberti and Petersen (2019)).

The number of bank branches in the United States increased steadily until 2009 and remained largely stable until 2013 (see Figure 1, Panel A). Beginning in 2013 and until 2016, the number of bank branches began to decline at an annual rate of -1.4%. The rate of decline accelerated to -2% in 2017 and reached -3.5% in 2022. By the end of 2022, the number of bank branches reached the lowest level since 2000 at 79,186, representing a 20% decline relative to the peak 99,550 in 2009. At the same time, total deposits grew every year since 2010 and surged during the Covid-19 pandemic. Overall, between 2010 and 2022, the number of U.S. bank branches decreased substantially relative to their total deposits, leading to diminishing branch density. Starting in 2016, U.S. banks could grow their deposits with fewer branches. However, whereas banks with a declining brick-and-mortar presence achieved fast growth before 2023, leading to a diminishing branch density, these same banks experienced significant difficulties during the 2023 Banking Crisis.

We argue that the decline in branch density, driven by both the decline in branches and the rapid growth in deposits from 2016 to 2022, contributed to the banking calamity in 2023. We are not arguing that low branch density per se caused these bank failures. Clearly, multiple factors affected these banks, including interest rates risk management and exposure to the cryptocurrency sector. Rather, lower branch density reflects the nature of these banks' deposits clientele. From 2010 to 2022 lower branch density banks grew fast by attracting uninsured deposits from both corporations and tech-savvy households with large funds to deposit. However, the *virtuous* cycle of deposits growth that enabled these banks to attract deposits, largely uninsured, became a *vicious* cycle when a banking run began.

Using data on stock prices from CRSP, we analyze the relation between branch density and banks' stock returns. We conduct two event studies around the March failures of Silicon Valley Bank and Signature Bank and the end-of-April failure of First Republic Bank. Across different empirical specifications, we uncover a positive and statistically significant relationship between bank branch density and stock returns around both bank failure events. Our results are robust to an inclusion of a host of control variables and suggest that around the collapse of SVB, a one standard deviation decrease in branch density is associated with 4 percentage points lower returns—

corresponding to approximately 30% of the sample mean stock returns. Similarly, during the failure of First Republic, a one standard deviation decrease in branch density is associated with 1.4 percentage points lower returns, corresponding to about 20% of the sample mean stock returns.

After documenting the negative relation between branch density and stock returns during the two episodes of bank failures in March and May 2023, we analyze the relation between branch density and deposits flows. We hypothesize that branch density positively predicts returns because banks with higher branch density are less likely to experience large deposits outflows. We test the relation between branch density and deposits flows during Q1 2023 using data from regulatory Call Reports. We measure the change in (i) *uninsured deposits*; (ii) *insured deposits*; or (iii) *total deposits* at the bank holding company level between Q4 2022 and Q1 2023. We also define indicators variables for large uninsured or insured deposits outflows during that period.

We find that branch density is positively correlated with deposits flows during Q1 2023. A one standard deviation decrease in branch density is associated with a 4.4% net outflow of uninsured deposits. Some banks with low branch density continued to attract insured deposits even in 2023, and thus their total deposits did not significantly change. However, among those banks that experienced net deposits outflows, banks with low branch density suffered larger outflows.

One potential explanation for the poor performance of banks with low branch density in 2023 is based on their deposits' clientele. According to this explanation, banks with low branch density attract largely uninsured deposits through digital banking. Digital banking services provide convenience and speed, which appeal to both corporations and tech-savvy households with large funds to deposit. Using data on information technology (IT) investment by banks from SWZD Aberdeen, we compare deposits growth across banks with different levels of IT investment intensity. We define changes to IT intensity as the log change of IT budgets between 2010 and 2017. We find that banks that made large investments in IT had *lower* branch density in 2022, with a one standard deviation increase in IT investment corresponding to 1.4 fewer branches per $1 billion of deposits (15% of the unconditional mean of branch density). We also find that large investment in IT resulted in lower stock returns around the failures of Silicon Valley Bank and First Republic Bank. Finally, in an instrumental variable (IV) regression in which we use IT investment as an instrument for branch density, we find that the instrumented value of branch density is positively correlated with bank stock.

Although digital banking helps banks in attracting deposits during booms, it may be a double-edged sword, since it may enable depositors to flee and swiftly move their deposits elsewhere when economic conditions deteriorate. To test the relation between digital traffic and bank performance, we use data on banks' website traffic from Semrush – a platform used for keyword research and online ranking data. We find that while the average bank experienced a 27.5% surge in webpage traffic in March 2023, when Silicon Valley Bank and Signature Bank collapsed, banks with lower branch density experienced a significantly higher increase in webpage traffic during that period. Banks with branch density that is one standard deviation lower experienced 29% higher traffic in March relative to February. The change in online traffic, in turn, negatively and significantly predicts stock returns around the SVB and First Republic Bank collapses, but the effect of branch density remains significant even when webpage traffic change is included in the regression. These results are consistent with both stock returns and increases in online banking web traffic being proxies for the instability of deposits.

Our study contributes to several strands of the literature on empirical banking. Traditionally, brick-and-mortar bank branches have been a venue for depositors, making deposits local by nature (Gilje (2019), Gilje, Loutskina, and Strahan (2016), Yang (2022)). Furthermore, the local nature of deposits and the relationship between banks and depositors rendered deposits as a stable source of finding for banks (Iyer and Puri (2012), Iyer, Puri, and Ryan (2016)). The location of bank branches also plays a critical role in their lending activities. Proximity of borrowers and lenders facilitates close monitoring and soft information production. And even though the distance between lenders and borrowers has increased as technology advanced (Petersen and Rajan (2002)), the physical presence of bank branches still matters (Degryse and Ongena (2005), Agarwal and Hauswald (2010), Nguyen (2019)).

But the role of bank branches in the confluence of deposits taking and lending has been challenged with recent development in technology and competition brought by online banks and fintech lenders (Haendler (2022), Jiang, Yu, and Zhang (2022)). Our paper highlights the importance of branch density and its implications for deposits stability. Lower branch density allows banks to attract deposit flows and expand funding capacity. However, low branch density also lessens the value of the bank-depositor relationship—shifting the depositor base to corporations and tech-savvy depositors with large, mostly uninsured deposits. These changes to the composition of the depositor base turn out to be detrimental during market downturns: banks with lower branch density experience larger deposit outflows and worse stock performance.

Our paper is part of a burgeoning literature on the 2023 Banking Crisis. Researchers have identified various factors that contribute to banks' fragility in late 2022 and early 2023, including: interest rate hikes (Drechsler at al. (2023), Jiang et al. (2023)), accounting rules such as held-to-maturity securities (HTM) (Granja (2023)), unbooked losses (Flannery and Sorescu (2023)), and deposits stability ((Haddad, Hartman-Glaser, and Muir (2023)). Caglio, Dlugosz, and Rezende (2023) show that even though depositors left regional banks, large banks that are considered safe experienced deposit inflows.

Our paper is closely related to the recent papers that study deposits' behavior in digital banks. Koont, Santos, and Zingales (2023) examine the effect of mobile banking on deposit stickiness and its connection to the 2023 Banking Crisis. They classify banks as digital based on the popularity of their mobile applications on either the Apple or Android App Store. Similarly, Erel et al. (2023) study the transmission of monetary policy through online banks. Their definition of online banks is based on a classification of Nerdwallet – a consumer finance website.

While both papers study the response of deposits to changes in interest rates, our paper focuses on the 2023 Banking Crisis by analyzing banks' stock prices and deposit flows during the crisis. Our paper proposes a straightforward and effective measure of branch density which reflects banks' overall business strategy in organizing branch network and obtaining funding. It captures both the recent decline of brick-and-mortar branches, the growth of deposits and the development of digital technologies that enable online banking. Indeed, using data on IT investment by banks we show that banks that made large investments in IT had *lower* branch density in 2022 To wit: our results emphasize the dualities of low branch density and online banking during normal times and banking crises.

The rest of the paper is organized as follows. Section I describes our data and provides summary statistics. Section II describes the decline of bank branches and the rise in deposits. Section III documents the negative relation between branch density and stock returns during the 2023 Banking Crisis. Section IV investigates the relation between branch density and deposits flows. Section V links the decline in branch density to investment in digital technology. Section VI concludes.

I. Data and Summary Statistics

To construct our main explanatory variable: *bank branch density*, we obtain data from the Summary of Deposits (SOD), an annual survey of branch office deposits as of June 30 for all FDIC-insured institutions, including U.S. branches of foreign banks. We aggregate the number of bank branches and deposits at the bank holding company (BHC) level.[2] We define branch density as the ratio of the number of bank branches to total deposits measured in billions of dollars. Similar to Acharya and Mora (2015), we also construct a measure of insured deposits as the ratio of insured deposits to total deposits at the BHC level. We obtain banks total assets from FR Y-9C reports.

Following Jiang et al. (2023), we measure mark-to-market (MTM) losses using Call Reports data as:

$$MTM\ losses = \sum_m (RMBS_m + Mortgages_m) \times Multiplier \times \Delta TreasuryPrice_m + \sum_m Treasury\ and\ Other\ Securities\ and\ Loans\ \times \Delta TreasuryPrice_m,$$

where *m* represents the maturity and repricing breakdowns in the Call Reports: three months or less, over three months through 12 months, over one year through three years, over three years through five years, over five years through 15 years, and over 15 years. $\Delta TreasuryPrice_m$ indicates the change in Treasury Bond prices for maturity *m* from Q1 2022 to Q1 2023 (see Figure 1c in Jiang et al. (2023)). *Multiplier* is the ratio of the change in the iShares MBS ETF over the change in the S&P Treasury Bond Index between 2022 and 2023.[3] Similar to Cookson et al. (2023), we aggregate this measure to the bank holding company level. Finally, we scale the negative of MTM losses by the total assets value in Q1 2022.

We also use data on investment in IT by banks. The IT investment data is obtained from SWZD Aberdeen (originally known as Harte-Hanks).[4] The dataset covers all industries and company sizes and was created by surveying establishments on their IT budget. The data, which Aberdeen sells to technology companies for sales and marketing purposes, is considered the main source for IT investment.[5] The data covers the years 2010 to 2017. In 2018, Aberdeen changed its data collection methodology from surveys of IT budgets to imputations of IT investment using

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[2] For brevity, we use banks and bank holding companies interchangeably throughout the paper unless specified otherwise.
[3] See Jiang et al. (2023) for a more detailed description of the construction of MTM changes in banks' asset value.
[4] https://www.aberdeen.com.
[5] See He et al. (2022) for a detailed description of the SWZD Aberdeen data. Other papers that have used the Aberdeen data include Bloom, Draca, and Van Reenen (2016) and Tuzel and Zhang (2021).

proprietary models, and so we use Aberdeen data only through 2017. We first match Aberdeen's IT data to bank branches and then aggregate IT investment at the BHC level.

We obtain data on banks' website traffic from Semrush – a platform used for keyword research and online ranking data. Semrush collects information on online keywords gathered from search engines to help businesses improve their online visibility and marketing strategy. We manually collect website traffic analyses reports at a monthly level for our sample of publicly traded banks. Last, to conduct event studies of the response of banks' stock prices to the failures Silicon Valley Bank, Signature Bank, and First Republic Bank, we measure banks' stock returns around those events. Silicon Valley Bank failed on Friday, March 10, 2023, and state regulators closed Signature Bank on Sunday, March 12, 2023. We obtain data on stock prices from CRSP and measure returns as the change of the close price between March 8, 2023, and March 13, 2023. Similarly, for the second event—the collapse of First Republic Bank, which the California Department of Financial Protection and Innovation closed on Monday, May 1, 2023—we measure returns as the change in the close stock price between Friday, April 28, 2023, and Tuesday, May 2, 2023.

[Insert Table I Here]

Table I presents the summary statistics for the main variables used in the analysis. Variables are defined in Table AI. Our key variable of interest, *branch density,* exhibited a significant decrease over time: starting from a mean of 20 branches per $1 billion deposits in 2010, it declined by 46% to a mean of 9.2 branches per $1 billion deposits in 2022. In 2022, the median branch density was 9.0, and the 25th and 75th percentiles were 5.0 and 13.0, respectively. As of June 2022, a typical sample bank has a deposits/assets ratio of 80%, and 63% of their total deposits are FDIC-insured deposits. Due to the Covid-19 pandemic, deposits increased by over 50% between 2019 and 2022 for an average bank. Banks poured significant resources into information technology in recent years: IT budgets more than tripled between 2010 and 2017.

In the 2023 Banking Crisis, following the collapse of Silicon Valley Bank and First Republic Bank, the stock price of the average bank in our sample declined 13.5% and 7.3%, respectively. Despite the stress in the U.S. banking industry in Q1 2023, an average bank still experienced a 1% deposit increase relative to Q4 2022, but uninsured deposits declined by 4.6% on average. The average bank experienced 13.2% MTM implied asset value losses between Q1

2022 and Q1 2023—stemming mostly from rising interest rates. Website traffic to the average bank increased by 27% in March 2023 relative to February 2023.

II. The Decline of Bank Branches and the Rise of Deposits

The number of bank branches in the United States steadily increased until 2009 despite technological advances that enabled digital banking through banks' websites and apps (Anenberg et al. (2018)). Beginning in 2010, the number of bank branches declined annually, and the rate of decline accelerated over time, reaching around 2% per year in the second half of 2010s and over 3% per year following the Covid-19 pandemic. By the end of 2022, the number of bank branches reached its lowest level since 2000 at 79,186, corresponding to a 20% decline relative to the peak of 99,550 branches in 2009. Figure 1 depicts the decline in the total number of bank branches in the United States.

[Insert Figure 1 Here]

Figure 1, Panel A, also demonstrates that the decline in the number of branches was not accompanied by a decline in total deposits. In fact, between 2010 and 2022, total deposits in U.S. banks almost doubled in real terms, increasing from a level of $7.55 trillion in 2010 to $13.29 trillion in 2022 – both in 2009 dollars. Deposits grew from $10.75 trillion in 2019 to $12.92 trillion in 2020, reflecting the increase in U.S. household saving rates and large government stimulus payments during the Covid-19 pandemic (Levine et al. (2021)).

[Insert Figure 2 Here]

Rising deposits and declining number of branches resulted in higher levels of deposits per branch. We demonstrate the correlation between rising deposits and declining branches in Figure 2. To construct the figure, we run the following cross-sectional regressions of bank-level total deposits on the number of bank branches in a given year *t*:

$$Deposits_i = \alpha + \beta \times Number\ of\ Branches_i + \epsilon_i. \qquad (1)$$

The analysis is conducted at the bank level and includes all FDIC-insured banks, regardless of whether it is a bank holding company. Total deposits are adjusted for inflation and are expressed in 2009 dollars.

Figure 2 plots the R^2s from each of the cross-sectional regressions (left axis) as well as β— the coefficient on the number of branches in each regression (right axis). As illustrated by the dashed line in Figure 2, in 2010, each branch accounted for about $100 million in deposits.

Deposits level per branch increased over time, and by 2022, a branch accounted on average for over $240 million in 2009 dollars. As the solid line in the figure illustrates, the explanatory power of the number of branches in the deposits regressions has declined significantly over time. In 2010, the number of bank branches accounted for over 90% of variation in banks' deposits. The explanatory power of branches in deposits regressions declined to less than 80% in 2022.

The decline in the number of bank branches is also evident in the bank-level regression. Table II demonstrates that the decline happened among medium and large banks (columns (3) and (4)), whereas the number of branches of small banks grew (column (2)). In total, each year saw more than 600 bank branches close on average, with additional 4,000 closing during the Covid-19 pandemic (column (1).

[Insert Table II Here]

A. The Evolution of Branch Density

[Insert Figure 3 Here]

The decline in the number of branches and the rise in total deposits led to a decline in branch density over time. The average bank in our sample has a branch density of 9.2 branches per $1 billion of deposits as of June 2022. Banks in the lowest decile of branch density have fewer than two branches per $1 billion of deposits – with the bottom 15 banks having 0.2 branches per $1 billion of deposits or less.

[Insert Table III Here]

Using data on deposits and branches aggregated at the bank holding company level, we categorize banks by their branch density as of 2022 into three groups: (i) *very low density*: banks with branch density below or equal to the 10th percentile of branch density; (ii) *low density*: banks with branch density greater than the 10th percentile but no more than the 50th percentile of branch density; and (iii) *high density:* banks with branch density higher than the 50th percentile of branch density.

Table III lists the 10 leading banks within each of the three groups in a descending order of their number of branches. As the table shows, the category of *very low density* banks includes both smaller banks such as Customers Bancorp (total assets of $20.3 billion and 12 branches) as well as giant financial institutions such as Morgan Stanley (total assets of $1.17 trillion and 5 branches) and Goldman Sachs (total assets of $1.6 trillion and 5 branches). It's worth noting that Silicon Valley Bank, Signature Bank, and First Republic Bank are included in the *very low density* group, and so is Western Alliance Bancorporation, whose share price plummeted more than 80% during the 2023 Banking Crisis.

The group of *low density* banks includes some of the largest banks in the United States, such as JPMorgan Chase, Wells Fargo, and Bank of America, as well as other large regional banks (PNC, U.S. Bancorp, Truist Financial Corporation, Citizens Financial Group, Fifth Third Bancorp, and Huntington). The list of *high density* banks includes mostly smaller banks with total assets that are between $4 and $45.8 billion as well as a medium-sized bank (Regions Financial Corporation, with $161.0 billion in total assets and 1,294 branches). As the bottom panel of Table III demonstrates, the three banks that failed during the Banking Crisis of 2023 (SVB, Signature, and First Republic) as well as banks that experienced significant stock prices declines or massive deposits outflows (PacWest, Western Alliance, and Silvergate Capital) had mostly *very low* branch densities.

Branch density exhibits significant variations across bank size. Figure 3, Panel A, demonstrates the decline of branch density for all FDIC-insured banks at the bank level, whereas Figure 3, Panel B, depicts the trend for all sample bank holding companies. Banks (or BHCs) are categorized into three groups based on their total assets value as of 2010: greater than or equal to $1 trillion, greater than or equal to $10 billion and less than $1 trillion, and below $10 billion. The largest group in both figures includes Bank of America, JPMorgan Chase, Wells Fargo, and Citi. The level of branch density as of 2022 for each group is annotated at the end of each line. As Figure 3 shows, and consistent with Table III, large and medium banks have experienced significant decline in branch density, whereas the drop among small banks is relatively mild.[6]

[Insert Figure 4 Here]

In Figure 4, we compare deposits growth across banks with different densities of bank branches. As before, we categorize banks into three branch density groups: (i) *very low density*: banks with branch density below or equal to the 10th percentile of branch density; (ii) *low density*: banks with branch density greater than the 10th but no more than the 50th percentiles of branch density; and (iii) *high density:* banks with branch density higher than the 50th percentile of branch density. Branch density is calculated every year. Figure 4, Panel A, displays the average growth in

[6] In assessing the differences between small banks in Figure 3, it is important to keep in mind that our sample captures mostly larger banks.

total deposits over time within each of these three branch density groups.[7] As Panel A illustrates, banks with lower branch density have experienced higher growth rates in total deposits between 2010 and 2022: the very low density group exhibits the fastest growth rates among all three, while the low density group grew faster than the high density group. The average growth rates of deposits in 2019, relative to 2010, are 98%, 32%, and 19% for the very low, low, and high branch density groups, respectively. Starting in 2020, and as a result of the Covid-19 pandemic, the average growth rate in deposits, once again relative to 2010, accelerates to 119% for the very low density group, compared to 49% for the low density and 32% for the high density groups. Further, we decompose total deposits into (i) insured and (ii) uninsured deposits and conduct similar analyses. As visualized in Figure 4, Panels B and C, the relation between branch density and deposit growth persists, regardless of whether the deposits are insured. Moreover, the growth rates of uninsured deposits are higher than those of insured deposits for all density groups.

Overall, the evidence presented in Figures 2–4 shows that between 2010 and 2022, the number of branches of U.S. banks has declined substantially relative to banks' total deposits, leading to declining branch density. Moreover, banks with lower branch density have experienced faster deposit growth.

III. Branch Density and Stock Returns during the 2023 Banking Crisis

During the 2010s, and in particular starting in 2016, U.S. banks were able to grow their deposits with fewer branches. However, while banks with low and very low branch density were able to attract deposits inflows before 2023, they experienced significant difficulties during the first several months of 2023. In March 2023, two medium-sized American banks failed: Silicon Valley Bank and Signature Bank. Consequently, regional banks suffered large stock price declines in March and April, and eventually a third bank, First Republic Bank, whose shares fell by 62% on March 13, 2023, suffered significant liquidity problems that led to its closure and the disposal of its assets to JPMorgan Chase Bank.

Interestingly, as illustrated in Table III, all three troubled banks had extremely low branch densities as of June 2022, which would place them in our very low density group (i.e., branch density is less than or equal to the 10th percentile, 0.7, in 2022). For instance, Silicon Valley Bank

[7] Deposits are adjusted to inflation using 2009 dollars. For each branch density group, we regress the log of deposits on a series of year indicators – which is equivalent to calculating the difference in mean of log(deposits) between 2010 and year *t*. The coefficients on the year indicator variables are displayed in the figure.

had only 17 branches and around $175 billion of deposits – implying a very low branch density of 0.097. Similarly, the branch densities of Signature Bank and First Republic were 0.36 and 0.53, respectively.[8]

We conjecture that the decline in branch density, driven by both the decline in branches and the rapid growth in deposits during the years 2016 to 2022, contributed to the banking calamity in 2023. Clearly, multiple factors affected these banks, including interest rates risk management and exposure to the cryptocurrency sector. However, it is possible that *virtuous* cycle of deposits growth that enabled these banks to attract deposits, largely uninsured, became a *vicious* cycle once a banking run began. We are not arguing that low branch density per se caused these bank failures. Rather, lower branch densities reflect the nature of these banks' deposits clientele, one that is more likely to run on the bank during difficult times.

To test our conjecture, we conduct two event studies around the March failures of Silicon Valley Bank and Signature Bank and the end-of-April failure of First Bank Republic. Figure 4 exhibits the relation between bank branch density and stock returns around the SVB (Panel A) and First Republic (Panel B) failures. We plot the stock return between March 8, 2023, and March 13, 2023, for the SBV event and the returns between April 28, 2023, and May 2, 2023, for the First Republic event. The sample includes all 294 publicly traded BHCs with branch and stock price information available.

[Insert Figure 5 Here]

As Figure 5 demonstrates, there is a positive and significant relation between stock returns and bank branch density during these two bank failure events. Both Panels A and B of Figure 5 highlight the names of some banks that performed particularly poorly during the 2023 Banking Crisis, such as PacWest and Western Alliance. Banks that suffered dramatic declines in their stock prices were also characterized by very low branch density.

To further explore the relation between branch density and stock price performance during the 2023 Banking Crisis, we conduct a multivariate analysis of banks' stock returns during the two events of bank failures in March and May 2023.

Specifically, we run the following regressions:

[8] Figure A1 depicts the evolution of branch density for First Republic Bank, Signature Bank, and Silicon Valley Bank.

$$\text{Return}_\text{i} = \beta \times \text{BranchDensity}_\text{i} + \alpha_1 \times \frac{Dep_i}{TA_i} + \alpha_2 \times \%\text{Insured Deposits}_\text{i} +$$

$$\alpha_3 \times \text{MTMLosses}_\text{i} + \alpha_4 \times \Delta\text{Dep22vs19}_i + \alpha_5 \times \log(Assets)_i + \alpha_6 \times \text{SizeBin}_\text{i} + \epsilon_i, (2)$$

where return is defined as in Figure 5 and branch density is as of June 2022 at the BHC level. In addition, we control for bank size measured by the logarithm of banks total assets and five size-quintile indicator variables. We control for deposits-to-assets ratio, insured deposits scaled by total deposits *(%Insured Deposits)*, as well as for estimates of MTM losses on banks investment, constructed following Jiang et al. (2023). Last, to capture a potential effect of abnormal deposits growth in the years leading to the crisis, we control for the change in deposits between 2019 and 2022. The results are presented in Table IV.

[Insert Table IV Here]

We uncover a positive and statistically significant relation between bank branch density and stock returns around both the SVB (Panel A) and the First Republic collapse (Panel B) through all specifications. Adding the control variables to the regressions has little impact on the key coefficient of interest and, in fact, makes it stronger in some specifications. The coefficients on branch density are also economically significant. Using the estimates in column (5), a one standard deviation lower branch density (5.78) corresponds to around 4% (= 5.78 * 0.00688) lower returns around the collapse of SVB, which represents approximately 30% (= -4%/-13.5%) of the sample mean of stock returns. Similarly, during the failure of First Republic Bank, a one standard deviation lower branch density is associated with 1.4% (= 5.78 * 0.00237) lower return, corresponding to about 20% (= -1.4%/-7.3%) of the sample mean of stock returns.

As for the effects of the control variables: banks with higher ratios of deposits to assets experience lower returns. A higher share of insured deposits, which implies a more stable base, is associated with higher returns, mostly during the SVB collapse. Banks that suffered higher MTM losses have significantly lower stock returns after the First Republic collapse, with an effect of one standard deviation change being similar in magnitude to the effect of branch density.

To better control for bank size, we reestimate equation (2) with an added interaction term between *branch density* and an indicator for banks with total assets over $1 trillion. Table V reports the results.

[Insert Table V here]

As Table V illustrates, the relation between branch density and stock return remains largely unchanged in both distress events. The coefficient of the interaction term between branch density and bank size is statistically insignificant, indicating that the effect is not driven by banks of particular size.

Since our event study methodology hinges on cross-sectional variation, we are unable to control for bank fixed effects in our regressions. This may raise the concern that the relation between branch density and stock returns is driven by unobserved bank-specific time-invariant characteristics. To alleviate this problem, and to shed more light on the effect of the evolution of branch density of stock returns, we decompose *branch density* into the two components: (1) branch density measured at the beginning of the sample, June 2010; and (2) the change in branch density between 2010 and 2022 (i.e., $\Delta(Branch\ density)$: branch density in 2022 minus branch density in 2010). As an alternative, we also explicitly include the log change in the number of branches $\Delta(Branches)$ and total deposits $\Delta(Deposits)$. We report the results in Table VI.

[Insert Table VI here]

Columns (1) and (3) in Table VI show that both branch density in 2010 and the change of branch density between 2010 and 2022 significantly and positively predict stock returns, suggesting that the relation between branch density and stock return during the 2023 distress episodes is not driven by some fixed unobservable bank characteristics. A one standard deviation decrease in Branch Density 2010 (10.23) is associated with a 4.6% (=10.23*0.00448) drop in stock returns around the SVB failure and a 2% (=10.23*0.00192) decline in stock returns around the collapse of First Republic Bank. A one standard deviation change in $\Delta(Branch\ density)$: is related to a 2.3% and 1.5% lower stock return around SVB and First Republic failures, respectively. These magnitudes are similar to those observed in Tables IV and V.

Columns (2) and (4) in Table VI show that both within-bank changes in the number of branches and in the number of deposits contribute to the effect of changing branch density. As expected, the coefficients on $\Delta(Branches)$ and $\Delta(Deposits)$ have opposite signs. Both are significant predictors of returns around the SVB collapse, while only the effect of changes in deposits is significant in the post–First Republic collapse returns regression, with the *p*-value for changes in branches coefficient being 0.11.

Our results show that banks with low branch density performed significantly worse during the two episodes of bank collapses, which we interpret as evidence that the financial markets perceive their deposits to be less stable and thus that these banks are more prone to runs. Low branch density does not appear to be a proxy for some long-standing unobservable differences between banks but seems rather to be a reflection of banks' different business strategies and clientele. We hypothesize that the degree of reliance on digital channels and online customers is an important factor behind the extent of banks' physical footprints and investigate this hypothesis in section V.

IV. Branch Density and Deposit Outflows

Having documented the negative relation between branch density and stock returns during the bank failures of March and May 2023, we now analyze the relation between branch density and deposits flows. We hypothesize that branch density positively predicts returns because banks with higher branch density are less likely to experience large deposits outflows. We test this relation between branch density and deposits flows during Q1 2023 using bank regulatory data and the following specification:

$$\text{Deposit Flow}_\text{i} = \beta \times \text{BranchDensity}_\text{i} + \alpha_1 \times \frac{Dep_i}{TA_i} + \alpha_2 \times \%\text{Insured Deposits}_\text{i} +$$

$$\alpha_3 \times \text{MTMLosses}_\text{i} + \alpha_4 \times \Delta\text{Dep22vs19}_i + \alpha_5 \times \log(Assets)_i + \alpha_6 \times \text{SizeBin}_\text{i} + \epsilon_i, \quad (3)$$

where the dependent variable *Deposit Flow*$_i$ is the change in: (i) uninsured deposits; (ii) insured deposits; or (iii) total deposits between Q4 2022 and Q1 2023. We also define indicators variables for large uninsured or insured deposit outflows during that period. These indicator variables take the value of one for changes that are below the 10th or 25th percentile of the deposit flow distribution, and zero otherwise. All explanatory variables are the same as in specification (2), in the previous section. Table VII reports the results from estimating regression (3).

As column (1) in Table VII illustrates, branch density is positively correlated with uninsured deposits flows. A one standard deviation lower branch density is associated with 4.4% higher outflow of uninsured deposits, which corresponds to 95% of the average net outflow of uninsured deposits in Q1 2023 and to 33% of the standard deviation of uninsured deposits change in that period. Conversely, lower branch density corresponds to higher inflow of insured deposits, with a one standard deviation higher branch density leading to 7% higher inflow of insured deposits, which corresponds to 80% of the mean and 40% of the standard deviation. It is worth noting that a median change of uninsured deposits during Q1 2023 was -6.2%, while a median change of insured deposits was +4.8%. Thus, the results in columns (1) and (2) of Table VII suggest that branch density alleviates outflow of uninsured deposits while also being associated with a slower pace of continued growth in insured deposits. On average, branch density has no effect on total deposits (column (3)), but among banks that do experience a net outflow of deposits during Q1 2023, branch density significantly alleviates the outflow (column (4)), with one standard deviation of branch density reducing the net outflow by 1.1 percentage points (31% of the average outflow among banks experiencing below-zero net flows).

Columns (5)–(8) demonstrate that low branch density is associated with a higher likelihood of large outflow of uninsured deposits while having no effect or a negative effect on the likelihood of an abnormally low flow of insured deposits. We define large outflow as changes that correspond to the lowest 10th percentile (columns (5) and (6)) or lowest 25th percentile (columns (7) and (8)) of the Q1 2023 deposit flows distribution. For uninsured deposits, the 10th and 25th percentile thresholds correspond to uninsured deposit flows of -14.3% and -9.5%, respectively. For insured deposits, the 10th and 25th percentile thresholds correspond to insured deposit flows of -0.3% and 1.6%, respectively.

[Insert Table VII Here]

The results demonstrate that depositors of banks with low branch density were likely concerned about their stability and more likely to withdraw their uninsured deposits. Interestingly, although deposit insurance reduced outflows of smaller deposits, there is no evidence that it had positive spillovers on the behavior of uninsured depositors, as suggested by the estimates of coefficient on the *% Insured Deposits* variable in columns (1) and (5).

The negative coefficient of branch density in the insured deposits regression (column (2)) may be related to insured depositors' continued movement to banks with low branch density even in Q1 2023, since they were not concerned about bank financial stability. This result is consistent with the estimate of the effect of the deposit growth in 2019 to 2022 which indicates that Q1 2023 still saw a continuation of insured deposits growth—in particular in banks that have been growing faster between 2019 and 2022. The effect of branch density on the insured deposits flows may also in part reflect a reduction in the value of deposits in banks with low branch density so that they fall under FDIC limits, which reduces uninsured deposits while increasing the number of insured accounts.

V. Declining Branch Density and Digital Technology

Why do banks with lower branch density perform worse in distress episodes? A possible explanation is that their business model relies on attracting depositors that access banking services via digital channels and that such depositors are more likely to withdraw their money in uncertain times. The growth of virtual, or digital, banks has been noted in the literature and is often linked to the extent of information technology investment (Haendler (2022), He et al. (2022)) and to the rise of fintech institutions (Berg, Fuster, and Puri (2021)). Digital banking services have no geographical boundaries and provide convenience and speed that traditional in-person bank teller services cannot match. These features enable banks that rely on digital banking to attract potential customers such as corporations or tech-savvy individuals nationwide and gain a competitive advantage.

To investigate the role that digital technology played in deposits growth, we perform similar analysis to that presented in Figure 4 by comparing deposits growth across banks with different levels of IT investment intensity. In particular, we define *IT intensity* as the pace of growth of IT budgets between 2010 and 2017 and divide banks into three groups: (i) *low IT*: banks with *IT intensity* below the 50th percentile (or growth rate of 3.15 between 2010 and 2017) of IT intensity; (ii) *high IT*: banks with *IT intensity* greater than or equal to the 50th and below the 90th percentiles (or growth rate between 3.15 and 4.23) of IT intensity; and (iii) *very high IT:* banks with *IT intensity* higher than or equal to the 90th percentile (or growth rate higher than 4.23) of IT intensity. Appendix Table AIII lists banks from each of the *IT intensity* groups, and Figure 6 displays the evolution of the average deposit growth within each group.

[Insert Figure 6 Here]

Figure 6, Panel A, shows that banks that have invested heavily in information technologies between 2010 and 2017 have seen a significantly larger deposits growth between 2010 and 2022. In particular, banks with the highest increases in IT investment (very high IT) have experienced much higher growth in deposits. Relative to the level in 2010, the average growth rate of deposits of very high IT banks is 105% until 2019, compared with 59% and 27% for high and low IT banks, respectively. This rate increased to 152%, 87% and 52% in 2022 for very high, high, and low IT banks, respectively, due to the Covid-19 pandemic. We also decompose total deposits into insured deposits (Figure 6, Panel B) and uninsured deposits (Figure 6, Panel C) and observe that banks invested heavily in IT experienced faster growth in both insured and uninsured deposits and that the pace of growth among all banks was significantly higher for uninsured deposits.

Next, we link branch density to IT intensity. Column (1) in Panel A of Table VIII shows that the change in IT investment between 2010 and 2017 is correlated with low branch density in 2022. That is, banks that have increased their spending on information technology have fewer branches in 2022, consistent with their stronger reliance on digital banking.

Columns (2) and (4) in Panel A of Table VIII show that the change in IT investment between 2010 and 2017 is negatively correlated with banks stock returns around the Silicon Valley Bank and First Republic Bank collapses. Next, we use the change in IT investment as an instrument for branch density using the following 2SLS specification:

$$\text{Outcome}_{\text{i}} = \beta \times \text{BranchDensity}_{\text{i}} + \alpha_1 \times \frac{Dep_i}{TA_i} + \alpha_2 \times \%\text{Insured Deposits}_{\text{i}}$$

$$+\alpha_3 \times \text{MTMLosses}_{\text{i}} + \alpha_4 \times \Delta\text{Dep22vs19}_i + \alpha_5 \times \log(Assets)_i + \alpha_6 \times \text{SizeBin}_{\text{i}} + \epsilon_i \quad (4a)$$

and

$$\text{BranchDensity}_{\text{i}_{\text{i}}} = \gamma \times \Delta\text{IT}Budget17vs10_{\text{i}} + \alpha_1 \times \frac{Dep_i}{TA_i} + \alpha_2 \times \%\text{Insured Deposits}_{\text{i}}$$

$$+\alpha_3 \times \text{MTMLosses}_{\text{i}} + \alpha_4 \times \Delta\text{Dep22vs19}_i + \alpha_5 \times \log(Assets)_i + \alpha_6 \times \text{SizeBin}_{\text{i}} + \epsilon_i. \quad (4b)$$

Equation (4b) represents the first stage regression in the estimation and includes an instrument for branch density, change in IT budgets between 2010 and 2017, $\Delta\text{IT}Budget17vs10_{\text{i}}$, which is excluded from the second-stage regression in equation (4a).

As demonstrated in column (1) of Table VIII, the IV specification produces a significant first-stage relation with an F-statistic of 18.6. Our second-stage estimates suggest significant positive coefficients of the instrumented branch density (columns (3) and (5) in Panel A of Table VIII). The magnitudes of the effects of instrumented branch density are larger but are broadly in line with the OLS estimates. Our IV estimates attempt, not to isolate exogenous variation in branch density, but rather to demonstrate that the endogenous codetermination of IT investment and branch density decisions are correlated with the lower stock returns of low branch density banks during times of crisis.

In Panel B of Table VIII we estimate 2SLS specifications based on equations (4a) and (4b) using deposit flows as the dependent variable. The effects of branch density instrumented with IT investment on deposits flows remain similar to those obtained in the OLS specification (Table VII). Higher branch density alleviates the decline in uninsured deposits (column (1)) while also reducing the inflow of insured deposits (column (2)). Although the net effect on total deposits is insignificant in the sample of all banks (column (3)), lower branch density leads to significantly larger deposits outflows in banks that experience negative net deposits flows (column (4)). Higher branch density diminishes the likelihood of large uninsured deposits outflows (columns (5) and (7)) but has no significant impact on the likelihood of abnormally low net insured deposits flows (columns (6) and (8)).

[Insert Table VIII Here]

Whereas digital banking helps banks attract deposits during normal market conditions, it could contribute to banks' deteriorating performance during distress episodes for several reasons. First, digital service by nature allows clients to transact quickly and with ease, enabling depositors to withdraw at their (literally) fingertips. Second, digital services tend to attract large uninsured deposits from corporations and tech-savvy individuals who also have access to digital news platforms and as such follow financial media and respond to financial news instantaneously. Third, the lack of in-person interaction could lower customers' engagement and forgo valuable bank-client relationships. As a result, digital banks are more prone to lose customers and their deposits during distressed times and market calamities.

One challenge with interpreting the higher levels of IT budgets as indicative of reliance on digital customers is that IT spending is related to various areas of bank activities—not necessarily related to deposits management. We use data on webpage traffic on banks' websites in the end of 2022 and beginning of 2023 as a more direct measure of customer-oriented digital banking exposure.

[Insert Figure 7 Here]

Figure 7 displays the coefficient from regressing the natural logarithm of the number of webpage visits on indicator variables for each month between November 2022 and April 2023 and bank fixed effects. The sample starts in October 2022, which is the omitted category. As Figure 7 shows, when Silicon Valley Bank and Signature Bank collapsed in March 2023, online traffic was on average 15% higher than in October 2022. And although, as evident from Figure 7, website traffic in each of the first four months of 2023 was somewhat elevated, the coefficients are not statistically significant for any other month except March, which displays a jump also relative to February. This pattern demonstrates that a modern banking crisis may have less to do with depositors queuing outside bank branches and more to do with depositors flooding bank websites to transfer their money online. Online money transfer to other banks is faster and more convenient, which is especially important when depositors are concerned about the safety of their deposits. Thus, online banking makes running on a bank easier.

However, the existence of online banking cannot fully explain the poor performance of banks with low branch intensity during the 2023 Banking Crisis. All the banks in our sample offer online banking services, even those with high branch density. And although banks with low branch density may have better online banking systems, it is likely that all online websites and applications should be good enough to be used for money transfers when customers desire to move their money.

The change in online banking traffic likely represents not only the extent to which accessing funds online is possible but also customers' online banking usage intensity. Banks with low branch density likely attract specific types of customers that are more likely to use online banking, and thus during a crisis, customers of these banks may be disproportionately likely to access their bank's website and use it to move their money. We analyze the relation between webpage traffic, branch density, and stock returns during distressed times and report the results in Table IX.

As column (1) of Table IX demonstrates, banks with lower branch density experienced significantly higher webpage traffic increase in March 2023 relative to February 2023. The magnitude of the estimated effect is large: a one standard deviation lower branch density corresponds to a 29% increase in online traffic in March 2023, accounting for more than 100% of the average increase in traffic and 27% of the standard deviation of traffic changes.

The change in online traffic, in turn, negatively and significantly predicts stock returns around the Silicon Valley Bank and First Republic Bank collapses (columns (2) and (4)), with one standard deviation increase in traffic corresponding to returns that are lower by 2% and 0.75% during the SVB and First Republic failures, respectively. Yet even when online traffic change is directly controlled for in the stock returns regressions (columns (3) and (5)), the coefficient of branch density continues to be positive and significant, and its magnitude changes by less than 10% compared to the baseline estimates from Table IV. These results are consistent with both stock returns and increases in online banking web traffic being proxies for deposits instability. Indeed, columns (6) and (7) of Table IX demonstrate that an increase in web traffic is associated with larger outflows of uninsured deposits. Nonetheless, even if the change in traffic is included as a control, the effect of branch density on uninsured deposits flows remains positive and significant, with a magnitude of almost 80% of the baseline estimates in Table VII.

[Table IX Here]

VI. Conclusion

We analyze the effect of branch density, defined as the number of bank branches per $1 billion of deposits, on the performance and stability of banks during banking crises. We show that the number of bank branches has declined between 2010 and 2022. The decline was fueled by a confluence of a reduction in the number of branches and the almost doubling of total deposits between 2016 and 2022. During this period, banks with low branch density benefited from large deposits inflows, which led to even lower branch density.

However, during the Banking Crisis of 2023, banks with fewer branches relative to their deposits experienced significantly lower stock returns and larger outflows of uninsured deposits during the crisis. We argue that the decline in branch density, driven by both the decline in branches and the rapid growth in deposits during the years 2016 to 2022, contributed to the banking calamity in 2023. Although digital banking helps banks attract deposits during booms, it may be a double-edged sword, enabling depositors to flee and swiftly move their deposits elsewhere when economic conditions deteriorate.

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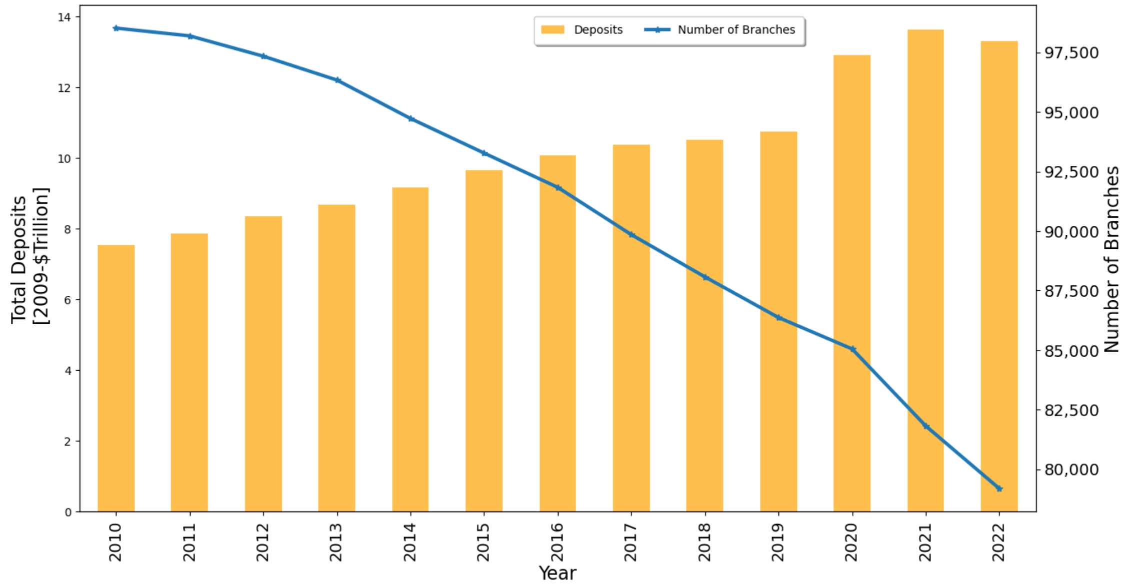
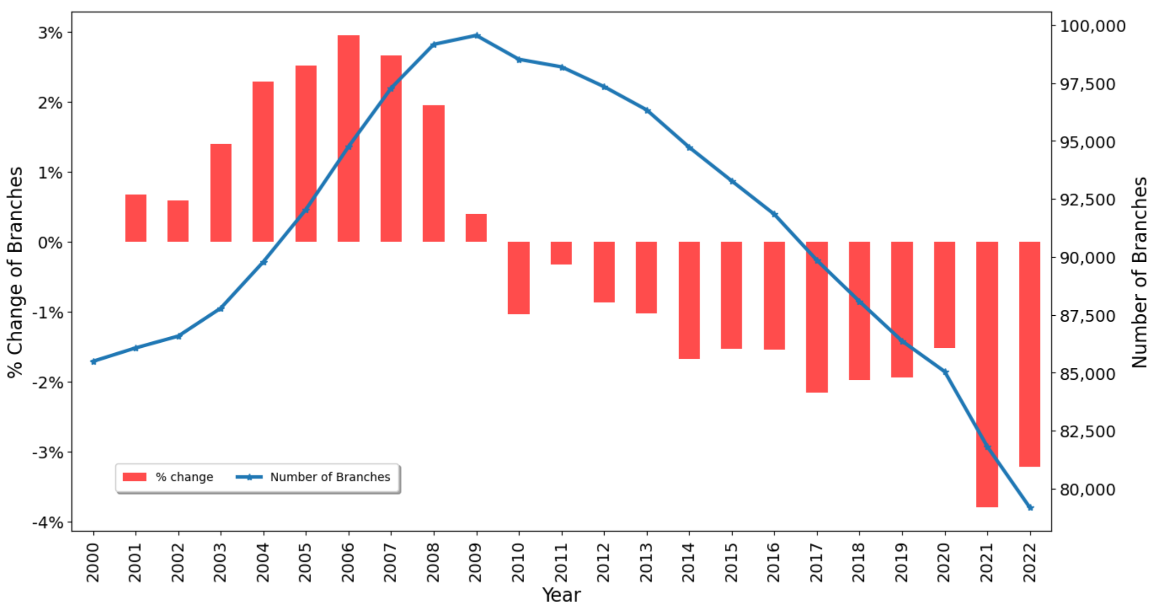
Figures and Tables



Panel A. Bank branches and total deposits in the United States



Panel B. Evolution of bank branches over time

Figure 1. Branches and deposits. Panel A shows the decline of bank branches (right axis) and the rise of total deposits (left axis) over the period of 2010 – 2022. Total deposits are adjusted for inflation and the values are in 2009 dollars. Panel B shows the evolution of bank branches since 2000. The line represents the number of bank branches, and the bar represents the annual percentage change in the number of branches. The sample includes all FDIC-insured banks. Source: Summary of Deposits.

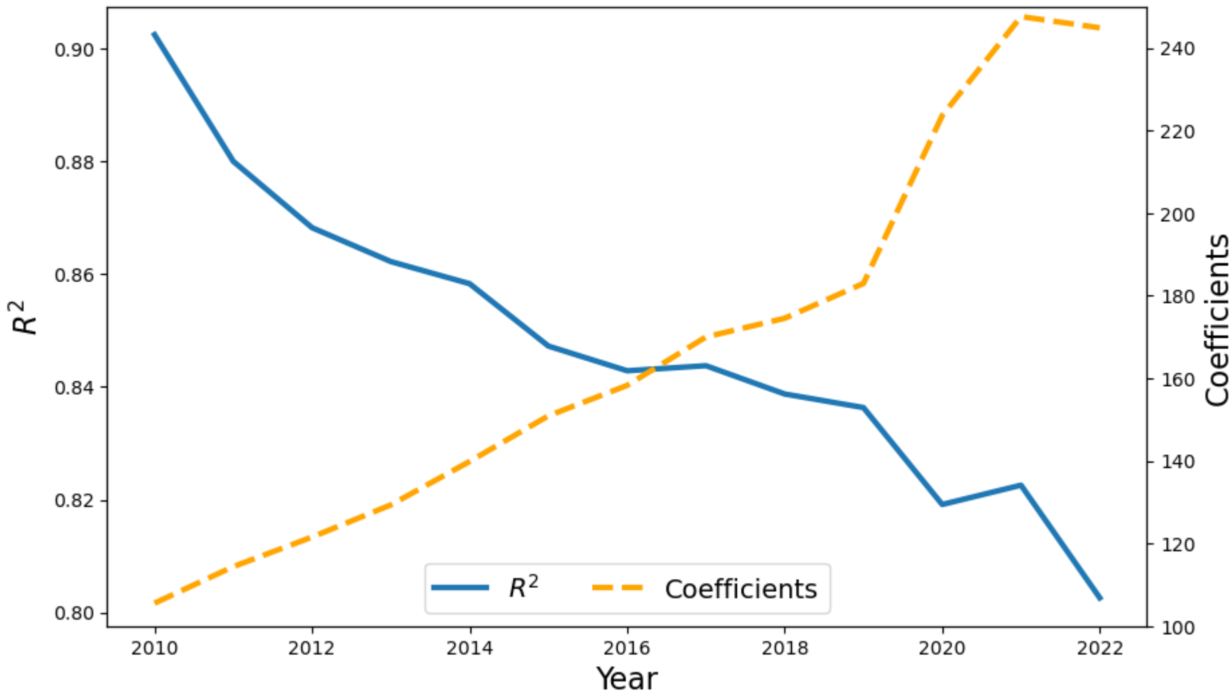
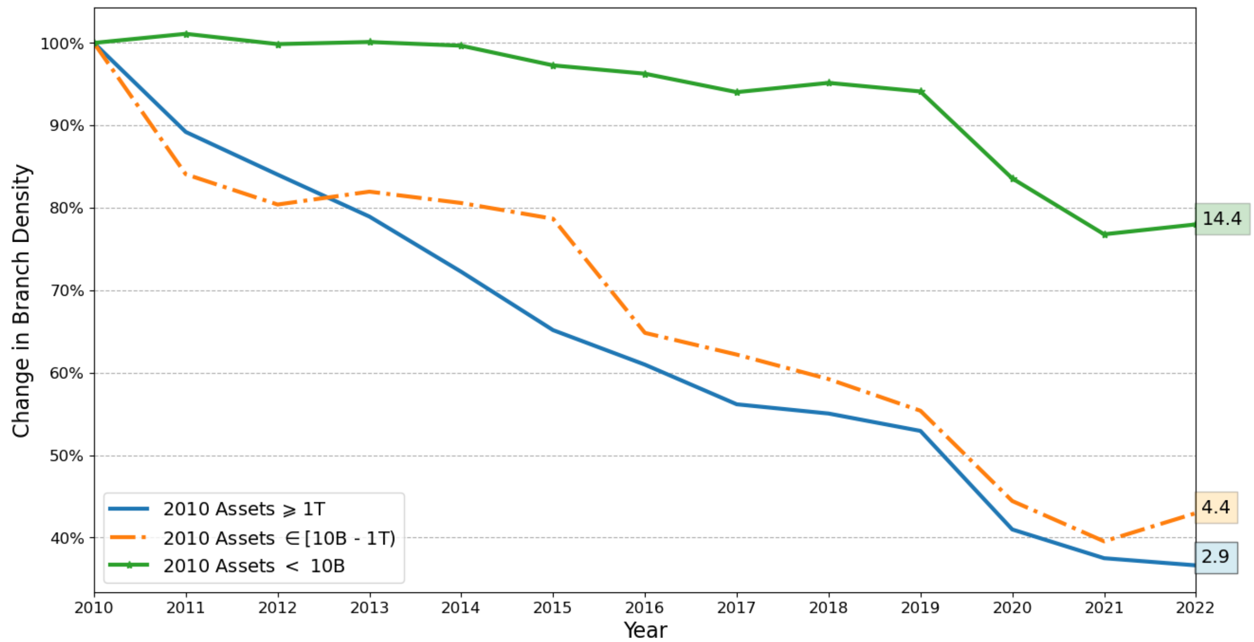
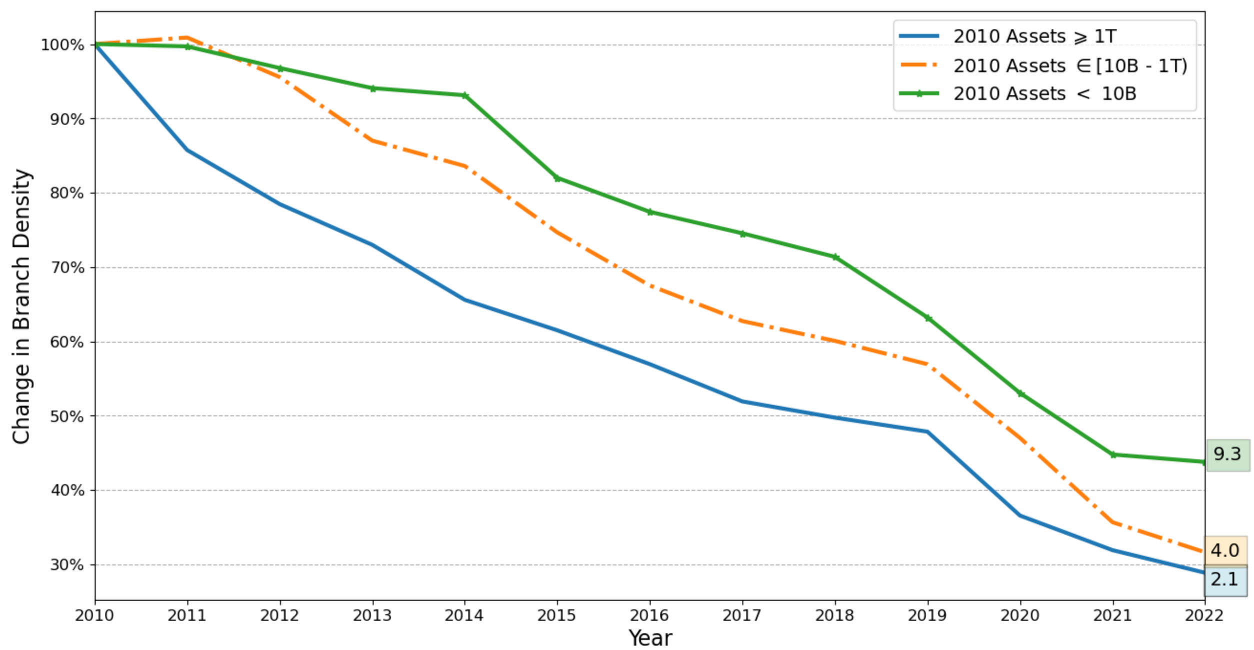


Figure 2. The explanatory power of bank branches. This figure plots the coefficients (right axis) and R^2 (left axis) of equation (1) from 2010 to 2022. The sample includes all FDIC-insured banks. Source: Summary of Deposits.

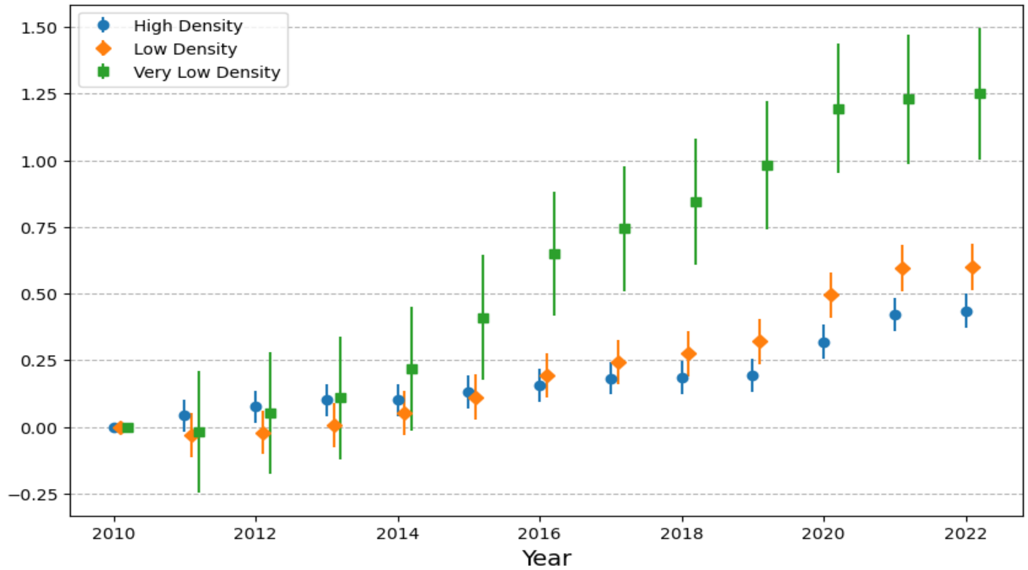


Panel A. All FDIC-insured banks

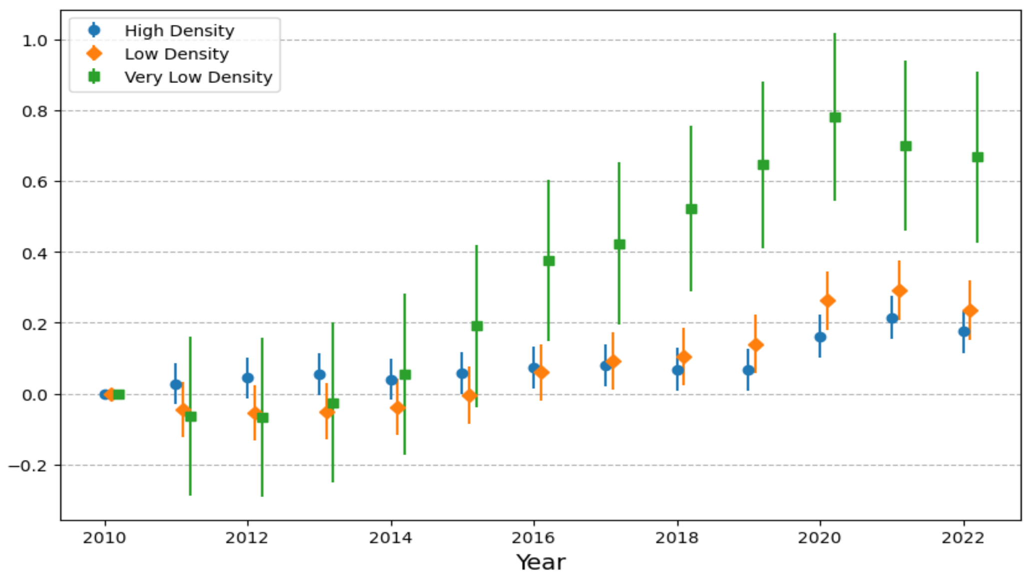


Panel B. Sample bank holding companies

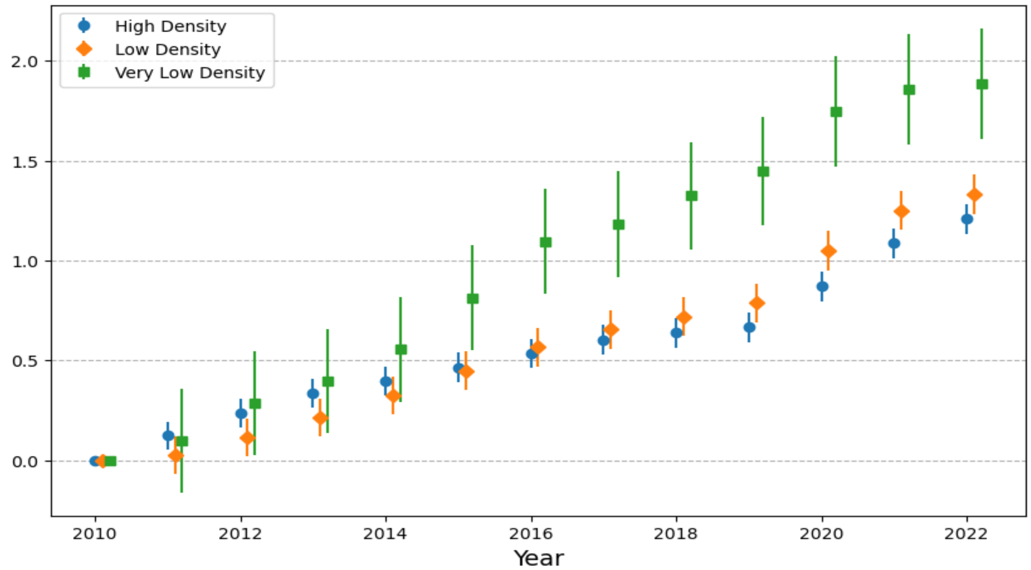
Figure 3. The evolution of branch density by bank size. The following figures demonstrate the decline of branch density across various groups. Branch density is defined as the number of branches per $1 billion deposits. Banks are categorized into size groups by their 2010 total assets value and the median of branch density within each group is plotted. The top panel includes all FDIC-insured banks and bottom panel capture all sample bank holding companies.



Panel A. Cumulative growth of total deposits

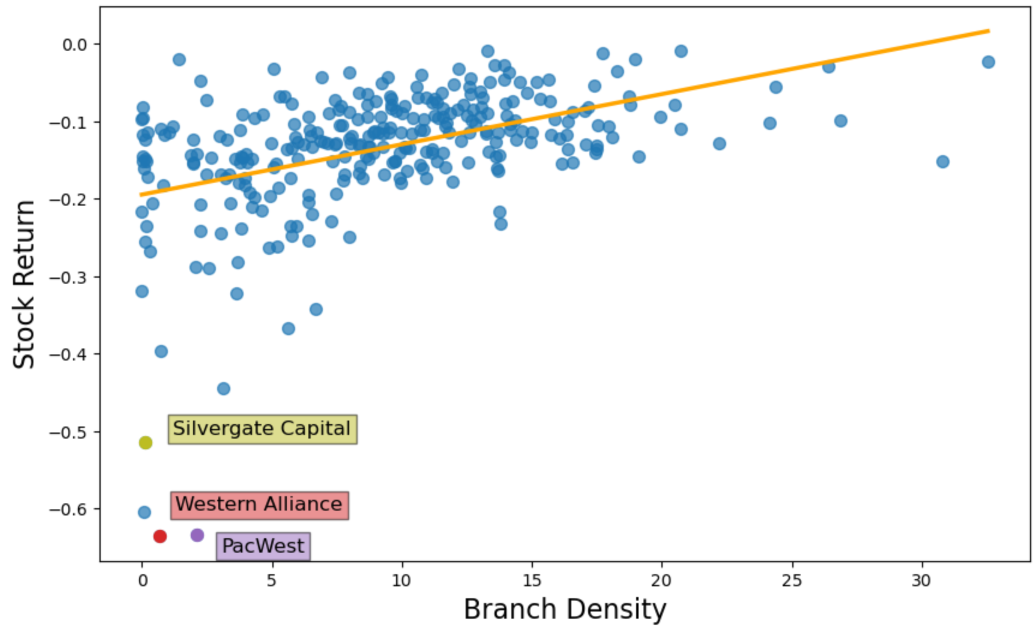


Panel B. Cumulative growth of insured deposits

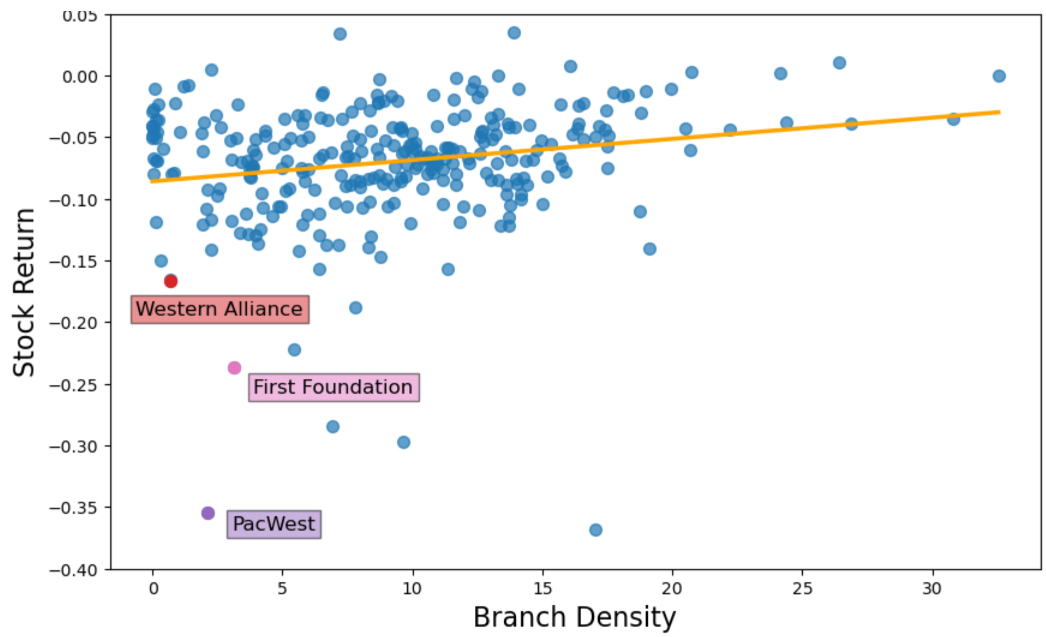


Panel C. Cumulative growth of uninsured deposits

Figure 4. Deposits Growth and Branch Density
This figure shows the growth of total deposits (Panel A), insured deposits (Panel B), and uninsured deposits (Panel C) for banks with various branch density. Total deposits, insured deposits, and uninsured deposits are in real term (2009 dollars) and are log transformed. Branch density is constructed at the bank-year level by dividing number of branches by total deposits (in billions). Banks with branch density less than or equal to the 10th percentile are categorized as *Very Low Density*, while banks with branch density higher than the 50th percentile are classified as *High Density*. The remaining banks are in the *Low Density* group. For each group, we regress log(deposits) (or log(insured deposits), log(uninsured deposits)) on indicators for years and plot the coefficients. The bars indicate the 95% confidence interval.

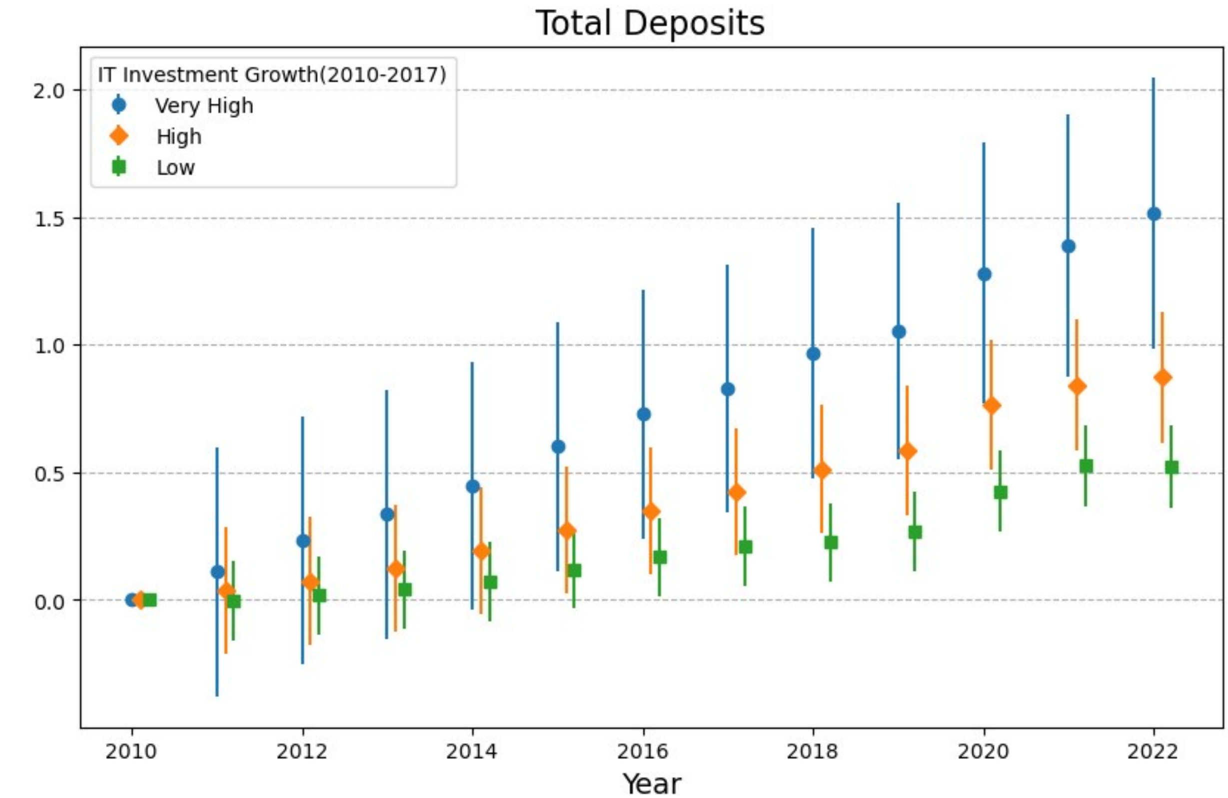


Panel A. Silicon Valley Bank collapse

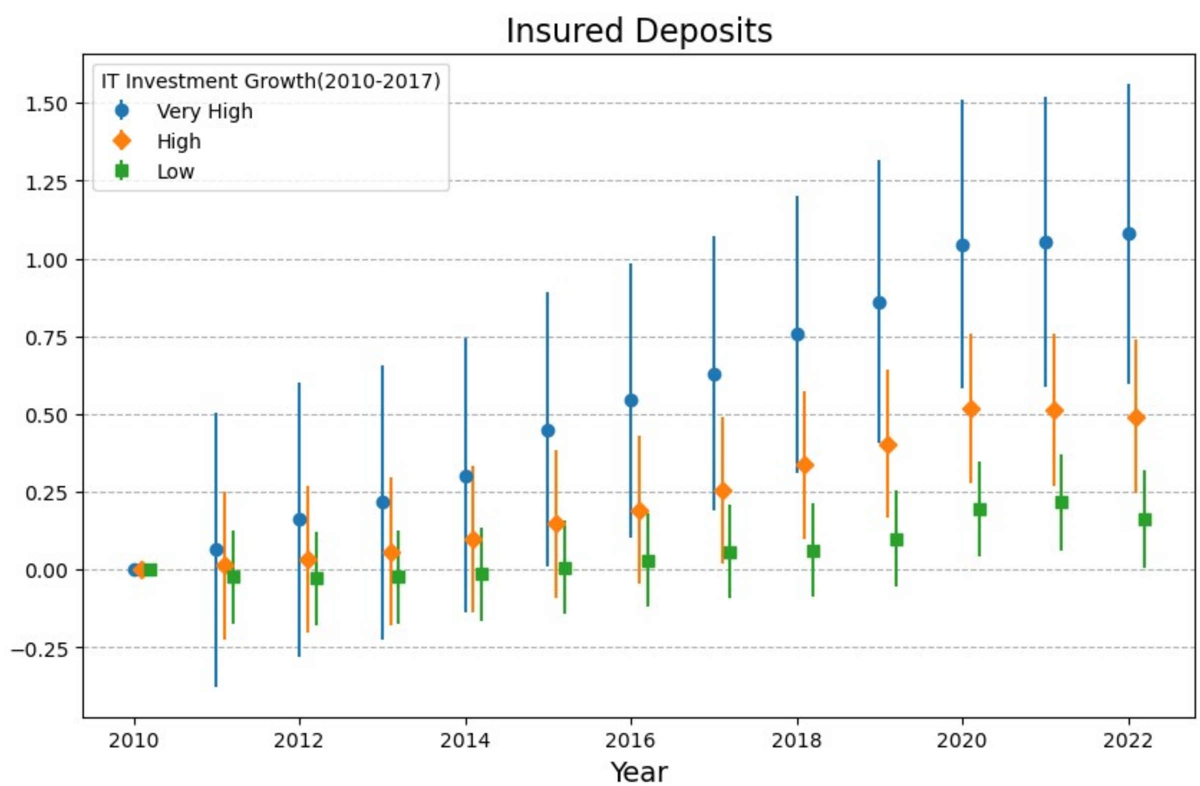


Panel B. First Republic Bank collapse

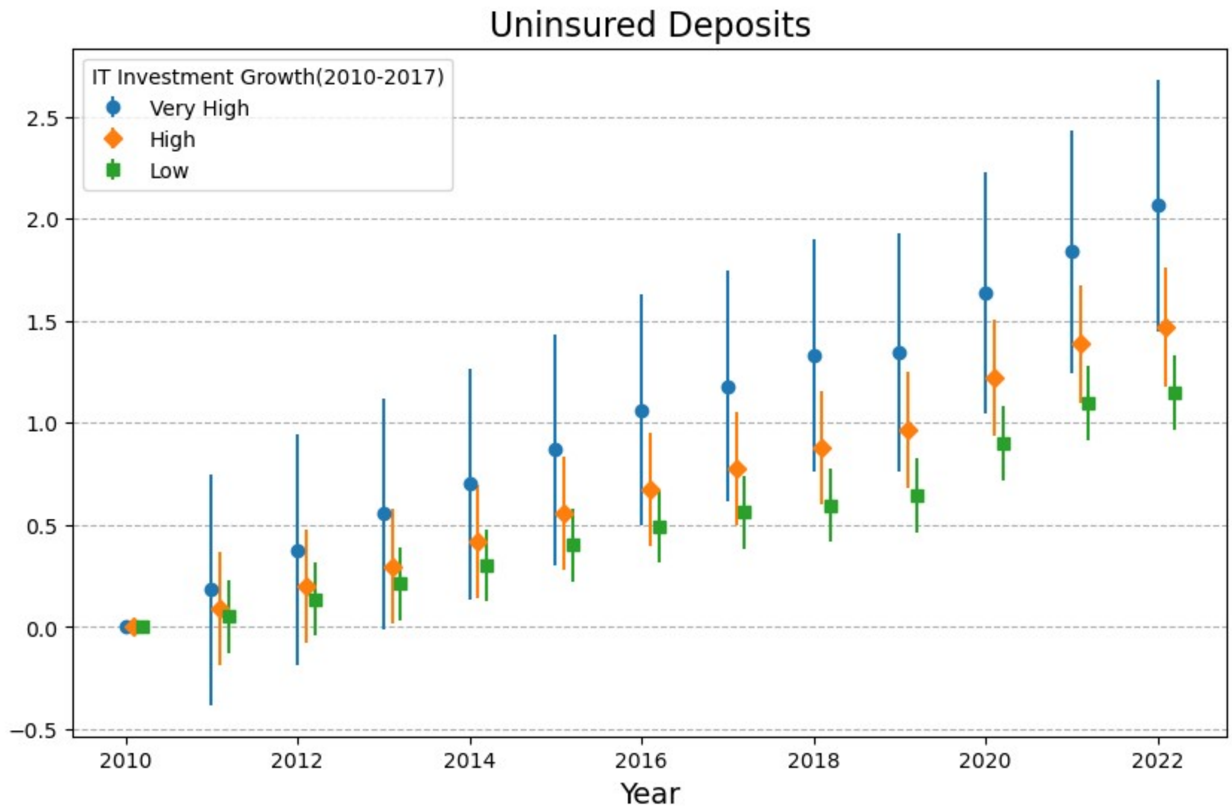
Figure 5. Branch density and stock return during the 2023 distress. This figure shows the relationship between branch density and stock return around two distress episodes in 2023: the collapse of Silicon Valley Bank (Panel A) and the failure of First Republic Bank (Panel B). Branch density is defined as the number of branches per $1 billion of deposits as of June 2022. Stock returns are calculated as the change in stock price between March 8 and March 13 in Panel A and April 28 to May 2 in Panel B. The sample includes 294 publicly traded bank holding companies. Banks that performed particularly poorly are labeled.



Panel A. Cumulative growth of total deposits



Panel B. Cumulative growth of insured deposits



Panel C. Cumulative growth of uninsured deposits

Figure 6. Deposits growth and IT investment. This figure plots the cumulative growth rate of deposits, insured deposits, and uninsured deposits. IT investment is calculated as the log-change of IT Budget from 2010 to 2017. Banks are classified into three groups based on their IT investment: Very High (>=90th percentile), High (>=50th percentile but < 90th percentile), and Low (< 50th percentile). Within each group, we regress deposits (or insured/uninsured deposits) in log transformation on a series of indicators for years and plot the coefficients. The bars represent the 95% confidence interval.

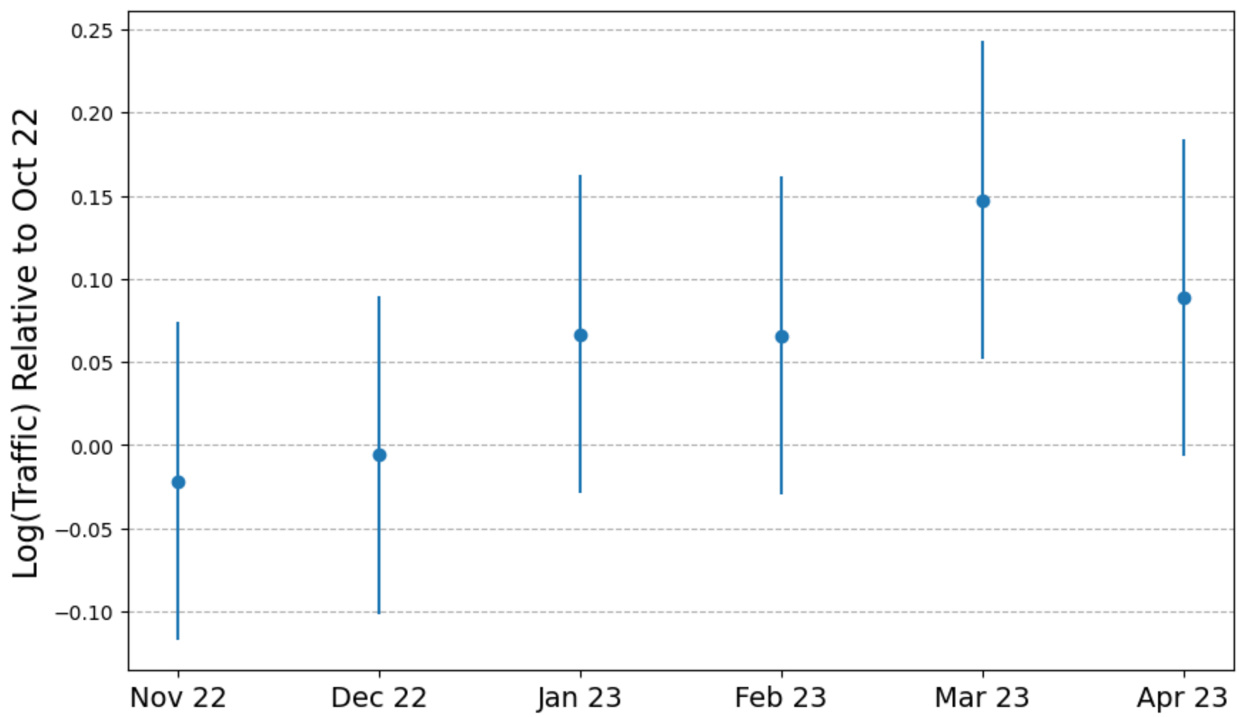


Figure 7. Website traffic. This figure displays the volume of website traffic to our sample banks relative to the level in October 2022. Using October 2022 as the baseline (omitted category), we regress the natural logarithm of the number of webpage visits on binary indicators for each month between November 2022 and April 2023, with bank fixed effects. The bar represents 95% confidence interval.

Table I
Summary Statistics

Variable Name	N	Mean	Std	25%	50%	75%
Stock Return (SVB Failure)	294	-0.135	0.084	-0.154	-0.12	-0.089
Stock Return (First Republic Failure)	294	-0.073	0.073	-0.088	-0.065	-0.041
Deposits Change Q422-Q123	276	1.13	9.03	-2.50	0.19	3.15
Uninsured Deposits Change Q422-Q123	291	-4.60	13.97	-9.47	-6.20	-0.49
Insured Deposits Change Q422-Q123	291	9.02	17.97	1.59	4.76	11.21
Branch Density	294	9.23	5.783	4.992	9.026	12.961
Δ(Branch Density)	229	-10.72	6.717	-14.533	-10.662	-6.533
Branch Density 2010	229	20.041	10.225	12.552	20.212	26.839
Log(Assets)	213	16.565	1.56	15.54	16.166	17.25
%Insured Deposits	294	62.589	17.099	52.673	63.564	75.512
Dep/Assets	213	0.803	0.116	0.792	0.83	0.866
MTM Losses	294	0.132	0.044	0.107	0.13	0.16
% Dep Growth 2019-2022	289	0.533	0.474	0.265	0.418	0.668
% Increase in IT Budget 2010-2017	194	3.215	0.785	2.715	3.155	3.634
Online Traffic Mar 23/Feb 23	182	1.275	1.085	0.789	1.04	1.363

Notes: This table reports summary statistics. Variables are defined at the bank holding company level. Stock return for SVB failure is from March 8 to March 13 and for First Republic from April 28 to May 2. Deposit changes are expressed in percentage points, data is based on call reports. Branch density is for 2022, and Δ(Branch Density) represents within-bank change in branch density between 2010 and 2022. Log(Assets) and Dep/Assets are for 2022 and come from Y-9C. %Insured Deposits is for 2022 and comes from call reports. MTM Losses are mark-to-market losses (Jiang et al. (2023b)) scaled by assets in 2022Q1 on bank holding company level. %Dep Growth 2019-2022 is the 3Y growth rate of total deposits based on call reports. %Increase in IT Budget 2010-2017 is the increase in total IT budget from Aberdeen IT investment data aggregated to bank holding company level. Online traffic Mar 23/Feb 23 is the ratio of the number of visits to banks' websites in March 2023 and February 2023 based on Semrush data. See Table AI for detailed descriptions.

Table II
The Evolution of Bank Branches in the United States

	(1)	(2)	(3)	(4)
		Number of Branches		
Year	-611.0***	0.181***	-2.587**	-109.7***
	(150.6)	(0.00647)	(1.047)	(16.02)
Covid (>= 2020)	-4201.3**	0.194***	2.347	-159.4
	(1337.6)	(0.0573)	(8.889)	(142.2)
N	13	54402	1142	39
Bank FE		0.969	0.978	0.875
Sample	All	Dep<10B	Dep [10B,1T]	Dep>1T

Notes: The sample covers the years 2010 to 2022. The regression in column (1) is at the year level, while that in column (2) is at the bank-quarter level. The dependent variable is the number of branches in all banks (column (1)) or of a given bank (columns (2)–(4)). Year is a continuous variable, while Covid is an indicator for year 2020 and beyond. The sample in columns (2)–(4) is limited based on the average level of banks' deposits from 2010 to 2022. Column (2) includes banks with average deposits of less than $50B, column (3) includes those with average deposits between $50B and $1T, and column (4) includes those above $1T.

Table III
Banks by Branch Density in 2022

	Bank Name	Total Assets($B)	Total Deposits($B)	# Branches	Branch/ $1B Dep
	Very Low Density				
1	First Republic Bank*	197.91	165.65	87	0.53
2	BNY Mellon Corporation	452.62	240.48	49	0.20
3	Signature Bank*	115.97	104.14	38	0.36
4	WesternAlliance Bancorp.	66.06	54.03	36	0.67
5	SVB Financial Group	214.40	174.96	17	0.10
6	Customers Bancorp, Inc.	20.26	17.03	12	0.70
7	Texas Capital Bancshares, Inc.	32.34	25.76	11	0.43
8	Stifel Financial Corp.	36.48	26.03	6	0.23
9	Morgan Stanley	1173.78	352.20	5	0.01
10	Goldman Sachs Group, Inc.	1601.22	343.13	5	0.01
	Low Density				
1	JPMorgan Chase & Co.	3841.31	2128.46	4819	2.26
2	Wells Fargo & Company	1881.14	1464.84	4768	3.25
3	Bank Of America Corporation	3111.61	1988.03	3906	1.96
4	PNC Financial	541.01	446.68	2615	5.85
5	U.S. Bancorp	591.38	455.31	2251	4.94
6	Truist Financial Corporation	545.12	435.44	2118	4.86
7	Citizens Financial Group, Inc.	227.19	181.57	1167	6.43
8	M&T Bank Corporation	204.03	173.08	1110	6.41
9	Fifth Third Bancorp	206.78	166.58	1090	6.54
10	Huntington Bancshares Inc.	178.78	148.69	1080	7.26
	High Density				
1	Regions Financial Corporation	160.95	139.56	1294	9.27
2	First Community Bancshares	3.94	3.52	345	97.98
3	F.N.B. Corporation	41.75	33.77	341	10.10
4	First Interstate Bancsystem	32.06	26.86	311	11.58
5	Prosperity Bancshares, Inc.	37.42	29.95	298	9.95
6	Southstate Corporation	46.21	38.96	289	7.42
7	Old National Bancorp	45.75	36.07	272	7.54
8	Simmons First National Corp	27.23	22.24	241	10.84
9	Community Bank System, Inc.	15.49	13.61	232	17.04
10	Home Bancshares, Inc.	24.25	19.94	230	11.54
	Affected Banks				
1	First Republic Bank*	197.91	165.65	87	0.53
2	PacWest Bancorp	40.95	34.35	72	2.10
3	Signature Bank*	115.97	104.14	38	0.36
4	Western Alliance Bancorp	66.06	54.03	36	0.67
5	SVB Financial Group	214.40	174.96	17	0.10
6	Silvergate Capital Corporation	15.90	13.51	2	0.15

Notes: Banks are sorted by branch density measured as of June 2022 (i.e., number of branches per $1B deposits). *Very Low Density* represents the bottom 10% of the distribution, *Low Density* includes banks between 10th and 50th percentile, and *High Density* includes banks above the 50th percentile. For each group, the 10 banks with the highest number of branches are presented. Banks denoted with * are not in our regression sample because they are not bank holding companies. Bank-level data from Call Reports are used for these banks.

Table IV
Branch Density and Stock Prices during the 2023 Banking Crisis

	(1)	(2)	(3)	(4)	(5)
	Stock Return around SVB Collapse				
Branch Density	0.00712***	0.00821***	0.00722***	0.00750***	0.00688***
	(0.00128)	(0.00125)	(0.00131)	(0.00133)	(0.00129)
Dep/Assets		-0.239***	-0.234***	-0.220***	-0.258***
		(0.0555)	(0.0550)	(0.0558)	(0.0555)
% Insured Deposits			0.000793**	0.000810**	0.000876**
			(0.000350)	(0.000349)	(0.000340)
MTM Losses				-0.187	-0.174
				(0.141)	(0.137)
% Dep Growth 2019-2022					-0.0483***
					(0.0122)
N	213	213	213	213	212
R2	0.189	0.256	0.274	0.281	0.331
Size controls	X	X	X	X	X
	(6)	(7)	(8)	(9)	(10)
	Stock Return around First Republic Collapse				
Branch Density	0.00191***	0.00234***	0.00197**	0.00240***	0.00237***
	(0.000727)	(0.000728)	(0.000770)	(0.000758)	(0.000767)
Dep/Assets		-0.0950***	-0.0929***	-0.0723**	-0.0785**
		(0.0323)	(0.0323)	(0.0319)	(0.0329)
% Insured Deposits			0.000299	0.000325	0.000316
			(0.000205)	(0.000200)	(0.000202)
MTM Losses				-0.286***	-0.287***
				(0.0806)	(0.0809)
% Dep Growth 2019-2022					-0.00401
					(0.00723)
N	213	213	213	213	212
R2	0.068	0.105	0.115	0.166	0.169
Size controls	X	X	X	X	X

Notes: The sample includes all U.S. banks for which returns and branch density are available. Return around SVB collapse is the relative change of average close price from March 8 to March 13; return around First Republic collapse is the relative change in close price from April 28 to May 2. Branch density is the number of bank branches per $1B of deposits as of June 2022; Deposits to assets ratio and share of FDIC-insured deposits are measured at the end of 2022. MTM losses, expressed as percentage of assets in Q1 2022, are calculated following Jiang et al. (2023). All columns include control for logarithm of total assets and for fixed effects for 5 total assets quintiles. Standard errors in parentheses. * - 10% significance; ** - 5%; *** - 1%.

Table V
Branch Density, Bank Size, and Stock Prices during the 2023 Banking Crisis

	(1) Stock Return around SVB Collapse	(2) Stock Return around First Republic Collapse
Branch Density	0.00667***	0.00231***
	(0.00129)	(0.000768)
Branch Density X TA > $1T	0.0260	0.0228
	(0.0277)	(0.0165)
Dep/Assets	-0.243***	-0.0828**
	(0.0607)	(0.0361)
% Insured Deposits	0.000873**	0.000318
	(0.000338)	(0.000201)
MTM Losses	-0.184	-0.293***
	(0.136)	(0.0807)
% Dep Growth 2019-2022	-0.0475***	-0.00348
	(0.0121)	(0.00721)
R2	212	212
Controls	0.347	0.183

Notes: Return around SVB collapse is relative change of average close price from March 8 to March 13; return around First Republic collapse is relative change in close price from April 28 to May 2. Branch density is the number of bank branches per $1B of deposits as of June 2022. TA>$1T represents binary indicator for banks with total assets above $1T at the end of 2022. All columns include control for logarithm of total assets and for fixed effects for five total assets quintiles, deposits/asset ratio, share of insured deposits, mark-to-market losses estimates, and 2019 to 2022 deposits growth. Standard errors in parentheses. * - 10% significance; ** - 5%; *** - 1%.

Table VI
Separating the Role of Branches and Deposits over Time

	(1)	(2)	(3)	(4)
	Stock Return around SVB Collapse		Stock Return around First Republic Collapse	
D(Branch Density)	0.00350*		0.00220**	
	(0.00183)		(0.00100)	
Branch Density 2010	0.00448***	0.00211***	0.00192***	0.000451
	(0.00134)	(0.000614)	(0.000733)	(0.000353)
Δ(Log(Deposits))		-0.0438***		-0.0121**
		(0.0103)		(0.00595)
Δ(Log(Branches))		0.0367***		0.00870
		(0.00950)		(0.00547)
Dep/Assets	-0.243***	-0.234***	-0.0641*	0.000531***
	(0.0627)	(0.0597)	(0.0342)	(0.000192)
% Insured	0.00130***	0.00136***	0.000450**	-0.279***
Deposits	(0.000361)	(0.000334)	(0.000197)	(0.0780)
MTM	-0.203	-0.263*	-0.262***	0.00154
Losses	(0.140)	(0.136)	(0.0766)	(0.00860)
% Dep Growth	-0.0546***	-0.0399***	-0.00249	0.00208
2019-2022	(0.0132)	(0.0149)	(0.00719)	(0.00860)
N	171	171	171	171
R2	0.409	0.468	0.217	0.207
Size Controls	X	X	X	X

Notes: Return around SVB collapse is relative change of average close price from March 8 to March 13; return around First Republic collapse is relative change in close price from April 28 to May 2. Changes in independent variables (branch density, defined as the number of branches per $1B of deposits; and logarithms of the number of branches and total deposits) are over the 2010 to 2022 horizon. All columns include control for logarithm of total assets and for fixed effects for five total assets quintiles, deposits/asset ratio, share of insured deposits, mark-to-market losses estimates, and 2019 to 2022 deposits growth. Standard errors in parentheses. * - 10% significance; ** - 5%; *** - 1%.

Table VII
Branch Density and Deposit Outflows in Q1 2023

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	%ΔDeposits Q4 2022-Q1 2023				Bottom 10% of Deposits Outflow Q4 2022-Q1 2023		Bottom 25% of Deposits Outflow Q4 2022-Q1 2023	
	Uninsured	Insured	Total		Uninsured	Insured	Uninsured	Insured
Branch Density	0.753***	-1.242***	0.0217	0.199**	-0.0190***	0.00227	-0.0205***	0.0120*
	(0.248)	(0.243)	(0.146)	(0.0886)	(0.00490)	(0.00448)	(0.00717)	(0.00693)
% Insured Deposits	0.0875	0.0662	0.0998**	-0.0175	0.000665	0.000648	0.00157	-0.000769
	(0.0697)	(0.0682)	(0.0411)	(0.0244)	(0.00137)	(0.00126)	(0.00201)	(0.00194)
Dep/Assets	-6.931	9.526	-3.606	1.165	0.289	-0.245	-0.221	-0.475
	(11.76)	(11.50)	(6.931)	(3.002)	(0.232)	(0.212)	(0.339)	(0.328)
MTM Losses	-26.07	6.707	-4.022	0.514	0.822	-0.202	1.856**	0.101
	(26.42)	(25.84)	(15.57)	(7.237)	(0.521)	(0.476)	(0.762)	(0.737)
% Dep Gr 2019-2022	1.458	5.102*	2.545	0.920	0.0192	-0.0749	0.0180	-0.0155
	(2.872)	(2.809)	(1.693)	(0.802)	(0.0566)	(0.0518)	(0.0828)	(0.0801)
Sample		Full		Net Outflow		Full		
N	209	209	209	105	209	209	209	209
R2	0.078	0.167	0.078	0.106	0.091	0.069	0.074	0.068

Notes: Dependent variables are relative changes of deposits—uninsured (column (1)), insured (column (2)), and total (columns (3) and (4))—between Q4 2022 and Q1 2023, and binary indicators for large uninsured (columns (5) and (7)) or insured (columns (6) and (8)) deposits outflows, where "large" is defined as below the 10th percentile (columns (5) and (6)) or the 25th percentile of the distribution (columns (7) and (8)). In column (4) the sample is limited to banks that experienced a net outflow of deposits between Q4 2022 and Q1 2023. Silvergate Capital is excluded from the sample as an outlier. All columns include control for logarithm of total assets and for fixed effects for five total assets quintiles, deposits/asset ratio, share of insured deposits, mark-to-market losses estimates, and 2019 to 2022 deposits growth. Standard errors in parentheses. * - 10% significance; ** - 5%; *** - 1%.

Table VIII
Instrumenting Branch Density with IT Investment

Panel A. Stock Returns Regressions

	(1)	(2)	(3)	(4)	(5)
	Branch Density	Stock Return around SVB Collapse		Stock Return around First Republic Collapse	
% Increase in IT Budget 2017-2010	-1.776***	-0.0205***		-0.00917**	
	(0.412)	(0.00732)		(0.00394)	
Branch Density			0.0116***		0.00516**
			(0.00438)		(0.00234)
Dep/Assets	2.593	-0.252***	-0.282***	-0.0703**	-0.0837**
	(3.652)	(0.0650)	(0.0709)	(0.0350)	(0.0378)
% Insured Deposits	0.108***	0.00194***	0.000689	0.000595***	0.0000380
	(0.0200)	(0.000355)	(0.000609)	(0.000191)	(0.000325)
MTM Losses	5.494	-0.121	-0.185	-0.252***	-0.280***
	(8.789)	(0.156)	(0.171)	(0.0842)	(0.0914)
% Dep Growth 2019-2022	-0.563	-0.0521***	-0.0456***	-0.000231	0.00268
	(0.791)	(0.0141)	(0.0156)	(0.00758)	(0.00832)
N	157	157	157	157	157
R2	0.498	0.406	0.259	0.204	0.112
F-Stat	18.6				18.6
IV			IT Budget		IT Budget

Panel B. Deposit Flows Regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ΔDeposits Q4 2022-Q1 2023				Bottom 10% of Deposits Outflow Q4 2022-Q1 2023		Bottom 25% of Deposits Outflow Q4 2022-Q1 2023	
	Uninsured	Insured	Total		Uninsured	Insured	Uninsured	Insured
Branch Density	1.789**	-3.138***	-0.0754	0.698*	-0.0539***	0.0126	-0.0649***	0.0147
	(0.881)	(0.889)	(0.483)	(0.394)	(0.0143)	(0.0112)	(0.0211)	(0.0199)
% Insured Deposits	-0.0268	0.369***	0.151**	-0.0887	0.00653***	-0.00114	0.00920***	-0.00108
	(0.128)	(0.130)	(0.0704)	(0.0731)	(0.00231)	(0.00181)	(0.00341)	(0.00321)
Dep/Assets	-9.317	13.41	-3.947	2.684	0.301	-0.382*	-0.162	-0.454
	(14.59)	(14.72)	(8.001)	(4.066)	(0.280)	(0.220)	(0.413)	(0.389)
MTM Losses	-40.03	25.44	-9.046	1.610	1.373**	-0.616	2.635***	0.186
	(34.88)	(35.18)	(19.13)	(10.30)	(0.674)	(0.529)	(0.996)	(0.938)
% Dep Gr 2019-2022	3.716	0.0341	2.288	2.404	-0.0469	-0.0240	0.0180	0.0512
	(3.543)	(3.574)	(1.943)	(1.568)	(0.0678)	(0.0532)	(0.100)	(0.0943)
F-Stat		29.3		8.6	29.3		29.3	
Sample		Full		Net Outflow	Full		Full	
N	160	160	160	81	160	160	160	160

Notes: Branch density is the number of branches per $1B of deposits as of June 2022. In Panel A, return around SVB collapse is relative change of average close price from March 8 to March 13; return around First Republic collapse is relative change in close price from April 28 to May 2. Increase in IT budget is the relative increase of banks' total IT budget in 2017 and the budget in 2010. In Panel B, dependent variables are relative changes of deposits—uninsured (column (1)), insured (column (2)), and total (columns (3) and (4))—between Q4 2022 and Q1 2023, and binary indicators for large uninsured (columns (5) and (7)) or insured (columns (6) (8)) deposits outflows, where "large" is defined as below the 10th percentile (columns (5) and (6)) or the 25th percentile of the distribution (columns (7) and (8)). In column (4) the sample is limited to banks that experienced a net outflow of deposits between Q4 2022 and Q1 2023. Silvergate Capital is excluded from the sample as an outlier. All columns include control for logarithm of total assets and for fixed effects for five total assets quintiles, deposits/asset ratio, share of insured deposits, and mark-to-market losses estimates. Standard errors in parentheses. * - 10% significance; ** - 5%; *** - 1%.

Table IX
Branch Density, Online Traffic, and Stock Returns

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	ΔOnline Traffic (Mar/Feb 23)	Stock Return around SVB Collapse		Stock Return around First Republic Collapse		%ΔUninsured Deposits Q4 2022-Q1 2023	
Branch Density	-0.0503***		0.00594***		0.00221**		0.579**
	(0.0192)		(0.00150)		(0.000906)		(0.262)
Online Traffic Mar/Feb 23		-0.0189***	-0.0143**	-0.00694*	-0.00523	-2.485**	-2.033*
		(0.00601)	(0.00588)	(0.00354)	(0.00356)	(1.022)	(1.031)
Dep/Assets	1.856**	-0.155**	-0.200***	-0.0634	-0.0801*	-14.53	-18.61
	(0.866)	(0.0692)	(0.0674)	(0.0407)	(0.0407)	(13.58)	(13.55)
% Insured Deposits	-0.00545	0.00118***	0.000647	0.000575**	0.000376	0.214***	0.162**
	(0.00517)	(0.000390)	(0.000398)	(0.000230)	(0.000241)	(0.0688)	(0.0721)
MTM Losses	-4.629**	-0.0927	-0.187	-0.332***	-0.368***	-17.21	-26.39
	(1.927)	(0.155)	(0.150)	(0.0910)	(0.0908)	(26.22)	(26.26)
% Dep Growth 2019-2022	0.485***	-0.0386***	-0.0358***	-0.00907	-0.00805	-3.317	-3.117
	(0.171)	(0.0140)	(0.0135)	(0.00824)	(0.00813)	(2.818)	(2.788)
N	181	181	181	181	181	180	180
R2	0.191	0.226	0.292	0.166	0.194	0.147	0.171

Notes: Online traffic change is the ratio of the number of webpage visits on bank's online banking website in March 2023 to the number of visits in February 2023. Return around SVB collapse is relative change of average close price from March 8 to March 13; return around First Republic collapse is relative change in close price from April 28 to May 2. Deposit change is the relative changes of uninsured deposits between Q4 2022 and Q1 2023. All columns include control for logarithm of total assets and for fixed effects for five total assets quintiles, deposits/asset ratio, share of insured deposits, mark-to-market losses estimates, and 2019 to 2022 deposits growth. Standard errors in parentheses. * - 10% significance; ** - 5%; *** - 1%.

Appendix

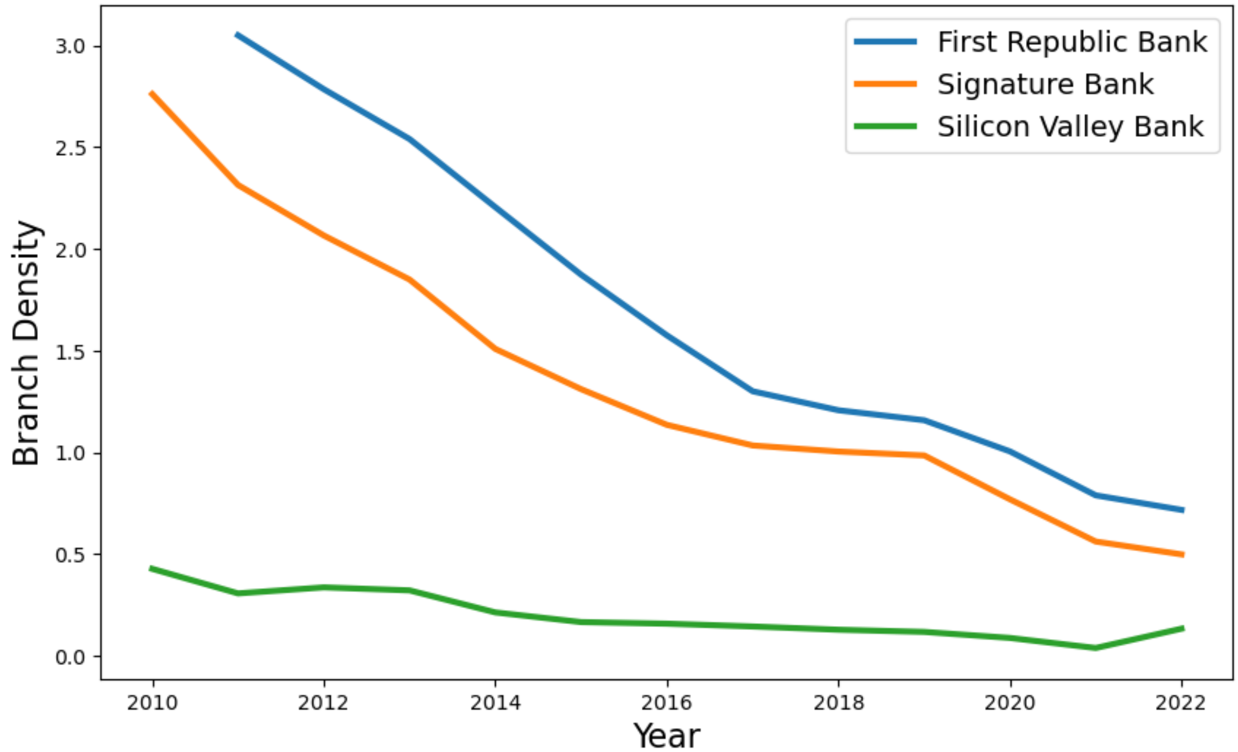


Figure A1. Branch Density of Failed Banks. This figure displays the branch density of First Republic Bank, Signature Bank, and Silicon Valley Bank from 2010 to 2022. Branch density is defined as the number of branches per $1B of deposits. Deposits are adjusted for inflation and are in 2009 dollars. First Republic Bank was established in July 2010, and therefore the data was only available from 2011 onward. Source: Summary of Deposits.

Table AI
Variable Definitions and Data Sources

Variable	Descriptions	Source
Stock Return (SVB Failure)	Relative change of the close price from March 8, 2023, to March 13, 2023.	CRSP
Stock Return (First Republic Failure)	The change in the close price between April 28, 2023, and May 2, 2023.	CRSP
Deposits Change Q4 2022-Q1 2023	Percentage change of total deposits in Q1 2023 relative to the total deposits in Q4 2022. Bank-level data are aggregated at the bank holding company level.	Call Reports
Uninsured Deposits Change Q4 2022-Q1 2023	Percentage change of uninsured deposits in Q1 2023 relative to uninsured deposits in Q4 2022. Uninsured deposits are calculated by subtracting insured deposits from total deposits. Bank-level data are aggregated at the bank holding company level.	Call Reports
Insured Deposits Change Q4 2022-Q1 2023	Percentage change of insured deposits in Q1 2023 relative to insured deposits in Q4 2022. We follow Acharya and Mora (2015) and define insured deposits as the sum of RCONF049 and RCONF045 in the bank-level call reports. Bank level data are then aggregated at the bank holding company level.	Call Reports
Branch Density	Number of branches scaled by total deposits as of June 2022. Bank-level data are aggregated at the bank holding company level.	Summary of Deposits
Δ(Branch Density)	Branch density in June 2022 minus branch density measured in June 2010.	Summary of Deposits
Branch Density 2010	Branch density as of June 2010.	Summary of Deposits
Log(Assets)	Log of total assets.	Y-9C
%Insured Deposits	The fraction of insured deposits out of total deposits. The bank-level data are aggregated at the bank holding company level.	Call Reports
Dep/Assets	Total deposits scaled by total assets.	Y-9C
MTM Losses	Mark-to-market losses scaled by total assets measured in Q1 2022. For details of mark-to-market losses, please see Jiang et al. (2023). Similar to Cookson et al. (2023), we aggregate bank-level data to the bank holding company level.	Call Reports
% Dep Growth 2019-2022	Growth rate in total deposits from the end of 2019 to the end of 2022. Bank-level data are aggregated at the bank holding company level.	Call Reports
%Increase in IT Budget 2010-2017	Percentage change in IT budget from 2010 to 2017. We match IT data from Aberdeen with summary of deposits first and then aggregate data to the bank holding company level.	Aberdeen
Online Traffic Mar 23/Feb 23	The ratio of online traffic in March 2023 relative to the online traffic in February 2023.	Semrush

Table AII
Branch Density and Insured Deposits

	(1)
	Share of Insured Deposits
Log(Deposits)	-0.1068***
	(0.0112)
Log(Number of Branches)	0.0653***
	(0.0072)
N	222,127
Dep. Var Avg	0.447
Fixed Effects	
Bank	X
Year	X

Notes: Each observation is on bank-quarter level. The dependent variable is the ratio of insured to total deposits; bank and year fixed effects are included as controls. Standard errors are clustered on the bank level and reported in parentheses. * - 10% significance; ** - 5%; *** - 1%.

Table AIII

Banks by IT Investment Level

	Bank Name	Tot Assets [$B]	Tot Deposits [$B]	# Branches	ΔIT Budgets
Very High IT Spending					
1	CAPITAL ONE FINANCIAL CORP	443.0	399.0	297	4.54
2	PACIFIC PREMIER BANCORP INC	21.7	18.1	61	4.35
3	MIDWESTONE FINANCIAL GROUP	6.4	5.6	60	4.99
4	NORTHERN TRUST CORP	161.0	54.6	58	4.30
5	NICOLET BANKSHARES INC	8.1	6.3	55	4.50
6	BUSINESS FIRST BANCSHS INC	5.7	4.7	50	4.87
7	SERVISFIRST BANCSHARES INC	14.6	11.8	23	5.17
8	EAGLE BANCORP INC/MD	11.0	9.2	18	4.93
9	TEXAS CAPITAL BANCSHARES INC	30.6	25.8	11	5.01
10	BRIDGEWATER BANCSHARES	4.0	3.2	8	4.41
High IT Spending					
1	JPMORGAN CHASE & CO	3810	2130	4819	3.42
2	BANK OF AMERICA CORP	3120	1990	3906	3.30
3	US BANCORP	613	455	2251	3.46
4	TRUIST FINANCIAL CORP	548	435	2118	3.17
5	FIFTH THIRD BANCORP	208	167	1090	3.45
6	HUNTINGTON BANCSHARES	179	149	1080	3.36
7	KEYCORP	187	149	999	3.25
8	CITIGROUP INC	2390	764	678	3.58
9	COMERICA INC	87	77	433	3.47
10	PROSPERITY BANCSHARES INC	38	30	298	4.15
Low IT Spending					
1	WELLS FARGO & CO	1890	1460	4768	3.06
2	PNC FINANCIAL SVCS GROUP INC	550	447	2615	2.60
3	REGIONS FINANCIAL CORP	160	140	1294	2.67
4	FIRST CITIZENS BANC	109	89	586	3.14
5	FIRST HORIZON CORP	83	72	415	2.06
6	F N B CORP/FL	43	34	341	3.09
7	FIRST INTERSTATE BANCSYSTEM	32	27	311	2.87
8	SYNOVUS FINANCIAL CORP	58	50	261	2.55
9	VALLEY NATIONAL BANCORP	53	44	240	2.75
10	COMMUNITY BANK SYSTEM INC	16	14	232	3.15

Notes: Banks are sorted by the log-change of IT budgets from 2010 to 2017, which is shown in the last column. Very high IT spending means top 10% of the distribution, high IT spending means banks between 50th and 90th percentile, and low IT spending means banks below 50th percentile. For each group, the 10 banks with the highest number of branches are presented.