The Fundamental Role of Uninsured Depositors in the Regional Banking Crisis*

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Abstract

We examine the role of uninsured depositors in the 2023 Regional Banking Crisis by emphasizing that they are valuable clients who demand loans. Banks with more uninsured deposits experienced greater equity value declines and stock price risk after the start of 2022 when interest rates rose sharply. Before 2022, these banks also had greater stock price risk, profitability, valuations, executive pay, and exposure to commercial loans than other banks but had similar exposure to securities. To explain these facts, we develop a model where banks better at risk-taking attract large uninsured depositors who have loan demand. Rising interest rates and decreased loan demand reduce lending relationship values, leading to outflows from riskier banks.

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The high level of uninsured deposits at Silicon Valley Bank (SVB) and the losses on its large securities portfolio amid rising interest rates have naturally led to a narrative of flighty uninsured depositors worried about bank defaults as a main driver of the Regional Banking Crisis of 2023. However, SVB held a significant role in the Silicon Valley community and maintained lending relationships with large corporate clients, who kept uninsured deposits in the bank.[1] Indeed, Sequoia Capital partner Michael Moritz wrote an op-ed describing how "For those of us who have worked in Silicon Valley for the past forty years, SVB has been our most important business partner" (Moritz, 2023). As S&P Market Intelligence observed, such deep business relationships cut against the narrative of flighty uninsured depositors:[2]

> Meanwhile, large corporate depositors that may have balances well above the Federal Deposit Insurance Corp.'s insured limit may use their deposit account to pay payroll, collect money from vendors, and for other regular corporate operations, and may be well-integrated with treasury management services provided by the bank, which would make moving deposit accounts to another financial institution a significant undertaking. (Hayes, 2023)

This paper studies why some banks have more uninsured deposits than others and why they might lose them. We do so through the lens of fundamentals by accounting for loan demand attached to uninsured deposits. To start, we provide a series of new stylized facts about the cross-section of regional banks leading up to the crisis. Among these are that banks with more uninsured deposits experienced bigger equity value declines in the March 2023 drawdowns of the regional banking index and after the start of 2022, when interest rates rose sharply. These banks were also riskier before 2022, but exposure to commercial loans played at least as important a role as exposure to securities during this period in explaining this fact.[3] To understand these facts, we develop a model where banks better at taking risks

[1]SVB's largest depositors, each of whom had several hundred million dollars in deposit at the bank, were tech companies such as Roku and the venture capital firm Sequoia Capital (Chapman and Leopold, 2023).

[2]Others have also documented that SVB specialized in making loans and taking deposits from the tech industry, including many smaller and medium-sized startups (Gompers, 2023; Chow, 2023). On the loan side, company materials describe the bank "serv[ing] the innovation economy...There are few banks that truly understand venture debt and many that don't" (Argueta, 2023). On the deposit side, companies often used their large deposit accounts for working capital management, and several start-ups had difficulties paying bills after the failure of SVB (Stokes et al., 2023).

[3]SVB was not alone among regional banks in pursuing risky, specialized strategies financed with large, uninsured deposits. Signature Bank embraced cryptocurrencies and, according to its CEO, became a "pre-eminent player in that space" (DiCamillo, 2021). First Republic Bank specialized in making large loans to

attract large uninsured depositors who demand loans to finance risky projects. The model thus articulates a fundamentals-based view emphasizing that greater bank loan risk-taking and uninsured deposits go together in equilibrium. We then work out the implications for how changes in interest rates and loan demand lead depositors to reallocate across banks.

Specifically, we establish six stylized facts that, taken together, point to the importance of lending relationships among uninsured deposits. First, regional banks with greater uninsured deposits experienced worse returns and greater stock price risk than other banks after the start of 2022. For example, Figure 1 shows that uninsured deposits predict which regional banks experienced trouble in the March 2023 peak crisis period. Second, before 2022, banks with greater uninsured deposits were also riskier. Third, these banks had similar exposures to securities as other banks but greater exposures to commercial loans and deposits. They also had lower overall asset maturities despite securities with modestly higher maturities. Fourth, these banks were more profitable and valuable and experienced greater deposit growth. Fifth, these banks reported capital ratios and leverage measures that did not indicate greater risk. Sixth, these banks had similar or greater executive pay and incentives, which were themselves related to greater risk.

These facts build a case that high uninsured deposits and risk go together at banks for fundamental lending reasons. While the emerging narrative after the crisis emphasizes the importance of uninsured deposits in bank runs (Fact 1), such banks were also risky well before the crisis (Fact 2). The risk represented by uninsured deposits in this prior period is arguably related to exposure to commercial loans and deposits at least as much as securities or duration exposure (Fact 3). The fact that these banks were more profitable, more valuable (despite their greater risk), and experienced inflows (Fact 4) suggests that uninsured deposits are related to valuable business strategies. Risk-taking did not manifest in capital ratios and leverage (Fact 5) but required high executive pay and strong incentives at financial firms to

wealthy entrepreneurs and bankers that subsequently lost significant value (Eisen, Ackerman, and Driebusch, 2023), and its executives famously declared that "to get best relationship pricing, we want the full deposit relationship...it's a very key focus for us and one of the reasons we've been able to grow deposit balances so quickly" (Delevingne, 2023). Several other banks, such as Bank of Hawaii and Western Alliance, also accumulated significant loan losses during the crisis (Weil, 2023).

execute (Fact 6, similar to Cheng, Hong, and Scheinkman, 2015).

Motivated by these six facts, we develop a model that shows why risk-taking and uninsured deposits go together in equilibrium and what drives the allocation of uninsured deposits across banks. There is a continuum of ex-ante identical uninsured depositors who demand loans for risky projects and have working capital (exceeding the deposit insurance limit) to deposit in a bank. After an uninsured depositor chooses a bank, that bank receives an informative signal about the project's success, e.g., through a better understanding of the project cash flows, and decides whether to invest. There is a continuum of banks with heterogeneous abilities to understand risky projects (modeled through heterogeneous signal precisions) and total deposit-taking capacity. Banks post loan and deposit rates ex-ante, decide whether to invest in projects, and face a reduced-form convex cost of holding risk. All depositors match with a bank through market clearing.

The model makes two sets of predictions that align with the above facts. First, banks that attract greater uninsured depositors in equilibrium also take more risks and are more profitable than other banks. Intuitively, these are more-specialized banks with a better ability to screen projects and thus generate higher returns than less-specialized banks. Therefore, they are willing to take on more risky projects despite paying a greater total cost of holding that risk, attracting more uninsured deposits in the process.

Second, a decline in the return of risky projects and an increase in the risk-free rate leads to outflows from more specialized banks toward less specialized banks. That is, a risky, high-uninsured deposit bank should experience an outflow of uninsured depositors and a decline in value after such a shock. This effect occurs because that bank's screening advantage becomes less valuable, which no longer justifies the high cost of risk-taking. This decrease in the match value between an entrepreneur and a risk-taking bank leads to a reallocation of depositors away from that bank. The prediction provides a rationale for outflows from banks with high uninsured depositors grounded in fundamentals.

We calibrate the model and quantitatively show that fundamentals can affect deposit allocations on the same order of magnitude as the data describe. An increase in interest rates from approximately zero to 4% generates a reallocation that significantly evens out the distribution of uninsured deposits across banks. In particular, the calibration suggests that a 4-percentage point increase in interest rates translates to a 12-percentage point decrease in uninsured deposits at the bank with the most uninsured deposits. These model-implied effects are, if anything, larger than what the data describe.

Related literature. We contribute to the literature by re-examining the role of uninsured depositors in bank risk-taking through the lens of fundamentals. The fundamentals-based view is consistent with the literature emphasizing the importance of the deposit franchise (Drechsler, Savov, and Schnabl, 2017, 2021; Egan, Lewellen, and Sunderam, 2021), relationships (Bharath et al., 2009; Chodorow-Reich, 2013), and specialization (Blickle, Parlatore, and Saunders, 2023; Paravisini, Rappoport, and Schnabl, 2023) for banks. It is also consistent with the view that macroeconomic factors fueled risk-taking (Acharya et al., 2023). We emphasize that it complements and does not exclude the idea that bank runs are essential in explaining the events of March 2023 (Benmelech, Yang, and Zator, 2023; Cookson et al., 2023; Diamond and Dybvig, 1983; Drechsler et al., 2023; Egan, Hortaçsu, and Matvos, 2017; Goldstein and Pauzner, 2005; Haddad, Hartman-Glaser, and Muir, 2023; Iyer and Puri, 2012; Jiang et al., 2023b; Koont, Santos, and Zingales, 2023). We intentionally abstract from runs since the literature has clearly established their importance.

Indeed, an emerging narrative of the crisis emphasizes the role of flighty uninsured depositors in precipitating bank runs, consistent with the prior literature (Jiang et al., 2023b; Egan, Hortaçsu, and Matvos, 2017). An expanded version of this narrative further emphasizes that SVB, with its high concentration of uninsured deposits, was a mismanaged, outlier bank that spread contagion to other banks who only posed a "passing resemblance" (Ip, 2023; Salmon, 2023). The Federal Reserve Board (Fed), in its report on SVB's collapse, wrote that SVB was a "textbook case of mismanagement" that, "in some respects, was an outlier" due to its "concentrated business model, interest rate risk, and high level of reliance on uninsured deposits" (Barr, 2023). The Fed also noted that SVB spread contagion even though it was "not extremely large, highly connected to other financial counterparties, or involved in critical financial services."

Our facts suggest that the default narrative of regional banks being risky because they hold large, long-duration securities portfolios financed by uninsured deposits may have described SVB in 2022-23 but does not describe the cross-section of regional banks before 2022. We propose a fundamentals-based view emphasizing that the allocation of uninsured deposits at high-risk banks is not accidental but the outcome of valuable equilibrium matches and lending relationships.[4] This view suggests that the fundamental origins of the broader deterioration of health among high-uninsured deposit banks, amplified by bank runs, lay in a decline in match values due to rising interest rates and declining risky opportunities.

1 Data and Summary Statistics

Our sample consists of publicly traded US banks classified as regional banks under the eight-digit Global Industry Classification Standard (GICS) code #40101015. We select these banks using the historical lists of Compustat GICS codes and match their stock price data from the Center for Research in Security Prices (CRSP) database using the standard CRSP-Compustat link. Our data on Treasury yields and equity factor returns come from the US Treasury and Ken French's website, respectively.[5]

We obtain data on bank deposits from the quarterly bank call reports available through the Federal Financial Institutions Examination Council (FFIEC, Forms 031 and 041). We link the bank to its bank holding company (BHC) using the FFIEC bank relationship map, and then link the BHC to CRSP using the CRSP-FRB link maintained by the Federal Reserve Bank of New York. We require that each BHC contain only one entity for which it has a direct relationship and that it have a 100% equity stake in that entity to cleanly link

[4] d'Avernas et al. (2023) and Begenau and Stafford (2022) document how the deposit business at small banks differs from that of large banks as customers of the latter value liquidity services more highly. We leave for future research the question of how the channel we document affects larger banks.

[5] Available online at `https://home.treasury.gov/policy-issues/financing-the-government/interest-rate-statistics` and `https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html`, respectively.

bank-level depositor composition data with BHC-level stock price data.[6]

We obtain our other balance sheet and income statement data from a combination of bank call reports and Compustat. Data about executive pay comes from ExecuComp, and data about boards of directors comes from Institutional Shareholder Services (ISS).

Our sample includes 179 regional banks. We require data on total assets, depositor composition, and market capitalization at the beginning of 2022, an observed return during the March 8–13, 2023 crash, and a 5-year monthly market beta from 2017-2021 estimated with a minimum of 48 months. We further screen out illiquid stocks where our price-based risk measures might be less reliable by requiring that a stock's average price exceed $5, that its Amihud (2002) illiquidity ratio (average daily absolute return/dollar volume) be less than 10% (per $1MM dollar volume), and that the stock trade at least 90% of days, over the course of 2021. These screens yield a single cross-section of banks for which we can assess pre-2022 and 2022-onward stock price risk cleanly.

Table 1 reports summary statistics. Our key variable of interest is the "uninsured deposit fraction," defined as the fraction of deposit dollars in accounts with balances over the deposit insurance limit of $250,000 from Schedule RC-O on the call reports. We focus on the gross total dollars in these accounts rather than the amount in excess of the insurance limit, although our main results are similar with either. On average, the uninsured deposit fraction was 55% as of the end of 2021, while the five year average from 2017-2021 was 48%.[7]

Regional banks are small: median total assets, deposits, and market capitalization at the end of 2021 equal $7, 6, and 1 billion, respectively. We obtain total assets and deposits from the call reports and market capitalization from CRSP as of calendar year-end. We apply

[6] We rely on the bank-level call reports instead of the consolidated BHC Form FR Y-9C call reports since only the former contain detailed information about depositor composition. The FFIEC bank relationship map is available online at `https://www.ffiec.gov/npw/FinancialReport/DataDownload`. The CRSP-FRB link is available online at `https://www.newyorkfed.org/research/banking_research/crsp-frb`. The CRSP-FRB link maps some bank-level call reports directly to CRSP firm identifiers, and it is not necessary to map the bank to a BHC in this case.

[7] Prior to 2008-Q4, the deposit limit was $100,000 for non-retirement deposit accounts and $250,000 for retirement accounts; prior to 2006-Q2 and going back to 1980, the limit was $100,000. For a brief history of changes in deposit insurance limits, see the announcements by the Federal Deposit Insurance Corporation at `https://archive.fdic.gov/view/fdic/4000` and `https://archive.fdic.gov/view/fdic/2789`.

our liquidity screens to mitigate biases that may occur due to small stock illiquidity (Ibbotson, Kaplan, and Peterson, 1997). After applying our screens, the median illiquidity ratio and percentage of days without trade are 0.5% and 0.8%. We discuss additional summary statistics in the course of documenting our facts below.

2 Six facts about the cross-section of regional banks

We document six stylized facts that build the case for an alternative view of the regional banking crisis centered on the fundamental role of uninsured depositors. The first fact focuses on the role of uninsured deposits in explaining bank drawdowns and risk after 2022, while the latter five facts focus on the role in explaining risk and other characteristics in the five years prior to 2022. We divide our analysis around the start of 2022 since it was the turning point for when interest rates began to increase sharply and risky investment opportunities in the broader market began to lose value, as Figure 2 depicts.

2.1 The facts

Fact 1. *Regional banks with greater uninsured deposits experienced worse returns and were riskier after the start of 2022 compared with other regional banks.*

We focus on stock price risk and calculate returns, return volatilities, market betas, and rate betas between 2022 and 2023:03 using daily returns, applying the Dimson (1979) method to account for possible asynchronous trading. Rate betas equal the estimated coefficient from a time series regression of a bank's stock returns on changes in the average Treasury yield in the term structure. Partial rate betas equal the estimated coefficient from a two-factor regression that also controls for the overall market return. The idea is that a firm's equity is immunized from interest rate risk if its equity value is insensitive to unexpected interest rate movements, although our measure ignores the expected component for simplicity.[8]

[8] We estimate rate betas through March 7, 2023 to capture the effect of the general upward trend in rates from 2022-onward on bank stock prices that we discuss in our model.

Regional banks performed poorly on average in this period. From Table 1, the average (1-standard deviation, or "sd" from now on) return in the 4-day window from March 8-13, 2023 equaled -16% (11%), and the broader return over the 2022-onward period equaled -20% (26%). Average (1-sd) realized return volatility, market beta, rate beta, and partial rate beta equaled 32% (12%), 0.6 (0.3), –2.7 (2.5), and 1.2 (2.0), respectively.

Figure 3 illustrates our first fact by plotting market betas and return volatilities against the uninsured deposit fraction at the start of 2022. Evidently, banks with greater uninsured deposits had greater realized betas and volatilities.

Table 2 investigates in more detail and reports ordinary least squares (OLS) estimates of the following specification:

$$y_{i,2022/23} = a + b_0\, UNINS_{i,2021} + b_1\, logAssets_{i,2021} + B \times liquidity_{i,2021} + u_i, \qquad (1)$$

where $y_{i,2022/23}$ are risk measures estimated from 2022-2023 and $UNINS_{i,2021}$ is the uninsured deposit fraction as of the start of 2022 (end of 2021), our principal variable of interest, and u_i is the bank-level error term. We include $logAssets_{i,2021}$, the natural logarithm of bank assets, because greater bank size is correlated with greater uninsured deposits (ρ=0.37). We include quintile indicators of Amihud (2002) illiquidity and the percentage of days without trade as a vector of controls in $liquidity_{i,2021}$ to mitigate any illiquidity biases left after excluding extremely illiquid stocks and using Dimson (1979) betas.

The estimates show that banks with greater uninsured deposits had greater realized risk. The economic magnitudes are large: from columns 1 and 2, a bank with an uninsured deposit fraction that was one-sd (14%) greater than another bank was associated with a 0.43-sd worse return (5% over 4 days) during the peak crisis period and 0.37-sd worse average daily return (9% annualized) over 2022:01-2023:03. Columns 3 and 4 show that same bank was also associated with a 0.27-sd greater return volatility and 0.21-sd greater market beta.

Columns 5 and 6 show that uninsured deposits have a negative relationship with unconditional rate betas but that the relationship with partial rate betas is largely attenuated. That is, banks with greater uninsured deposits have stock prices that have greater unconditional sensitivity to interest rate movements, but that relationship is due to the greater sensitivity of their stock prices to the overall stock market.

Fact 2. *Before 2022, regional banks with greater uninsured deposits were riskier than other regional banks.*

We calculate returns, return volatilities, market betas, and rate betas from 2017 through the end of 2021 using monthly raw returns from CRSP. Regional banks had an average annual return of 9% (1-sd: 7%) from Table 1. The average (1-sd) return volatility, market beta, rate beta, and partial rate beta equaled 29% (6%), 1.0 (0.4), and 26.0 (7.5), and 16.1 (5.4), respectively.

Figure 4 illustrates our second fact that uninsured deposits and risk are correlated in the five-year period leading up to 2022, analogous to the 2022-onward period. The figure plots five-year market betas and volatilities against the five-year average uninsured deposit fraction over 2017-21. As in Figure 3, banks with greater uninsured deposits had greater betas and volatilities.

Table 3 reports OLS estimates of the following specification that relates 5-year average uninsured deposits and risk contemporaneously during the pre-2022 period:

$$y_{i,2017/21} = a + b_0\, UNINS_{i,2017/21} + b_1\, logAssets_{i,2017/21} + B \times liquidity_{i,2017/21} + u_i. \quad (2)$$

We define variables analogously to those in Equation 1, with the exception that all variables represent averages or sensitivities calculated over the five-year period.

The association between uninsured deposits and risk is positive and economically large. Column 1 shows that a bank with a 5-year average uninsured deposit fraction that was 1-sd greater than another bank was associated with a 0.17-sd greater average daily stock return (1% annualized) during the 2017-2021 stock price boom, although the slope estimate is not statistically reliably different from zero. Columns 2 and 3 show that the same bank would have been associated with a 0.22-sd greater return volatility and 0.29-sd greater market beta.

Columns 4 and 5 show that same bank would have a 0.19-sd greater unconditional rate beta but largely the same partial rate beta. As with Fact 1, the relationship of uninsured deposits with a bank's market beta largely subsumes its relationship with interest rates.

Fact 3. *Before 2022, regional banks with greater uninsured deposits had similar balance sheet exposure to securities but greater exposure to commercial loans and deposits compared to other regional banks.*

We calculate a bank's securities exposure as the value of securities divided by assets, where securities include Treasuries, mortgage-backed securities (MBS), asset-backed securities, and other debt securities in hold-to-maturity (HTM) and available-for-sale (AFS) portfolios. We study both the value carried on the main balance sheet (HTM amortized cost plus AFS fair value) and the total fair value (HTM plus AFS fair values). Using either metric, securities comprise about 16-17% of the balance sheet on average.

We also study total loan exposure and commercial and industrial (C&I) loan exposure, which equal the total amount of these loans divided by total assets. Loans comprise 70% of the average bank's assets, while C&I loans comprise 13% (19% of the bank's loan portfolio). We also study a proxy for commercial deposits, equal to the fraction of individual, partnership, and corporate (IPC) deposits held for non-personal purposes. We calculate five-year 2017-2021 averages for all variables with a minimum of three years of data.

We first illustrate Fact 3 in Figure 5 before diving into regressions. The figure plots the average annual exposure to securities and C&I loans for different quintiles of firms sorted by their contemporaneous fraction of uninsured deposits at the end of each year. Panel A shows that high- and low-uninsured deposit banks have similar securities exposure in the cross-section with an upward time trend for all groups. In contrast, panel B shows that high-uninsured deposit banks consistently have greater C&I loan exposure than low-uninsured deposit banks. The line for the highest-uninsured deposit banks lies above that for the lowest every year, and the ratio of exposures is 1.5x on average.

Table 4 reports OLS estimates of the following specification that relates 5-year averages of uninsured deposits to the contemporaneous averages of these variables before 2022:

$$y_{i,2017/21} = a + b_0 \, UNINS_{i,2017/21} + b_1 \, logAssets_{i,2017/21} + u_i. \tag{3}$$

Panel A, columns 1-3 suggest that banks across the spectrum of uninsured deposits have similar securities and loan exposures, consistent with Figure 5, as point estimates are not statistically distinguishable from zero or economically significant. Columns 4-6 show that, in contrast, banks differ in their C&I loan exposures, as a bank with 1-sd greater uninsured deposits tends to have 0.22-sd greater C&I loan and 0.50-sd greater commercial deposit exposures.

Panel B shows that a high-uninsured deposit bank has a lower maturity gap between assets and liabilities than a low-uninsured deposit bank, primarily due to lower maturity loans. We follow English, Van den Heuvel, and Zakrajšek (2018) and calculate the weighted average maturity of assets (securities and loans) and liabilities (time, brokered, and demand deposits, the last of which we assume a contractual maturity of zero). Columns 1-2 suggest that it holds somewhat longer-term securities, particularly Treasuries; column 3 suggests that it also holds loans with significantly lower maturity. Since high- and low-uninsured deposit banks have similar loan exposures that are much larger than their securities exposures, the net result in column 4 is that the high-uninsured deposit bank has a lower overall asset maturity. Column 5 shows that it also has a lower liability maturity. Despite this, column 6 shows that a bank with 1-sd greater uninsured deposits has a 0.20-sd lower overall maturity gap (assets minus liabilities). Column 7 suggests that it is also less likely to use interest rate swaps, although the effect is statistically indistinguishable from zero.[9]

[9] As English, Van den Heuvel, and Zakrajšek (2018) discuss, their method does not account for embedded options in instruments such as residential mortgages, does not account for the relative dollar value of assets versus liabilities, does not cover all assets and liabilities, focuses on maturity rather than duration, and does not include hedges. Following their method, we use the midpoint of each maturity for each bin reported in the call reports with a maturity of 20 (5) years when the bin indicates securities with maturity or next repricing over 15 (3) years away. For example, for RMBS securities with maturity or next repricing date of over 5 years through 15 years, we assume a maturity of 10 years. When calculating the weights for each bin, we use only the total value of assets and liabilities with maturity breakdowns in the denominator. On average, assets with maturity breakdowns cover 87% of total assets for banks in our sample, and liabilities with maturity breakdowns (counting demand deposits as zero maturity) cover 92% of total liabilities. Our

Fact 4. *Before 2022, regional banks with greater uninsured deposits were more profitable, more valuable, and experienced greater deposit growth than other regional banks.*

We calculate return on equity (assets) as pretax income scaled by stockholder equity (assets). We abstract from taxes to focus on bank operating profits. Market equity / book equity equals market capitalization divided by total stockholder equity. The market value of assets equals book assets less book equity plus market capitalization, while book assets equals total assets. We calculate these values at the BHC level from Compustat using the last fiscal year value reported each calendar year. We calculate deposit growth as the change in the log deposit base reported from the bank's balance sheet. We winsorize these variables at 1% and 99% levels annually before calculating five-year averages.

Average (1-sd) regional bank pretax return on equity before 2022 equaled 14% (4%), with a return on assets of 1.6% (0.4%), from Table 1. Average (1-sd) equity and asset valuation ratios equaled 1.3 (0.4) and 1.0 (0.04), respectively. Average deposit growth was approximately 4% (2%) per annum.

Table 5 reports OLS estimates of the following specification that relates 5-year averages of uninsured deposits to the contemporaneous averages of these variables before 2022:

$$y_{i,2017/21} = a + b_0\, UNINS_{i,2017/21} + b_1\, logAssets_{i,2017/21} + u_i. \qquad (4)$$

The estimates suggest that a bank with 1-sd greater uninsured deposits is associated with a 0.27- and 0.21-sd greater return on equity and assets, respectively. It is also associated with 0.21- and 0.16-sd greater equity and asset valuation ratios. Banks with 1-sd greater uninsured deposits also experienced 0.22-sd greater annual deposit growth.

Fact 5. *There is little evidence that banks with greater uninsured deposits reported riskier capital ratios and leverage before 2022 than other regional banks.*

We relate the uninsured deposit fraction to regulatory capital ratios, which we obtain

inferences are unchanged if we use the total balance sheet value of assets and liabilities in the denominator when calculating weights.

directly from Schedule RC-R on the call reports, "Regulatory Capital." Each bank reports its common equity Tier 1 (CET1), Tier 1, and total capital ratios (all divided by risk-weighted assets) alongside the regulatory leverage ratio (which ignores risk weights). From Table 1, average regulatory capital ratios were 13-14%, indicating healthy capitalization levels.

Regulatory capital ratios showed little correlation with our risk measures. Table 6 reports the OLS estimates of Equation 4 but where the dependent variables are these regulatory capital ratios. Point estimates do suggest that greater uninsured depositors are associated with slightly lower capital ratios—greater risk—although the estimates are not statistically distinguishable from zero. In terms of economic significance, a bank with 1-sd greater uninsured deposit fraction was associated with 0.05-0.10-sd (0.2-0.3%) lower capital ratios and little movement in the leverage ratio.

Fact 6. *Banks with greater uninsured deposits had similar or greater pay and incentives, without strong evidence of weaker boards, compared with other regional banks before 2022. Moreever, pay was related to risk.*

We investigate whether uninsured deposits are linked to pay and incentives, and whether these latter variables help explain risk-taking. Total top-5 executive compensation equals the average total direct compensation (TDC1 in Execucomp) to the top-5 most highly paid executives listed in the company's proxy statement plus the CEO (if not already included). Executive ownership includes the sum of all share ownership by executives including delta-weighted options divided by shares outstanding, where we calculate option deltas in a manner similar to Coles, Daniel, and Naveen (2013) from the Execucomp outstanding awards tables. We calculate the percentage of board members that ISS classifies as independent well as the average share ownership of independent directors.

Table 7 panel A reports estimates of Equation 4 but where the dependent variables are average pay and ownership of top-5 executives, the fraction of the board that is independent, and the average ownership of independent directors. Including $logAssets_{i,2017/21}$ in Equation 4 is particularly important in these regressions given the well-known relationships between pay, incentives, and size (Baker and Hall, 2004). Our sample relating uninsured deposits, pay, and risk-taking contains only 73 banks because several banks do not fall within the S&P 1500 coverage of Execucomp. We therefore concentrate on point estimates and remain cautious about statistical significance.

The estimates suggest that banks with greater uninsured deposits had similar or greater pay and incentives. A bank with 1-sd greater uninsured deposits is associated with 0.08-sd greater pay and 0.33-sd greater insider ownership, the latter statistically significant at the 5% level. Boards of banks with greater uninsured deposits are slightly less independent, but its independent directors have slightly greater share ownership.

Panel B reports estimates from a specification that relates risk to pay:

$$y_{i,2017/21} = a + b_0\, Top5Pay_{i,2017/21} + b_1\, logAssets_{i,2017/21} + u_i. \tag{5}$$

The estimates show that, even in the limited sub-sample, executive pay is correlated with risk. A bank with 1-sd greater pay (residual from size) was associated with 0.44-sd greater return volatility, 0.32-sd greater beta, and 0.43-sd greater rate beta. Panel C reports that insider ownership also tends to be positively correlated with risk.

2.2 Summary and discussion

Fact 1 emphasizes the importance of uninsured depositors in explaining which banks ran into trouble from 2022 onward. This evidence is consistent with Egan, Hortaçsu, and Matvos (2017), Haddad, Hartman-Glaser, and Muir (2023), Iyer and Puri (2012), Iyer, Puri, and Ryan (2016), Jiang et al. (2023b), and Martin, Puri, and Ufier (2023) who emphasize the role of uninsured deposits in bank runs such as the one we saw starting March 8, 2023, even uninsured deposits are often bailed out (Pancost and Robatto, 2023). The evidence will also be consistent with our model where declining risky opportunities coupled with rising interest rates drive deposit outflows and trouble at high-uninsured deposit banks.

Fact 2 shows that there was also a strong relationship between uninsured deposits and risk in the five years before 2022. Banks with greater uninsured deposits were associated with significantly greater equity risk. The positive average rate beta suggests that increases in interest rates were typically associated with bank stock price increases. This finding is consistent with a correlation between rate increases and good economic news and banks earning high spreads over deposit rates (Drechsler, Savov, and Schnabl, 2017, 2021; Hutchison and Pennacchi, 1996). Interestingly, stock prices of banks with greater uninsured deposits were more sensitive to interest rates, but this association is not present if one accounts for stock price sensitivity to the overall market.

Fact 3 shows that the risk represented by uninsured deposits is less related to greater exposure to securities or duration and more related to commercial loans and deposits. Thus, the default narrative of regional banks being risky because they hold large, long-duration securities portfolios financed by uninsured deposits may have described SVB in 2022-23 but does not describe the overall cross-section of regional banks before 2022. Instead, uninsured deposits exist largely for commercial purposes and finance C&I loans to some extent, consistent with Pancost and Robatto (2023), which shows that firms hold most uninsured deposits. Our result on interest rate swaps is consistent with Jiang et al. (2023a), who find mixed evidence on interest rate swap usage among banks with greater uninsured deposits.

Fact 4 shows that banks with greater uninsured deposits also tended to be more profitable, more valuable (despite their greater risk), and attracted more deposits than other banks during this prior period. The fact suggests that greater uninsured deposits and their risks connect to valuable underlying business strategies. It also supports the anecdotes of banks like SVB and First Republic pursuing risky strategies to generate more profits and attract deposits. Additionally, greater bank profits during good times, particularly greater ROE, indicate greater underlying bank risk (Meiselman, Nagel, and Purnanandam, 2020).

Fact 5 suggests that greater uninsured deposits capture a dimension of risk not captured by balance sheet capital ratios and leverage. It is consistent with the literature that suggests these measures may be only weakly informative of bank risk potentially due to manipulation (Begley, Purnanandam, and Zheng, 2017). More broadly, Fact 4 is consistent with risk-weighted assets and regulatory capital measures not capturing key dimensions of bank risk.

Fact 6 further supports the idea that risk-taking was part of a business strategy since risk-taking strategies at financial firms require high executive pay and strong incentives to execute in equilibrium (Cheng, Hong, and Scheinkman, 2015). Others, including the Fed, have suggested that uninsured deposits and bank failures were due to mismanagement or governance failures (Barr, 2023; Warmbrodt, 2023). While not ruling out aspects of mismanagement—SVB notoriously did not have a chief risk officer for several months leading up to the crisis (Johnson, Rosenblatt, and Dolmetsch, 2023)—the evidence rules in the possibility that banks with uninsured deposits compensated their executives for taking risks.

3 A fundamentals-based model of uninsured deposits

Motivated by these six facts, we propose a fundamentals-based model of regional banks that delivers three key insights. First, bank risk-taking, uninsured deposits, and profitability are positively correlated in equilibrium because banks specialized in financing risky projects compete to attract large deposit accounts and establish lending relationships. Second, rising interest rates and declining risky opportunities lead to outflows from high-uninsured deposit banks. Third, this mechanism is quantitatively relevant for the reallocation of depositors we saw after 2022.

Our model intentionally does not feature runs or contagion, forces that other papers have studied extensively. Contagions and runs likely amplify the fundamental forces we highlight but lie outside of our model.

3.1 Setup

There are three types of agents: a unit measure of uninsured depositors, a unit measure of banks, and a large measure of insured depositors. We model uninsured depositors as agents who are potential entrepreneurs and have large deposit amounts d_u, where d_u exceeds the deposit insurance limit and can be interpreted as the working capital needed for a potential project. We assume that the investment opportunity arrives at the i.i.d. rate of λ per dollar, so that each uninsured investor has an investment opportunity with probability λd_u. Each project requires an investment of I along with an exogenous amount of d_u working capital, where $d_u < I$. Uninsured depositors cannot finance a project themselves and need to obtain financing from a bank.

Banks differ in two dimensions (D, b): their total dollar deposit-taking capacity D and their ability to screen risky projects b, which we describe in detail below. We think of b as representing the bank's specialization in understanding risky projects. For simplicity, we assume that banks are funded only by deposits. Thus, D also represents a bank's total assets. Let $g(D, b)$ represent the density function of different banks. The purpose of D is to provide independent variation of bank size from depositor composition in the model.

Insured depositors have small deposits d_0 below the deposit insurance limit and do not have investment opportunities.[10] They receive an exogenous deposit rate $\rho_o = \nu_l r_f$ where $\nu_l \leq 1$ and r_f is the risk-free rate and are not strategic. The parameter ν_l represents a discount that the insured depositors are willing to take, which we take as given. As explained in Drechsler, Savov, and Schnabl (2017) the value of v_l generally depends on the banks' market-share or households' level of financial sophistication, which can be measured by the deposit beta. In the special case where $\lambda = 0$, uninsured and insured depositors only differ in their deposit size. In this case, uninsured depositors do not generate additional value, as banks can substitute them with more insured depositors instead.

We envision banks and uninsured depositors forming ex-ante relationships which are valuable as they generate information about risky loans. Formally, our model can be understood as three stages. In period 0, banks post deposit and loan rates, and uninsured depositors choose a bank. In period 1, uninsured depositors find out if they have a project, and the bank receives a signal about the project and decides whether to invest if and only if they have an existing relationship.[11] In period 2, the project cash flows and payments realize. We

[10]This is consistent with our assumption that agents need to have significant working capital to implement a project.

[11]Note that ex-ante relationships can be interpreted as long-term relationships between banks and uninsured depositors where different draws of loan demand and information at the interim stage represent different realizations within the relationship.

develop the model in reverse chronological order starting from period 1.

Information structure and loan decisions at period 1. At the beginning of period 1, each uninsured depositor receives a risky investment project with i.i.d. probability λd_u. The project has a binary payoff that realizes in period 2 and depends on a latent state variable s (unknown to all agents). The variable s is distributed according to a cumulative density function F and is i.i.d. across projects. Conditional on s, the project's payoff equals $(1+\sigma)I$ if $s \geq z$ and $(1-\sigma)I$ if $s < z$ for some exogenous threshold z. Thus, ex ante, the project succeeds with unconditional probability $1 - F(z)$ and fails with probability $F(z)$.

Bank (b, D) receives a noisy signal x about success for projects where uninsured depositors have deposited their working capital d_u with the bank. The signal is $x = 0$ if and only if the project will fail, while $x = 1$ indicates success but with false positives. Banks with greater $b \in [b_L, b_H] \subset [0, 1]$ receive fewer false positives. Specifically, $x(s, b) = \mathbb{1}\{s \geq bz\}$, so that there are false positives of $x = 1$ if $bz \leq s < z$. Thus, the parameter b captures the informativeness of the signal: a greater b means a more informative signal and lower probability of a false positive, where $b = 1$ ($b = 0$) represents the special case of perfect (no) information.

Let $\alpha(b)$ denote a project's total expected return relative to banks' outside option (r_B) conditional on getting good news ($x = 1$):

$$\alpha(b) \equiv \left(\frac{1-F(z)}{1-F(bz)}(1+\sigma) + \left(1 - \frac{1-F(z)}{1-F(bz)}\right)(1-\sigma)\right) - (1+r_B),$$

which increases with b as a higher b is more informative.

We impose the following parameter assumptions. First, the project has a negative NPV relative to banks' outside option without any information, which is equivalent to saying that the return is negative when the signal has no information ($b = 0$): $\alpha(0) < 0$. Second, the information generated within the relationship is precise enough to generate investment under good news: $\alpha(b) > 0$ for all banks in support of the distribution of banks. In other words, information is the value of the relationship. Note that for simplicity, we assume that the bank receives the signal only if the depositor deposits the full working capital amount d_u. This assumption can be relaxed by assuming that the informativeness of a bank's signal is proportional to the amount of the working capital deposited.[12]

Assumption 1 (NPV)**.** *The project is negative NPV without information and positive NPV conditional on* $x = 1$*:* $\alpha(0) < 0$ *and* $\alpha(b) > 0$ $\forall b \in [b_L, b_H]$.

By construction, the bank will not invest when it receives a negative signal ($x = 0$) as it learns that the project will fail. Hence, given a project, the probability of investment for bank b is the probability that bank b receives a positive signal, $1 - F(bz)$. All else equal, a greater b bank is more selective: it invests with a lower unconditional probability but earns a higher return conditional on investment as it makes fewer mistakes.

How much a bank invests in risky loans in total depends on the measure of uninsured depositors matched to the bank, which will be determined in equilibrium. Given the measure of uninsured depositors, denoted by μ, the fraction of dollars invested in risky projects for a bank with capacity D equals:

$$\chi(b, D, \mu) \equiv \frac{\lambda d_u I \mu \left(1 - F(bz)\right)}{D}. \tag{6}$$

We further assume that making risky loans is costly for banks (e.g., through its cost of capital and internal risk management capability). Specifically, we assume that the cost of making risky loan is given by $Dr_f\xi(\chi)$, where $\xi(0) = 0, \xi'(0) = 0$, $\xi'(\chi) > 0$ $\forall \chi > 0$, and $\xi''(\chi) > 0$. That is, conditional on the fraction of dollars invested in risky project χ, the cost is proportional to the capacity D. We interpret this risk-taking cost as related to the cost of capital in the market, so that it also proportional to the risk-free rate. The cost is zero if the bank takes on zero risky projects (i.e., $\xi(0) = 0$).

[12] That is, suppose that an entrepreneur deposits $\frac{d_u}{n}$ across n banks. Then the precision of bank b's signal is $\frac{b}{n}$, and an entrepreneur can potentially receive a loan size of $\frac{1}{n}$ from each bank. One can show that it is always (weakly) optimal to have one very precise bank instead of n moderately informed banks.

Ex-ante Relationships We now turn to the decision of forming relationships between banks and uninsured depositors. A bank offers loan rate R and deposit rate ρ_u. An entrepreneur chooses a bank to deposit their working capital accordingly, understanding that this relationship would improve her chance of getting a loan if an investment opportunity arrives. On the other hand, while attracting uninsured depositors is valuable to a bank, it takes into account the cost of making risky loans. The allocation of uninsured depositors across banks is thus determined by the benefit versus cost of making risky loans.

Expected payoffs of uninsured depositors. Given any (R, ρ_u) offered by a bank (b, D), the expected payoff of an entrepreneur equals:

$$W(R, \rho_u, b) = \lambda d_u I(1 - F(bz)) \left(\frac{1 - F(z)}{1 - F(bz)} (\sigma - R) \right) + (1 + \rho_u)\, d_u. \tag{7}$$

The first term represents her expected value of the project. She receives a loan for a project with probability $\lambda d_u(1 - F(bz))$, the project is successful with probability $\frac{1-F(z)}{1-F(bz)}$ conditional on investment, and she receives net payoff $(\sigma - R)$ conditional on success. The second term represents the interest earned on her deposited working capital.

Expected payoffs of banks. The expected payoff of bank (b, D) conditional on having μ entrepreneurs equals:

$$\begin{aligned} V(b, D, \mu | R, \rho_u) =& D\,(1 - \chi(b, D, \mu))\,(1 + r_B) \\ &+ \chi(b, D, \mu) \left\{ \left(\frac{1 - F(z)}{1 - F(bz)} (1 + R) + \left(1 - \frac{1 - F(z)}{1 - F(bz)} \right) (1 - \sigma) \right) \right\} - D r_f \xi(\chi(b, D, \mu)) \\ &- (1 + \rho_u) d_u \mu - (1 + \rho_o)(D - d_u \mu). \end{aligned} \tag{8}$$

The first line represents the return on deposit money the bank invests in its outside option. The second line represents the expected return of the banks' loans on the risky projects net of the cost of holding risk. Specifically, for each dollar invested into risky projects, a bank will receive $1 + R$ for each project that succeeds and $1 - \sigma$ for each project that fails. The final line represents payments to μd_u uninsured depositors (each paid deposit rate ρ_u) and $D - \mu d_u$ insured depositors (each paid exogenous deposit rate ρ_o). If the bank does not attract any uninsured depositors and $\mu = 0$, then it earns the net spread of the return of the outside option over the insured deposit rate, $V(D, b, 0) = D(\nu_h - \nu_l)r_f$.

Equilibrium. We solve for a competitive equilibrium. The endogenous equilibrium quantities are an allocation function $\mu^*(b, D)$ that determines the quantity of uninsured deposits at each bank, loan rates $R(b, D)$, and deposit rates $\rho_u(b, D)$ offered by each bank. Entrepreneurs choose banks optimally, and banks choose investments, loan rates, and deposit rates optimally. Market-clearing for deposits demands $\int \mu^*(b, D)\, g(b, D)\, db\, dD = 1$. For simplicity, we focus on the parameter space that generates interior solutions with $\mu(b, D)d_u/D < 1$ so that no bank has only uninsured deposits.

3.2 Characterization

We sketch the intuitions that characterize the unique equilibrium and provide the formal solution in the Appendix. Since entrepreneurs are identical ex ante, they must earn the same expected payoff in equilibrium W^*. Banks compete and adjust loan/deposit rates until the marginal benefit of attracting one more entrepreneur equals the marginal cost. Equivalently, banks effectively choose how many uninsured depositors to attract given W^*.

Let $s(b, D) \equiv \frac{\mu(b,D)d_u}{D}$ denote the fraction of uninsured dollars for a bank. From Equation 8, we can write banks' profits relative to assets as a function of the fraction of uninsured deposit dollars. This yields:

$$v(b) \equiv \frac{V(b, D)}{D} = \max_s \left(v_h - v_l\right) r_f + \hat{\chi}(b, s)\alpha(b) - r_f \xi(\hat{\chi}(b, s)) - s\left(\frac{W^* - (1 + \rho_0)d_u}{d_u}\right), \quad (9)$$

where $\hat{\chi}(b, s) \equiv \lambda I(1 - F(bz))s$ re-writes the risky loan fraction $\chi(b, D, \mu)$ as a function of bank b's uninsured dollar fraction s. The first term represents the spread earned from standard loans. The second term represents the excess return earned from the project loans brought by uninsured depositors. The third term is the cost of handling project loans. The last term represents the payoff required by the uninsured depositors relative to the insured depositors.

One can see that the optimal fraction of uninsured dollars s for the bank is independent of capacity D, as the right hand side of Equation 9 is a function of b but not D. That is, if two banks have the same b, the uninsured depositor fraction and thus the risky loan fraction ($\hat{\chi}$) must be the same. This also implies that the bank with a larger capacity will attract more uninsured deposits: $\mu^*(b,D) = D\mu^*(b,1)$ so that $s(b,D') = s(b,D)\,\forall(D,b)$. Thus, we now proceed by directly characterizing $s^*(b) \equiv \frac{\mu(b,D)d_u}{D}$.

Allocation of uninsured depositors. In equilibrium, $s^*(b)$ must satisfy the following first order condition for all b:

$$\lambda I(1-F(bz))\left(\alpha(b) - r_f\xi'(\hat{\chi}(b,s))\right) - \left\{\frac{W^* - (1+\rho_0)d_u}{d_u}\right\} = 0. \tag{10}$$

The first term represents the marginal change in the bank's utility from adding an uninsured depositor through an additional potential investment opportunity, which equals the excess return of a risky project $\alpha(b)$ net of the marginal cost of risk times the probability of investing $\lambda(1-F(bz))$. The second term represents the effective price that the bank must pay per uninsured depositor relative to insured depositors.

Proposition 1 (Equilibrium)**.** *The equilibrium $\{W^*, s^*(b)\}$ exists, is unique, and is efficient, where $s^*(b)$ must satisfy the following ODE:*

$$\frac{ds^*(b)}{db} = \frac{-F'(bz)z}{(1-F(bz))^2}\left\{\left(\frac{\sigma + r_B}{r_f}\right)\frac{1}{\xi''(\hat{\chi}(b,s^*(b))} + \frac{1}{\lambda I}\left(\frac{\xi'(\hat{\chi}(b,s^*(b))}{\xi''(\hat{\chi}(b,s^*(b))} + \hat{\chi}(b,s^*(b))\right)\right\}, \tag{11}$$

where the initial condition is given by market clearing $\int s^*(b)D\,g(b,D)\,db\,dD = d_u$. The equilibrium playoff of uninsured depositors W^* is given by Equation 10.

Equation 11 follows from differentiating Equation 10 with respect to b. Note that Equation 10 implies that the equilibrium is also efficient, as each bank takes on enough uninsured depositors so that the marginal value of each depositor equals its marginal cost.

Loan and deposit rates. Given the allocation $s^*(b)$, Equation 11 pins down the payoff of uninsured depositors. Two observations are in order.

First, observe from Equation 7, the expected payoff of uninsured depositors W^* is independent of b conditional on the loan and deposit rate (R, ρ_u). This is because they gain only when the project succeeds, which happens with probability $1 - F(z)$ independent of b, and banks bear the cost of failed projects. Hence, we look for (R, ρ_u) that is independent of b.

Second, the equilibrium pins down the payoff of uninsured depositors up to W, where:

$$\frac{W^* - (1+\rho_o)d_u}{d_u} = \lambda I \left(1 - F(z)\right)(\sigma - R) + (\rho_u - \rho_0).$$

That is, there are generally different ways to compensate uninsured depositors with different combinations of loan rates R and deposit rates ρ_u. As such, we further impose that (R, ρ_u) is characterized by $\eta \in (0, 1)$ such that:

$$\lambda I \left(1 - F(z)\right)(\sigma - R) = \eta \left(\frac{W^* - (1+\rho_o)d_u}{d_u}\right), \tag{12}$$

and:

$$(\rho_u - \rho_0)\, d_u = (1 - \eta) \left(\frac{W^* - (1+\rho_o)d_u}{d_u}\right). \tag{13}$$

A higher η means that uninsured depositors are compensated by lower loan rates instead of greater deposit rates in equilibrium. From Equation 12, $\eta > 0$ guarantees that uninsured depositors are rewarded if the project succeeds. From Equation 13, $\eta < 1$ guarantees that it is optimal for uninsured depositors not to divide their deposits into different banks even if they do not have an investment project at period 1.

3.3 Predictions

3.3.1 Cross-sectional implications: uninsured deposits, bank risk, and profits

Equation 11 implies that higher-b banks have more uninsured depositors relative to their deposit size and have higher exposure to risky loans, denoted by $\chi^*(b) \equiv \lambda I(1 - F(bz))s^*(b)$.

Moreover, since our model predicts that these banks take more risks because they have higher screening ability, such risk-taking in fact leads to higher profits. This is true despite that these banks are paying the higher cost of taking risks (as the cost is convex in χ).

Proposition 2 (Correlation of uninsured deposits, bank risk, and profits)**.** *In equilibrium, a bank with higher screening ability b has a higher uninsured deposit fraction $s^*(b)$, risky loan fraction $\chi^*(b)$, and profits relative to size $\frac{V(b,D)}{D}$, than a bank with lower screening ability.*

Proposition 2 provides a fundamentals-based rationale for why high-uninsured deposits banks are riskier but also more profitable. Recall that higher-b banks are more selective about projects, which means that, conditional on the fraction of uninsured deposits, they should invest fewer risky loans. Our result shows that, in equilibrium, these banks will attract much more uninsured deposits so that they end up taking more risks than lower-b banks. That is, $s^*(b)$ must increase quickly enough with b so that the risky loan fraction $\chi^*(b)$ also increases with b.

3.3.2 (Re)allocation of uninsured deposits and its effects on profits

We now use comparatives statics to establish that the allocation of uninsured depositors crucially depends on the return on the risky project relative to the interest rates, denoted by $\theta \equiv \frac{\sigma}{r_f}$. One can interpret θ as the fundamental value of uninsured deposits.

Any change in θ will trigger reallocation of uninsured deposits across banks, which further has differential effect on banks' value. Recall that $V(b, D)$ represents the end-of-period profits for bank (b, D). To better map to our empirical result, we thus look at the present value of bank b's profits scaled by its size. Specifically, if we hypothetically repeat our static model over time, each bank receives the same cash flow $V(b, D)$ each period, and thus the present value of bank b relative to their size equals $v^*(b) \equiv \frac{V(b,D)}{r_f D}$ assuming a constant interest rate r_f.[13] One can show that both allocation $s^*(b)$ and $v^*(b)$ depend on interest rate r_f only through the value of θ.

[13]One can show that $V(b, D)$ scales with r_f holding θ fixed. Thus, analyzing $v^*(b)$ also takes out this scaling effect of interest rates.

Proposition 3 (Reallocation of uninsured deposit and profits)**.** *There exists* $\hat{b} \in (b_L, b_H)$ *such that a lower* θ *leads to lower (higher) uninsured deposits* $s^*(b)$ *and present value of profits* $v^*(b)$ *for bank* $b > \hat{b}$ $(b < \hat{b})$*.*

In other words, when θ decreases, high- (low-) b banks experience outflows (inflow) of uninsured deposits and declines in value and profitability. Intuitively, the expertise of high-b banks becomes less valuable, and they are less willing to make risky loans. Thus, a decrease in θ predicts that the allocation of uninsured deposits and profits become more similar across banks. Note that since the equilibrium is efficient, one can also understand the result from the viewpoint of a planner: since the cost of holding risk is convex in the risky loan fraction χ, it is optimal to make uninsured depositors more evenly distributed across banks when the value of expertise declines.

Our result highlights that what matters for depositor allocation and valuation is the ratio θ. In the special case that project return always moves proportionally to the interest rate (i.e., $\sigma = \rho r_f$), a change in the interest rate will not affect the fundamental value of uninsured deposits, and, by implication, the distribution of depositors and profits across banks. On the other hand, when $\theta'(r_f) < 0$ $(\theta'(r_f) > 0)$, the return of risky loan σ decreases (increases) when interest rates increase, which then predicts an outflow (inflow) for high-b banks.

3.3.3 Relationship to evidence

Propositions 2 and 3 provide an equilibrium explanation for the facts in Section 2. Specifically, before 2022, high-uninsured deposit banks were riskier, had greater exposure to commercial loans, and were more profitable and valuable. One can interpret this as a high or rising-θ regime when interest rates were low and the economy, specifically the technology sector, boomed. After 2022, high-uninsured deposit banks lost value, consistent with a low or falling-θ regime where interest rates were rising, and the economy and technology sector were slowing. The model predicts that such a decline led to outflows of uninsured depositors and portended trouble at high-uninsured deposit banks.[14]

3.4 Quantitative analysis

Since Proposition 2 shows that $s^*(b)$ increases with b, we can rank banks based on the fraction of their uninsured dollars s. Let $i \in [0,1]$ represent such a rank, with $i = 1$ representing the bank with the greatest uninsured dollar fraction and $i = 0$ representing the bank with the lowest. Let $b[i]$ and $s[i] \equiv s^*(b[i])$ represent the associated screening ability and fraction of uninsured dollars of a bank at rank i.

Functional forms. Before proceeding further, we describe the distributional and functional form assumptions we make to map the model to the data.

We first make a distributional assumption that will help pin down the underlying distribution of banks. Define $\kappa[i] \equiv \lambda I(1 - F(b[i]z))$ as the probability of investing in a project for bank $b[i]$. Observe from Equation 8 that $\kappa[i]$ is the key payoff-relevant quantity. We assume that $\kappa[i]$ follows a uniform distribution between $[\kappa_H - \Delta, \kappa_H]$, where κ_H and $\Delta > 0$ are thus the parameters that control the distribution of banks.

We assume the cost of holding risk follows the functional form, $\xi(\chi) = \frac{\delta}{2}\chi^2$, and we look to calibrate the parameter δ, which represents the scale parameter for the cost of risk.

Given these assumptions, Equation 11 simplifies to:

$$\frac{ds[i]}{di} = \frac{\Delta}{(\kappa[i])^2} \left\{ \frac{\left(\frac{\sigma}{r_f} + v_h\right)}{\delta} + 2\kappa[i]s[i] \right\}. \tag{14}$$

Recall that the initial condition is such that $\int s[i]di = \bar{S}$. Hence, the value of $\frac{\left(\frac{\sigma}{r_f}+v_h\right)}{\delta}$ uniquely pins down the allocation $s[i]$. Intuitively, the higher $\left(\frac{\sigma}{r_f} + v_h\right)$ increases the disper-

[14] The model also can rationalize why high-uninsured deposit banks had lower maturity gaps before 2022, building on insights from Drechsler et al. (2023). Drechsler et al. (2023) discuss how banks can optimally use asset duration to hedge against the interest rate that affects their franchise value. They show that high-deposit beta banks have a deposit franchise value that is less sensitive to rates and thus should invest in shorter-duration assets. While our model does not explicitly analyze this hedging behavior, one can show that banks with more uninsured deposits will invest in shorter-duration assets due to a similar effect.

sion of s as it means the screening ability is more valuable. On the other hand, a higher cost of holding risks (δ) implies a lower dispersion of s.

The equilibrium profits for bank i (under the optimal choice of $s[i]$) further simplifies to:

$$v[i] = r_f \left\{ (v_h - v_l) + \delta \left(\frac{1}{2} \right) [\chi[i]]^2 \right\}, \tag{15}$$

where $\chi[i] = \kappa[i]s[i]$. The first term represents the spread earned by the standard loan return minus the deposit discount, while the second term represents the net benefit of making risky loans, which increases in the ranking i.

Calibration. We next describe how we calibrate the model. The parameters are reported in Table 8. According to Equation 6, we can directly estimate the distribution of $\kappa[i]$ by looking at the ratio of the fraction of risky loan for bank i over its fraction of uninsured deposits s. Let $\chi[i]$ denote the fraction of risky loan for bank i, which we measure using the fraction of C&I loans. Under the uniform distribution, we have

$$\frac{\chi[i]}{s[i]} = \kappa[i] = \kappa_H - \Delta i.$$

Recall that our model predicts that $\kappa[i]$ is decreasing in i, since a bank with a higher ranking is more selective. Figure 6 shows $\frac{\chi[i]}{s[i]}$ indeed decreases with the ranking, consistent with the model. That is, the fraction of risky loans for banks decreases slower than the fraction of risky loans for banks i. The estimated slope is $\Delta \approx 0.1$. Given the average value of $\frac{\chi[i]}{s[i]}$ of 0.28, we can then pin down the value of $\kappa_H \approx 0.33$.

We set $\bar{S}$ to the observed mean of s in the data between 2017-2022, which is 0.48. The value of v_l represents the exogenous deposit date discount relative to the risk-free rate for insured deposits. Since uninsured deposits can earn at least the same deposit rate as insured deposits, this value affects the deposit rates of all types. We set it to $v_l = 0.345$, which is the average deposit rate beta estimated by Drechsler et al (2021).

We then calibrate the remaining parameters (σ, v_h, δ) to target the following three moments. The first is the standard deviation of the fraction of uninsured deposits across banks (0.14). The second is the mean of the pre-tax return on assets ROA (1.58%). The third is the standard deviation of ROA implied by a one-standard deviation change in uninsured deposits (0.14*0.6%).

3.5 Model-implied deposit flows

We now quantify the deposit flows implied by Proposition 3 from a decline in θ through an increase in interest rates, fixing all other parameters including σ. The proposition predicts that banks with higher (lower) screening ability will have outflows (inflow) of uninsured depositors. Figure 7 illustrates the allocation of uninsured depositors $\frac{s[i]}{\bar{S}}$ in a high-θ (low-rate) regime (where $r_f = 0.1\%$, the level of short-term rates at the start of 2022) and under a low-θ (high-rate) regime with $r_f = 4\%$ (where interest rates end up per Figure 2).

The figure shows that interest rate movements provide a strong fundamental force that reallocates uninsured deposits across banks. The high-θ regime (blue, solid line) features significant heterogeneity in the equilibrium allocation of uninsured deposits: the ratio of uninsured deposits of the bank with the most uninsured deposits over the average bank is 1.75. As rates increase and θ declines, however, the allocation evens out across banks. In the low-θ regime (yellow, dashed line), the same ratio for the highest-uninsured deposit bank is 1.5. Given the 4-percentage point increase in interest rates and that these ratios are scaled around an average of $\bar{S} = 0.48$, the estimates imply that, at the highest-uninsured deposit bank, a 4-percentage point increase in interest rates translates to a 12-percentage point decrease in uninsured deposits due to fundamental forces.

The figure also shows that fundamentals can affect deposit allocations on the same order of magnitude as what the data describe. To compare model-implied estimates to the data, the figure also plots actual values of $\frac{s[i]}{\bar{S}}$ for 2017-2021 (blue, high-θ regime) and 2022 (red, low-θ regime excluding 2023). We split banks into 20 demi-deciles of i, and each data point is the average value of $\frac{s[i]}{\bar{S}}$ of each demi-decile. Consistent with our model predictions, the allocation of uninsured depositors in the data becomes more evenly distributed after 2022.

The model-implied effects are if anything larger than in the data.

We focus our study on the endogenous reallocation of deposits within the regional banking sector. Thus, we fix the mean $\bar{S}$ in this exercise and focus on the relative value of $\frac{s[i]}{\bar{S}}$ across rankings i. In reality, endogenous deposits flows from regional banks towards larger banks, or out of the aggregate banking sector, are likely important forces. Drechsler, Savov, and Schnabl (2017) estimate that a 1-percentage point increase in the federal funds rates translates to a 3-percentage point contraction in aggregate deposits. We can introduce changes in aggregate deposits by allowing for a time-varying $\bar{S}$ in our counterfactual. A higher $\bar{S}$ will increase the level of $s[i]$ for all banks, but the pattern of $\frac{s[i]}{\bar{S}}$ will remain similar.

We also investigate how such a reallocation affects the distribution of bank profitability. Figure 8 plots the distribution of ROA, $\frac{v[i]}{\bar{v}}$, under the high-θ, low-rate regime (blue, solid line) in our calibration and the counterfactual ROA under the low-θ, high-rate regime (yellow, dashed line). Similarly, we include the actual values of $\frac{v[i]}{\bar{v}}$ from 2017-2021 (blue, high-θ regime) and 2022 (red, low-θ regime excluding 2023).

The figure shows that, when θ declines, the model-implied profitability of high-uninsured deposit banks falls while that of low-uninsured deposits rises relative to each other. The ROA of the highest-uninsured deposit bank is 25% more than the average in the high-θ regime but becomes only 12% more than the average under the low-θ regime. Consistent with this model implication, the distribution of ROA across i in the data becomes more evenly distributed after 2022, although the data exhibits significant heterogeneity in ROA not determined by i. When taken together, Figures 7 and 8 quantify the associated loss in ROA and uninsured deposits as θ falls associated with Proposition 3.

4 Conclusion

We provide reduced-form evidence and a model supporting a fundamentals-based role for uninsured depositors by pointing out that uninsured deposits and bank risk-taking go together in an efficient equilibrium. Banks more specialized in understanding risky projects take on greater uninsured deposits and risky projects despite the greater cost of holding that risk because they create more value from uninsured deposits than other banks. As interest rates increase and risky opportunities decline, these banks experience outflows and declines in profits as deposits reallocate across banks. Accounting for a fundamentals-based role for uninsured depositors suggests important trade-offs when discussing future policy and bank regulation surrounding uninsured deposits.

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Appendix A Mathematical Proofs

A.1 Proof for Proposition 1

Proof. Observe from Equation 7, $W(R, \rho_u, b)$ is independent of b given (R, ρ_u), we thus use $W(R, \rho_u)$ denote the promised payoff to the depositors under (R, ρ_u).

According to Equation 9, we have $V(b, D) = D \max_s v(b, s)$,where

$$v(b,s) \equiv (v_h - v_l)\, r_f + \hat{\chi}(b,s)\alpha(b) - r_f \xi(\hat{\chi}(b,s)) - s\left(\frac{W^* - (1+\rho_0)d_u}{d_u}\right). \qquad \text{(A.1)}$$

Thus, $s^*(b)$ is independent of D. Hence, the equilibrium allocation and payoff $\{s^*(b), W^*\}$ must be such that for all $s^*(b) > 0$, FOC 10 holds.

That is, given W^*, the marginal benefit and cost of adding one uninsured depositor is equalized for all active banks. If this condition does not satisfy, a bank can lower (raise) W in order to attract less (more) UD. Lastly, since $v_{ss}(b,s) \propto -r_f \xi''(\chi(b,s)) < 0$, it means that $s^*(b)$ that satisfies Equation 10 is unique.

To guarantee the interior solutions, where uninsured depositors allocate across different banks, we assume that

$$\lambda(1 - F(b^H z))\alpha(b^H) - r\xi'\left(\lambda(1 - F(b^H z))\frac{1}{d_u}\right) < 0$$

That is, for the most informed bank b^H, the cost of capital is high enough so that it is not optimal to have uninsured depositors only. That is, together with the fact that $\xi'(0) = 0$, it means that there must be some uninsured depositors in other bank $b < b^H$ in equilibrium. Equation 11 can be derived by differentiating Equation 10 with respect to b. The market clearing condition of $s^*(b, D)$ implies that

$$\int s^*(b) D\, g(b, D)\, db\, dD = d_u.$$

■

A.2 Proof for Proposition 2

Proof. Equation 11 implies that $\frac{ds^*(b)}{db} > 0$. The measure of uninsured depositors $\mu^*(b, D) = D\left\{\frac{\chi^*(b)}{\lambda(1-F(bz))}\right\}$ also increases in b, as $1 - F(bz)$ decreases in b. Lastly, since

$$V^*(b, D) = \max_s Dv(b, s),$$

we thus have $\frac{dV^*(b,D)}{db} = Dv_b(b, s^*(b)) > 0$. ■

A.3 Proof for Proposition 3

Proof. Let $\theta \equiv \frac{\sigma}{r_f}$ and $s^*(b|\theta)$ denote the allocation under θ. First of all, for any $\theta' > \theta$, it must be the case that $s^*(b|\theta)$ and $s(b|\theta')$ only cross once at $\hat{b}$, otherwise it must violate market-clearing condition. Moreover, observe that From Equation 11 $\frac{ds^*(b)}{db}$ increases with θ, hence, at any point when these two functions cross, it must be the case that $\frac{ds^*(b|\theta')}{db} > \frac{ds^*(b|\theta)}{db}$. In other words, $s^*(b|\theta')$

must cross cross $s^*(b|\theta)$ from below, and thus these two functions can cross at most once. Thus, we have $s^*(b|\theta') > s^*(b|\theta')$ iff $b > \hat{b}$. ■

To understand the effect of interest rate, we first establish that, without any reallocation (i.e., fixing θ), $\upsilon^*(b,\theta) \equiv \frac{v^*(b)}{r_f}$ remains constant. Then, we show that a decrease in θ results in a larger drop for the more informed banks, where the change in the valuation is defined as $\Delta(b) \equiv \upsilon^*(b,\theta') - \upsilon^*(b,\theta)$.

Lemma A1. *(Scaling effect w.o reallocation) Conditional on the ratio of $\theta \equiv \frac{\sigma}{r_f}$, the payoffs of all agents are scaled by the risk-free rate. That is, if $\tilde{r}_f = \gamma r_f$ and $\tilde{\sigma} = \theta \tilde{r}_f, \tilde{\rho}_u = \gamma \rho_u, \tilde{R} = \gamma R, \tilde{V}(b) = \gamma V(b)$ and $\Delta(b) = 0\ \forall b$.*

Proof. Note that $\chi^*(b)$ remains the same conditional on $\frac{\sigma}{r_f}$. Let $\omega^* \equiv \frac{W^* - (1+\rho_0)d_u}{d_u}$, Banks' valuation can thus expressed as

$$\begin{aligned} v(b, s^*(b)) &= r_f(\nu_h - \nu_l) + \chi(b, s^*(b)) \left(\frac{1 - F(z)}{1 - F(bz)} 2\sigma - (\sigma + \nu_h r_f) \right) - r_f \xi(\chi(b, s^*(b))) - s^*(b)\omega^* \\ &= r_f \left((\nu_h - \nu_l) + \chi(b, s^*(b)) \left(\frac{1 - F(z)}{1 - F(bz)} 2\frac{\sigma}{r_f} - (\frac{\sigma}{r_f} + \nu_h) - \xi(\chi(b, s^*(b))) \right) - s^*(b)\frac{\omega^*}{r_f} \right) \end{aligned}$$

Since ρ_0 is scaled with r_f ($\rho_0 = \nu_l r_f$), by guess and verify, one can see that ω^*,ρ_u and R is also scaled with r_f and $\frac{v(b,s^*(b))}{r_f}$ is the same conditional on $\theta = \frac{\sigma}{r_f}$. ■

Lemma A2. *(Distributional effect under reallocation) For $\theta' < \theta$, $\upsilon^*(b,\theta') - \upsilon^*(b,\theta) < 0\ \forall b > \hat{b}$ and $\upsilon^*(b,\theta') - \upsilon^*(b,\theta) > 0$ for $b < \hat{b}$. Moreover, $\Delta(b') < \Delta(b) < 0\ \forall b' > b > \hat{b}$.*

Proof. Given $\theta' < \theta$, there exists $\hat{b}$ such that $\chi^*(\hat{b})$ remains the same. Moreover, one can show that $\frac{v(\hat{b},\chi^*(\hat{b}))}{r_f}$ remains the same as well, as

$$\frac{v(\hat{b},\chi^*(\hat{b}))}{r'_f} - \frac{v(\hat{b},\chi^*(\hat{b}))}{r_f} = \chi^*(\hat{b}) \left\{ \left(\frac{1 - F(z)}{1 - F\left(\hat{b}z\right)} 2\left(\theta' - \theta\right) - \left(\theta' - \theta\right) \right) - \frac{1}{\lambda(1 - F(bz))} \left(\frac{\omega^*_{\theta'}}{r'_f} - \frac{\omega^*_{\theta}}{r_f} \right) \right\} = 0,$$

where we use the fact that

$$\lambda\left(1 - F(z)\right) 2\theta' - \lambda(1 - F(\hat{b}z)(\theta' + v_h) - \lambda(1 - F(\hat{b}z))\xi'(\chi^*(\hat{b})) = \frac{\omega^*}{r_f} \tag{A.2}$$

must hold for θ and θ' for $\hat{b}$. In other words, let $\omega^*(\theta) \equiv \frac{w^*}{r_f}$ denote the equilibrium payoff to uninsured depositors relative to risk-free rate under θ, we have

$$\omega^*_\theta(\theta) = \lambda\left(1 - F(z) + \left(F(\hat{b}z) - F(z)\right)\right) > 0.$$

That is, the change in $\omega^*(\theta)$ offsets the change in $\alpha(\hat{b})$ at the bank $\hat{b}$ so that bank $\hat{b}$ takes the same amount of risk $\chi^*(\hat{b})$. Bank's profits can be expressed as

$$\upsilon^*(b,\theta) = \max_{\chi} \left((\nu_h - \nu_l) + \chi \left(\frac{1 - F(z)}{1 - F(bz)} 2\theta - (\theta + \nu_h) - \xi(\chi) \right) - \frac{\chi}{\lambda(1 - F(bz))}\omega^*(\theta) \right),$$

hence, by Envelope theorem, we have

$$\begin{aligned}\upsilon_\theta^*(b,\theta) &= \chi^*(b)\left(2\frac{1-F(z)}{1-F(bz)}-1\right)-\frac{\chi^*(b)}{\lambda(1-F(bz))}\omega_\theta^*(\theta)\\ &= \chi^*(b)\left\{\left(2\frac{1-F(z)}{1-F(bz)}-1\right)-\left\{2\frac{(1-F(z))}{(1-F(\hat{b}z))}2-1\right\}\right\},\end{aligned}$$

which is positive if and only if $b>\hat{b}$. Hence, a decrease in θ means lower (higher) $\frac{\upsilon^*(b)}{r_f}$ if and only if $b>\hat{b}$.

Moreover, for $b>\hat{b}$, we thus have

$$\frac{\upsilon^*(b)}{r_f}=\frac{\upsilon^*(\hat{b})}{r_f}+\int_{\hat{b}}^{b}\frac{\upsilon_b^*(\tilde{b})}{r_f}d\tilde{b}=\frac{\upsilon^*(\hat{b})}{r_f}+\int_{\hat{b}}^{b}\chi^*(\tilde{b})\frac{\alpha_b(\tilde{b})}{r_f}d\tilde{b},$$

where, by the envelope theorem, we have $\frac{\upsilon_b^*(\tilde{b})}{r_f}=\frac{\chi^*(\tilde{b})\alpha_b(\tilde{b})}{r_f}=\chi^*(\tilde{b})\frac{F'(bz)z(1-F(z))}{(1-F(bz))^2}2\theta$.

Hence,

$$\Delta(b)=\int_{\hat{b}}^{b}\left(\chi_{\theta'}^*(\tilde{b})\theta'-\chi_\theta^*(\tilde{b})\theta\right)\left(\frac{F'(\tilde{b}z)z(1-F(z))}{\left(1-F\left(\tilde{b}z\right)\right)^2}\right)d\tilde{b}'<0$$

and for any $b'>b\geq\hat{b}$ and $\theta'<\theta$, as $\chi_{\theta'}^*(b)-\chi_\theta^*(b)<0$. We thus have

$$\Delta(b')-\Delta(b)=\int_{b}^{b'}\left(\chi_{\theta'}^*(\tilde{b})\theta'-\chi_\theta^*(\tilde{b})\theta\right)\left(\frac{F'(\tilde{b}z)z(1-F(z))}{\left(1-F\left(\tilde{b}z\right)\right)^2}\right)d\tilde{b}<0.$$

■

Lemma A1 establishes the scaling effect, fixing the ratio of $\theta\equiv\frac{\sigma}{r_f}$. Thus, in Proposition 3, we focus on the change in the scaled profits, which follows from Lemma A2.

Table 1: Summary Statistics

This table reports summary statistics for our cross-section of regional banks. Data sources are bank call reports, CRSP daily and monthly stock files, ExecuComp, and RiskMetrics.

Variable	Units	Mean	Stdev	Median	25th pct.	75th pct.	N
A. Basic characteristics, 2021							
Start of 2022							
Uninsured deposit dollars	Fraction	0.55	0.14	0.54	0.46	0.63	179
Assets	$ billions	21.7	51.5	7.2	3.4	19.6	179
Deposits	$ billions	18.8	44.3	6.0	2.9	16.2	179
Market cap	$ billions	3.2	7.8	1.1	0.4	3.0	179
Illiquidity ratio	%/$1MM flow	1.5	2.1	0.5	0.1	2.1	179
Days with no trade	%	1.1	1.1	0.8	0.4	1.6	179
2017-2021 Average							
Uninsured deposit dollars	Fraction	0.48	0.14	0.46	0.38	0.56	179
Assets	$ billions	15.7	35.1	5.4	2.5	14.2	179
Deposits	$ billions	12.9	28.9	4.5	2.1	11.5	179
Market cap	$ billions	2.2	4.9	0.8	0.3	2.3	179
B. Price-based risk, 2022-onward							
Return, Mar 8-13 2023	%	-15.5	11.3	-13.1	-16.9	-9.9	179
Average return	%, annualized	-20.3	25.6	-15.6	-28.2	-7.2	179
Return volatility	%, annualized	31.6	11.8	28.7	25.7	32.9	179
Beta	Sensitivity	0.59	0.33	0.51	0.39	0.69	179
Rate beta	Sensitivity	-2.70	2.48	-2.34	-3.75	-1.22	179
Rate beta (Partial)	Sensitivity	1.21	2.06	1.25	-0.02	2.47	179
C. Price-based risk, pre-2022							
Average return	%, annualized	9.0	6.9	7.6	4.6	11.7	179
Return volatility	%, annualized	28.9	5.5	28.2	24.7	31.1	179
Beta	Sensitivity	0.99	0.35	0.96	0.75	1.24	179
Rate beta	Sensitivity	26.03	7.52	25.66	20.79	30.71	179
Rate beta (Partial)	Sensitivity	16.07	5.42	15.63	12.69	19.49	179
D. Balance sheet exposures							
Securities	Fraction	0.16	0.08	0.15	0.10	0.19	179
Securities (fair value)	Fraction	0.17	0.08	0.16	0.11	0.21	179
Loans	Fraction	0.70	0.09	0.71	0.66	0.76	179
C&I loans / assets	Fraction	0.13	0.07	0.11	0.07	0.17	179
C&I loans / loans	Fraction	0.19	0.10	0.16	0.11	0.24	179
Non-personal / total IPC deposits	Fraction	0.43	0.16	0.41	0.32	0.51	162
Securities (Treasury+MBS) maturity	Years	6.9	2.5	6.5	5.0	8.2	179
Treasury maturity	Years	5.3	3.1	4.6	3.1	7.3	179
Loan maturity	Years	3.5	2.0	2.9	2.1	4.3	179
Asset maturity	Years	4.1	1.8	3.9	2.7	5.0	179
Liability maturity	Years	0.2	0.1	0.1	0.1	0.2	179
A-L Gap	Years	4.0	1.8	3.7	2.6	4.9	179
Interest rate swap usage	Indicator	0.7	0.4	1.0	0.4	1.0	157

Table 1, continued.

Variable	Units	Mean	Stdev	Median	25th pct.	75th pct.	N
E. Profitability and valuation							
Return on equity, pre-tax	%	14.3	3.9	13.6	11.8	16.4	179
Return on assets, pre-tax	%	1.6	0.4	1.6	1.3	1.8	179
Market equity / book equity	Ratio	1.33	0.39	1.25	1.10	1.44	179
Market assets / book assets	Ratio	1.04	0.04	1.03	1.01	1.05	179
Deposit growth, quarterly	Log points	0.04	0.02	0.03	0.02	0.04	179
F. Regulatory capital							
Common equity tier 1 capital	%	13.1	2.9	12.5	11.7	13.7	178
Tier 1 capital	%	13.2	2.9	12.6	11.8	13.7	178
Total capital	%	14.2	3.0	13.5	12.8	14.8	178
Leverage ratio	%	10.2	2.1	9.8	9.2	10.7	179
G. Compensation and governance							
Avg total compensation (top 5)	$ Thousands	1870.8	1165.5	1541.0	1075.7	2245.4	73
Total insider ownership (top 5)	%	1.4	1.5	1.0	0.5	1.4	73
Board independence	%	82.5	7.7	85.6	77.5	88.2	63
Average indep-director ownership	%	0.2	0.3	0.1	0.0	0.2	63

Table 2: Price-based risk, January 2022-March 2023

This table reports estimates of ordinary least square (OLS) regressions where the left-hand-side variables are stock returns and realized risk measured over January 2022-March 2023 and where the right-hand-side variables are the uninsured deposit fraction and control variables as of the end of 2021. Control variables include log assets and quintile indicators for Amihud (2002) illiquidity and the frequency of days with no trade. We measure all left-hand-side variables using daily returns and calculate sensitivities using the Dimson (1979) method, requiring 80% of possible observations in the period. The column headers indicate the left-hand-side variable of each regression. The four-day return in column 1 represents the return from March 8-13, 2023, inclusive, and is not annualized. The average return and volatility in column 2 are annualized. Robust standard errors are reported in brackets. */**/*** indicates significant at the 10%, 5% and 1% levels, respectively.

	4-Day Return	Average Return	Volatility	Beta	Rate beta	Rate beta (Partial)
	(1)	(2)	(3)	(4)	(5)	(6)
UNINS	-35.350	-67.914	22.868	0.505	-3.541	-1.563
	[7.141]***	[18.671]***	[8.163]***	[0.207]**	[1.715]**	[1.250]
N	179	179	179	179	179	179
R^2	0.432	0.257	0.398	0.507	0.265	0.172

Table 3: Price-based risk, 2017-2021

This table reports estimates of ordinary least square (OLS) regressions where the left-hand-side variables are stock returns and risk and the right-hand-side variables are the average uninsured deposit fraction and control variables, all measured over 2017-2021. We measure all left-hand-side variables using monthly returns and require 80% of possible observations in the period. Control variables include log of 5-year average assets, quintile indicators for Amihud (2002) illiquidity, and quintile indicators for the frequency of no-trade days. We measure the latter two variables using daily returns from 2017-2021. The column headers indicate the left-hand-side variable of each regression. */**/*** indicates significant at the 10%, 5% and 1% levels, respectively.

	Average Return	Volatility	Beta	Rate beta	Rate beta (Partial)
	(1)	(2)	(3)	(4)	(5)
UNINS	8.489	8.829	0.726	10.552	1.190
	[5.446]	[3.772]**	[0.167]***	[4.491]**	[3.592]
N	179	179	179	179	179
R^2	0.099	0.184	0.487	0.300	0.096

Table 4: Balance sheet exposures

This table reports estimates of ordinary least square (OLS) regressions where the left-hand-side variables are balance sheet weights (panel A) and weighted-average maturities (panel B) and the right-hand-side variables are the average uninsured deposit fraction and log of average assets, all measured as averages over 2017-2021. We measure weighted-average maturities and the asset-liability gap using the English et al. (2018) method. The column headers indicate the left-hand-side variable of each regression. */**/*** indicates significant at the 10%, 5% and 1% levels, respectively.

A. Weights

	Securities / Assets	Sec. (FV) / Assets	Loans / Assets	C&I Loans / Assets	C&I Loans / All Loans	Non-personal IPC deposits
	(1)	(2)	(3)	(4)	(5)	(6)
UNINS	-0.058	-0.057	0.047	0.116	0.171	0.594
	[0.043]	[0.052]	[0.054]	[0.047]**	[0.066]**	[0.111]***
N	179	179	179	179	179	162
R^2	0.030	0.050	0.073	0.092	0.142	0.321

B. Maturities

	Securities Maturity	Treasury Maturity	Loan Maturity	Asset Maturity	Liability Maturity	A-L Gap	IR Swap Indicator
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
UNINS	0.605	2.785	-3.323	-2.918	-0.232	-2.686	-0.358
	[1.523]	[2.146]	[0.941]***	[0.946]***	[0.050]***	[0.944]***	[0.240]
N	179	179	179	179	179	179	157
R^2	0.057	0.017	0.099	0.053	0.238	0.043	0.168

Table 5: Profitability and valuation

This table reports estimates of ordinary least square (OLS) regressions where the left-hand-side variables are profitability and valuation measures, as well as annual deposit growth, and the right-hand-side variables are the average uninsured deposit fraction and log of average assets, all measured as averages over 2017-2021. We measure annual ROE, ROA, and valuation ratios at the BHC level from Compustat and other variables at the quarterly bank level from the call reports. For annual Compustat variables, we take the last fiscal year value during each calendar year. The column headers indicate the left-hand-side variable of each regression. */**/*** indicates significant at the 10%, 5% and 1% levels, respectively.

	ROE	ROA	ME/BE	MA/BA	Deposit Growth
	(1)	(2)	(3)	(4)	(5)
UNINS	0.076	0.006	0.586	0.051	0.024
	[0.029]**	[0.003]**	[0.269]**	[0.026]*	[0.009]**
N	179	179	179	179	179
R^2	0.064	0.036	0.041	0.028	0.041

Table 6: Regulatory capital

This table reports estimates of ordinary least square (OLS) regressions where the left-hand-side variables are regulatory capital measures (columns 1-4). The right-hand-side variables are the uninsured deposit fraction and log of assets. All variables are measured as averages (or the log of averages) over 2017-2021. The column headers indicate the left-hand-side variable of each regression */**/*** indicates significant at the 10%, 5% and 1% levels, respectively.

	CET1	T1	Total Capital	Leverage
	(1)	(2)	(3)	(4)
UNINS	-0.020	-0.020	-0.016	-0.001
	[0.015]	[0.015]	[0.016]	[0.011]
N	178	178	178	179
R^2	0.015	0.011	0.006	0.000

Table 7: Compensation and governance

Panel A reports estimates of ordinary least square (OLS) regressions where the left-hand-side variables are the average top-5 executive pay (TDC1), total ownership by top-5 executives, the fraction of board that is independent, and the average independent director ownership. Right-hand-side variables are the average uninsured deposit fraction and log of average assets. Both left- and right-hand-side variables are measured over 2017-2021. Panel B reports estimates of OLS regressions where the left-hand-side variables are stock returns and risk and the right-hand-side variables are the average (across time) of average (across executives) top-5 executive pay and control variables, all measured over 2017-2021. We measure all left-hand-side variables using monthly returns and require 80% of possible observations in the period. Control variables include log of 5-year average assets, quintile indicators for Amihud (2002) illiquidity, and quintile indicators for the frequency of no-trade days. We measure the latter two variables using daily returns from 2017-2021. Data on executives comes from ExecuComp while data from directors comes from Institutional Shareholder Services, and for this data we take the last fiscal year value during each calendar year. We include the CEO in our top-5 calculation even if the CEO does not belong to the top-5 executives ranked by total pay. The column headers indicate the left-hand-side variable of each regression. */**/*** indicates significant at the 10%, 5% and 1% levels, respectively.

A. Pay vs uninsured deposits

	Exec Comp	Exec Ownshp	Indep. Directors	Max IndD Ownshp
	(1)	(2)	(3)	(4)
UNINS	0.315	0.036	-0.073	0.024
	[0.260]	[0.014]**	[0.074]	[0.014]
N	73	73	63	63
R^2	0.796	0.172	0.020	0.170

B. Risk vs pay

	Average Return	Volatility	Beta	Rate beta	Rate beta (Partial)
	(1)	(2)	(3)	(4)	(5)
Top5Pay	1.996	9.644	0.450	12.816	8.558
	[3.864]	[2.985]***	[0.145]***	[3.957]***	[3.275]**
N	73	73	73	73	73
R^2	0.145	0.256	0.379	0.379	0.311

Table 8: Parameters

This table reports the seven parameters of our model which are calibrated to cross-sectional banking data from 2017-2021. See Section 3.4 for details.

Parameters	Symbol	Value	
Cost of risk – scale parameter	δ	279	Calibrated
Loan return volatility	σ	4.76%	Calibrated
Return of standard loan (outside option)	r_B	0.89%	Calibrated
Distribution of banks	(κ_H, Δ)	(0.33,0.1)	Estimated from $\chi[i]/s[i]$
Deposit beta for insured deposits	v_l	0.345	Drechsler et al (2021)
Aggregate uninsured deposits	$\bar{S}$	0.48	Data

Figure 1: Returns over March 8-13, 2023

This figure plots the cumulative return over March 8-13th, 2023 (vertical axis, non-annualized percentage points, dates inclusive) versus the 2021 fraction of uninsured deposits (horizontal axis, fraction) for 179 publicly traded U.S. regional banks meeting our sample criteria. The plot indicates tickers next to each data point. Data come from CRSP and quarterly bank call reports (FFIEC 031/041). The solid line is the best-fit line, and the dashed line is the best-fit line excluding Silicon Valley Bank.

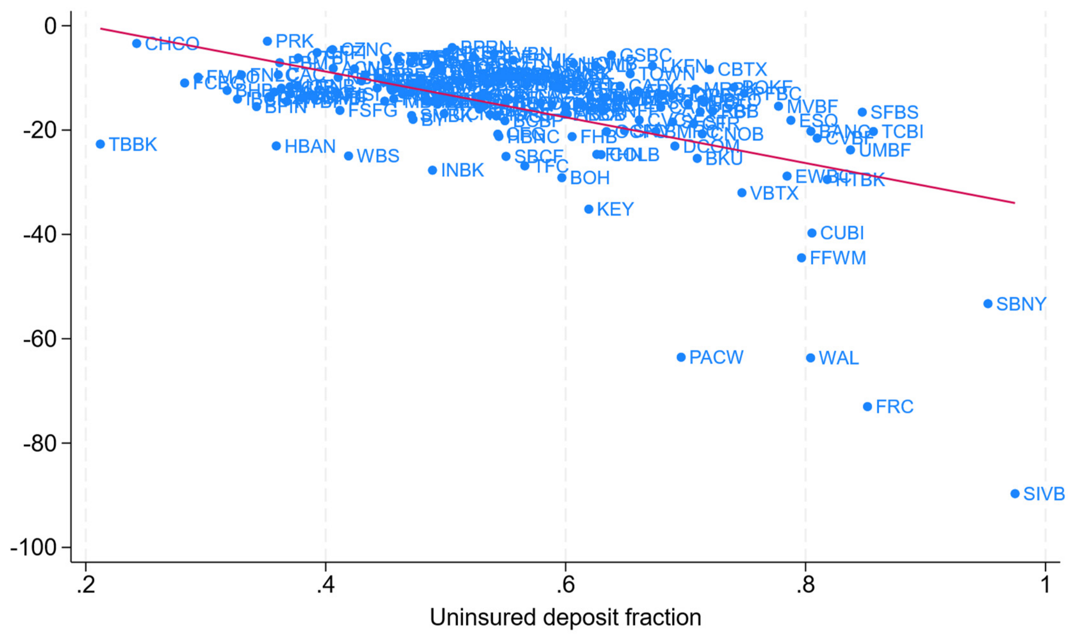


Figure 2: Stock market returns and Treasury yields, 2017-March 2023

This figure plots the cumulative return of the CRSP value-weighted index (left-hand axis, percentage points) and 3-month Treasury yield (right-hand axis, percentage points) from 2017-March 2023.

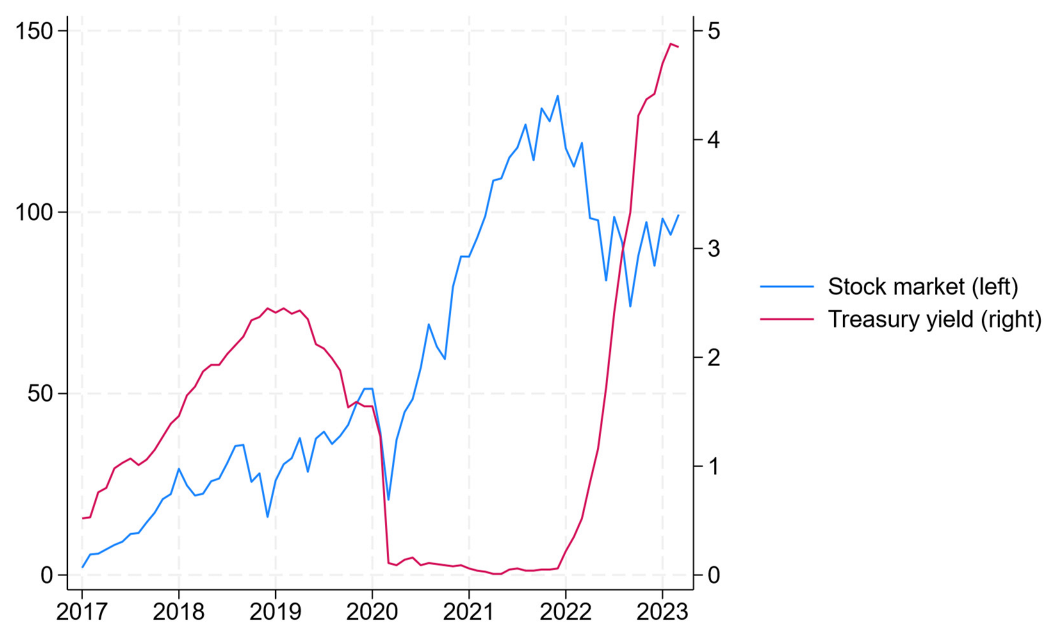
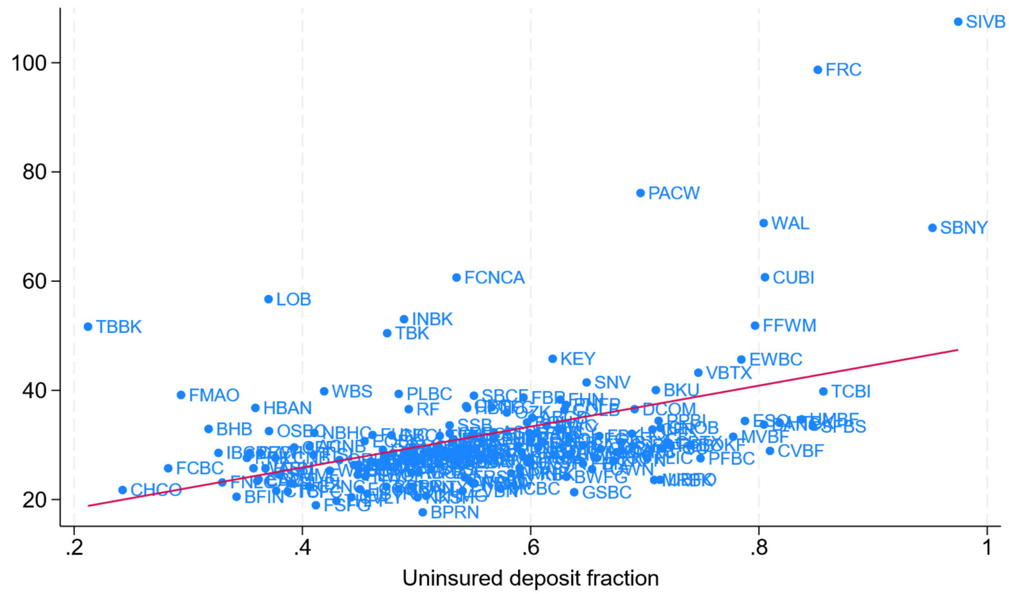


Figure 3: Price-based risk, January 2022-March 2023

This figure plots return volatility (panel A, vertical axis, annualized percentage points) and market beta (panel B, vertical axis) over January 2022-March 2023 versus the uninsured deposit fraction (horizontal axis) measured as of the end of 2021. We measure volatility and beta using daily returns and calculate beta using the Dimson (1979) method, requiring 80% of possible observations in the period. Data come from CRSP and quarterly bank call reports (FFIEC 031/041).

A. Volatility



B. Beta

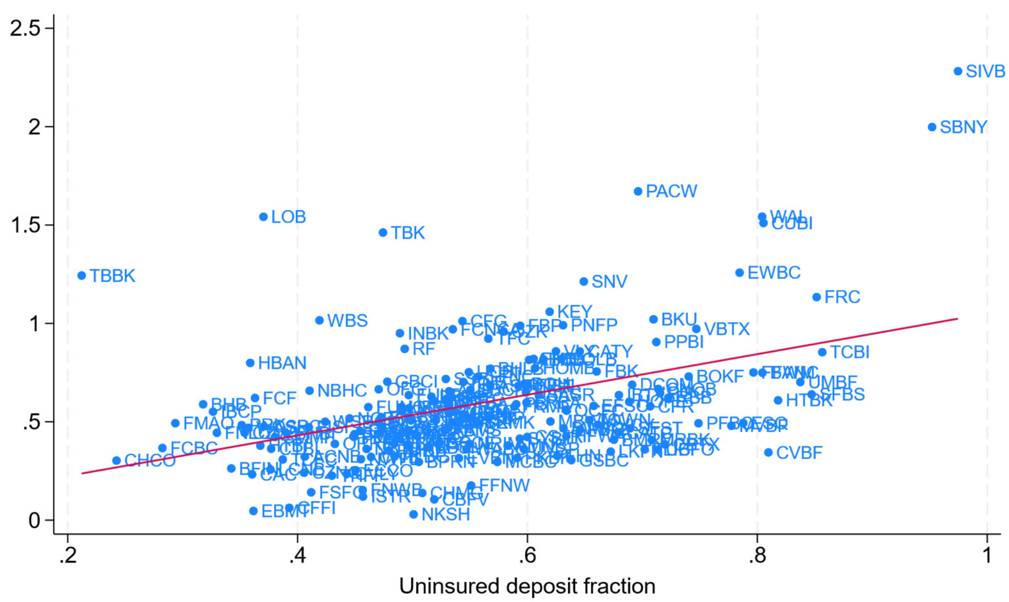
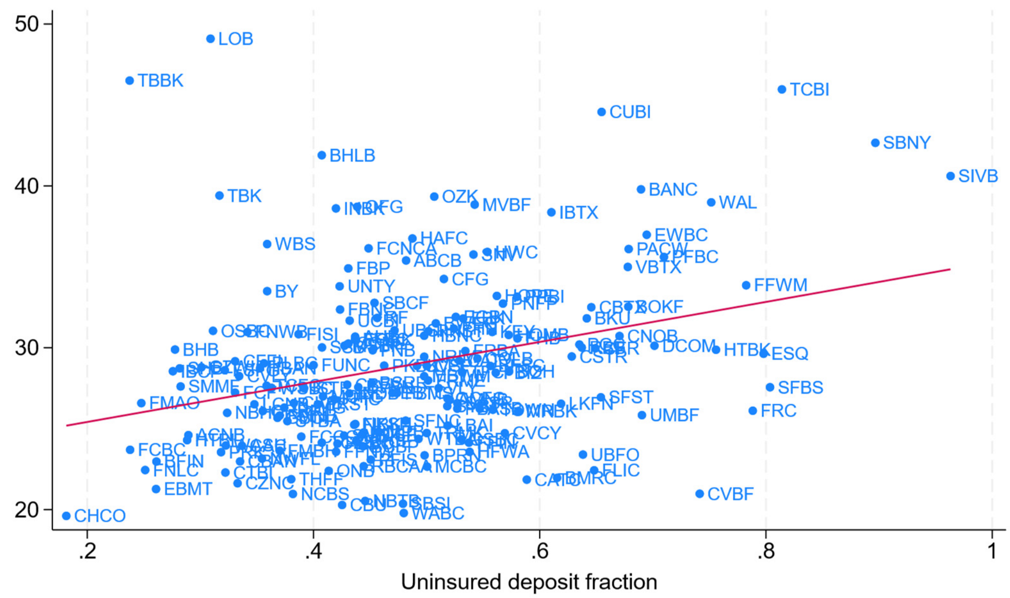


Figure 4: Price-based risk, 2017-2021

This figure plots return volatility (panel A, vertical axis, annualized percentage points) and market beta (panel B, vertical axis) versus the average uninsured deposit fraction (horizontal axis) and control variables, all measured over 2017-2021. We measure volatility and beta using monthly returns and require 80% of possible observations in the period. Data come from CRSP and quarterly bank call reports (FFIEC 031/041).

A. Volatility



B. Beta

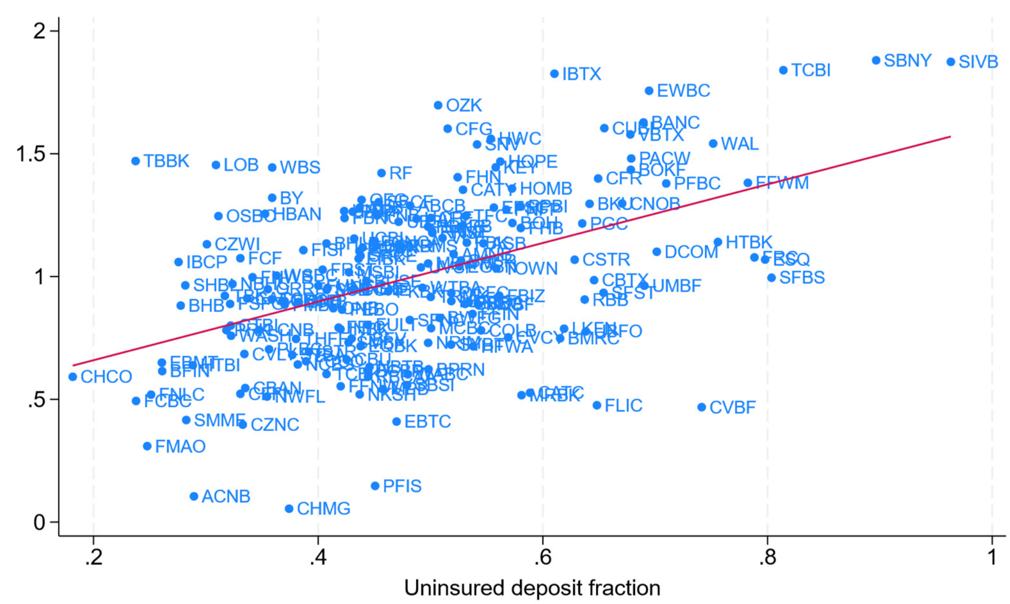
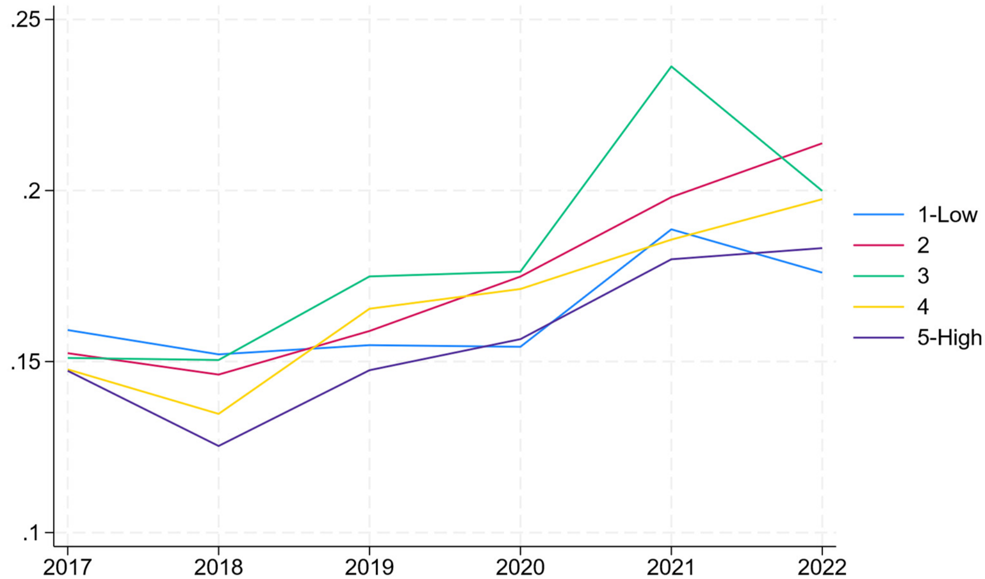


Figure 5: Balance sheet exposures

This figure plots balance sheet exposure to securities (panel A) and commercial and industrial loans (panel B; vertical axis of both panels is the fraction of assets). The different lines represent the average annual exposure for different quintiles of firms sorted by their contemporaneous fraction of uninsured deposits at the end of each year. Data come from quarterly bank call reports (FFIEC 031/041).

A. Securities



B. Commercial and industrial loans

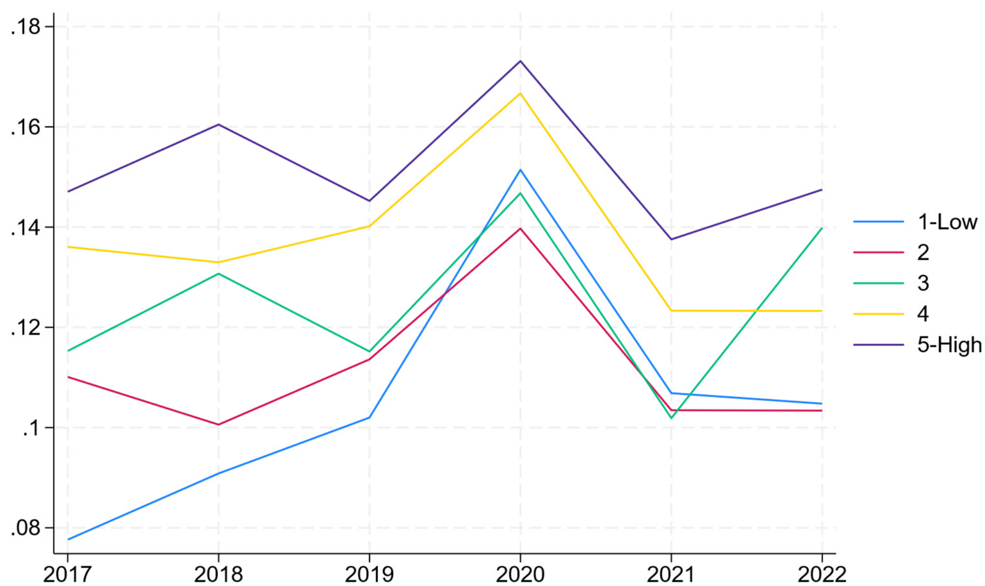


Figure 6: Inferred $\kappa[i]$

This figure displays data value of the ratio of the fraction of risky loan for bank over the fraction of uninsured deposits (vertical axis) versus the ranking of bank (horizontal axis) 2017-2021. The mean value is 0.28. The red line is the linear fitted line, where the slope is around 0.1.

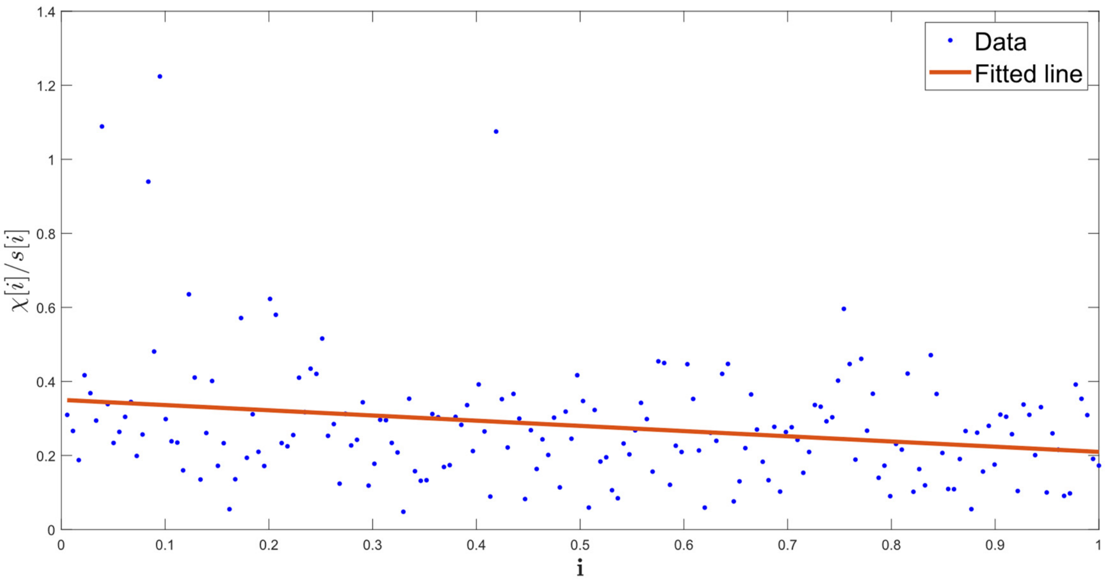


Figure 7: Deposit allocations

This figure plots the ratio of share of uninsured depositors (vertical axis) versus the ranking of bank (horizontal axis). The two lines represent the model-implied deposit allocations. The blue line represents the share under the high-θ, low-rate regime when interest rates are 0.1%. The dashed orange line represents the share predicted by the model in the low-θ, high-rate regime when interest rates are 4%. We scale the model-implied values by $\bar{S} = 0.48$. The plot also displays data values for two time periods: 2017-2021 (blue, high-θ regime), 2022 (yellow, low-θ regime excluding 2023), where we scale values by their within-period means and we divide banks into 20 bins, where each data point is the average value in each bin.

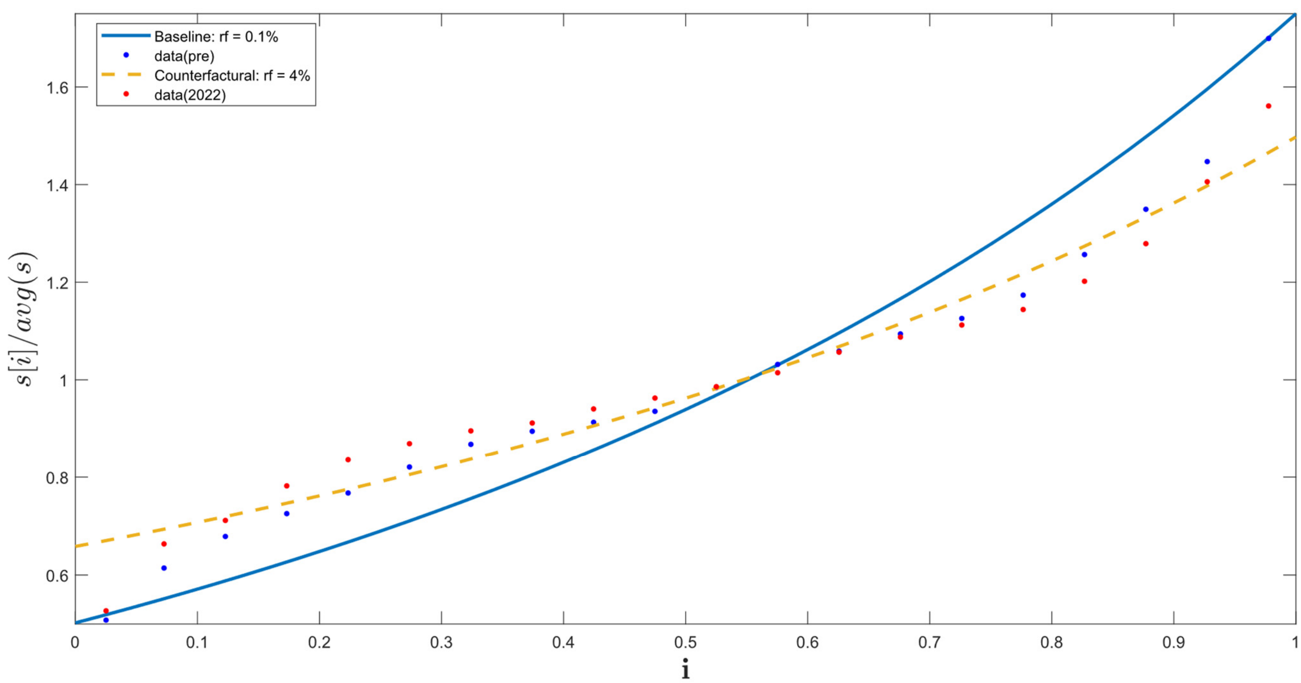


Figure 8: Distribution of ROA

This figure plots the return on assets (vertical axis) versus the ranking of bank (horizontal axis). The two lines represent the model-implied ROA. The blue line represents the share under the high-θ, low-rate regime when interest rates are 0.1%. The dashed orange line represents the profit predicted by the model in the low-θ, high-rate regime when interest rates are 4%. We scale the model-implied values by $\bar{v} = 1.58\%$. The plot also displays data values for two time periods: 2017-2021 (blue, high-θ regime), 2022 (yellow, low-θ regime excluding 2023), where we scale values by their within-period means and we divide banks into 20 bins, where each data point is the average value in each bin.