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Abstract

This paper examines the relationship between bank capital and reliance on insured deposit funding. Contrary to the conventional moral-hazard view underlying risk-based capital regulation, U.S. bank data reveal a robust negative association between capital and the share of insured deposits. We develop a delegated-monitoring model in which banks choose between insured and uninsured deposit financing. Although monitoring increases with capital under both funding regimes, its sensitivity to capital is greater when deposits are uninsured, strengthening the relative attractiveness of uninsured funding for well-capitalized banks. Our contribution is to show that the relationship between bank capital and deposit insurance depends not only on the direct effect of capital on risk-taking, but also on how capitalization changes a bank's incentives to monitor under different funding arrangements.

JEL codes: C78, D82, G11.

Key words: bank monitoring; deposit insurance, bank capital

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1 Introduction

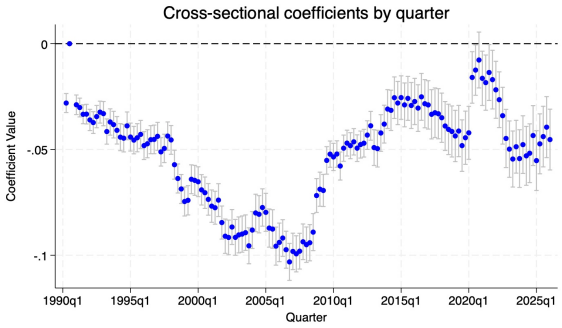
Bank funding relies on a delicate balance of equity capital and external financing, where the interaction between a bank's loss-absorbing capacity and the mix of its insured and uninsured funding dictates its overall stability. Bank capital, which consists of shareholder equity and retained earnings, serves as the cushion to absorb losses before they impact outside financiers. However, the resilience of this cushion is not independent of the composition of a bank's deposit base, specifically the combination of insured to uninsured deposits. While insured deposits—protected by the deposit insurer (supported in almost all cases with some form of public guarantee)—provide a stable source of funding, uninsured deposits are relatively more volatile and rate sensitive. Potential withdrawals of uninsured funding can serve as a way in which a 'market' disciplines inefficiencies in banks. But taken to their extreme, rapid withdrawals can trigger fire sales and collapse a bank before its capital reserves are depleted.[1],[2] Therefore, the linkages between bank capital and the composition of its external funding remain critically relevant for financial stability.

Theory predicts a positive relationship between insured deposits and capital, shaped largely by the role of deposit insurance. Deposit insurance provides valuable protection against bank runs (Diamond and Dybvig, 1983). However, it also weakens depositor incentives to monitor bank risk and allows banks to transfer part of the downside of risky investments to the deposit insurer (Merton, 1977; Kareken and Wallace, 1978). Empirical work has shown that deposit insurance weakens market discipline and, absent offsetting regulation, pushes insured banks toward higher leverage and riskier asset portfolios than an otherwise identical uninsured bank would choose (Keeley, 1990; Wheelock and Wilson, 1995). Because capital places more of the consequences of risk-taking on bank shareholders, capital requirements provide a conventional means of offsetting the risk-shifting incentives created by deposit insurance (Furlong and Keeley, 1989; Allen et al., 2015).[3] Under this rationale for capital reg-

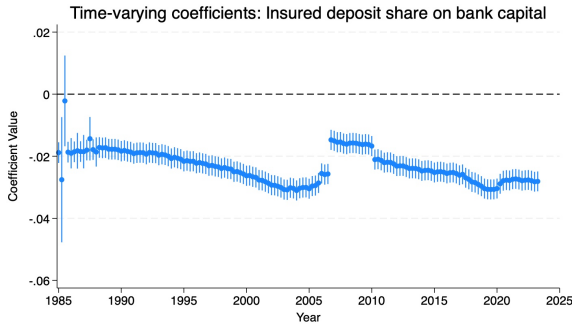
[1] Bank failures in the Spring of 2023 shared a common proximate trigger—exceptionally high shares of uninsured deposits, whose rapid withdrawal created a classic bank run (Cipriani et al., 2024). A post-mortem study of transaction-level analysis of the March–May 2023 runs conducted by the FDIC reveals that uninsured deposits comprised roughly three-quarters of total deposits at Signature Bank, and First Republic, and 94% at Silicon Valley Bank, immediately prior to failure (Chu et al., 2026). In comparison, uninsured deposits average well under 40 percent of total deposits at the median community bank.

[2] Flannery and Sorescu (2023) argue that despite the emphasis on bank capital in the post-crisis regulatory framework, reported capital measures omit substantial amounts of unbooked capital losses on portfolios of banks that failed in the Spring of 2023. They find that regulatory reports overstate the fair value of their assets leading numerous officials to declare that the banking system was "well-capitalized." Indeed, the regulatory capital ratios at all three banks reported in their last Call Reports (as of December 2022, and before their closure) exceeded the thresholds for the "well capitalized" designation under U.S. prompt corrective action rules.

[3] Risk-based capital requirements were formalized internationally beginning with the 1988 Basel Accord (Basel I) and refined substantially under Basel II (2004) and Basel III (2010–2017), each of which ties minimum capital charges to measures of asset-side risk rather than to a flat leverage ratio, consistent with the moral-hazard rationale developed in the



(a) Coefficients on bank capital from cross-section regressions of the share of insured deposits on bank capital and assets in each quarter.



(b) Time-varying coefficients on bank capital from (panel) fixed effects regression of the share of insured deposits on lagged values of bank capital and assets (see Section (2) for details).

Figure 1: Negative correlation between the share of insured deposits and bank capital in the (a) cross section and (b) panel over the sample period.

ulation, banks that rely more heavily on insured funding should hold more capital: insured deposits and bank capital would therefore, be *complements*.

The data, however, tell a different story. For U.S. banks, the association between the share of insured deposits and its capital ratio turns out to be negative rather than positive. Figure (1a) plots the coefficients on bank capital from cross-section regressions of the share of deposits that are insured on bank capital and assets in each quarter. The figure indicates that, accounting for size (assets), banks with higher capital tend to have a lower share of deposits that are insured. In addition, Figure (1b) plots time-varying coefficients from a fixed effects regression of the share of insured deposits on the lagged values of bank capital and assets (see Section (2) for details). Here again, the within-bank correlations are negative indicating that higher capital ratios for a bank over time is associated with a lower share of insured deposits. These results show that this is not just a composition story across banks but also holds for individual banks as their balance sheets change over time. The negative association for both within and across-variations hold for all quarters from 1990:Q1 to 2025:Q4. This is precisely the opposite association from what the standard moral-hazard-driven complementarity view would prescribe. In essence, these results are difficult to reconcile with a framework in which capital regulation has been largely motivated to mitigate the risk-shifting subsidy created by deposit insurance.

In this paper, we shift the focus from asking how much capital a bank should hold against insured deposits to asking how capitalization changes the bank's incentive to choose between insured and

theoretical literature discussed here.

uninsured funding. In doing so, we attempt to explain the empirical pattern of a negative association between the share of insured deposits and bank capital. We model the bank's choice between insured and uninsured financing in a setting where depositors (outside investors) face moral hazard because their payoffs depend on the post-contractual monitoring action of the bank. Greater monitoring effort increases the probability of a successful return for the bank. We examine this relationship between banks (lenders) and their depositors (investors), where banks act as *delegated monitors* (Diamond, 1984).

We determine the optimal monitoring effort of the bank and how that varies with capital under either financing mode. We begin by modeling the case where the bank is fully funded either with insured or uninsured deposits. Although monitoring is increasing in capital under either mode, we find that *monitoring intensity*—defined as the changing in monitoring effort with respect to bank capital–is higher under uninsured financing relative to insured financing. As a result, the relative attractiveness bank of uninsured financing rises for banks with higher capital. This difference in monitoring incentives causes capital to affect the bank's preferred funding structure. When capital is low, insured deposits can be relatively attractive because deposit insurance reduces the consequences of weak monitoring and provides a cheaper source of external finance. However, when capital is sufficiently high the bank has more at stake and obtains greater monitoring benefits from financing through uninsured deposits. Uninsured funding consequently becomes relatively more attractive to well-capitalized banks. When the bank chooses between fully insured and fully uninsured financing, the model predicts a negative relation between the insured deposit financing and bank capital: poorly capitalized banks prefer insured deposits while sufficiently well-capitalized banks prefer uninsured financing.

Next, we derive an optimal funding structure for any given level of capital by extending this model to situations in which the banks can combine insured and uninsured deposits. Letting the bank choose the share of its deposit funding that is insured produces an interior funding choice in which the optimal insured-deposit share declines with capital. Capital operates through two margins. First, additional capital directly substitutes for external financing, reducing the amount of deposits the bank needs to raise. Second, greater capital increases monitoring incentives, with the effect being stronger under uninsured funding. Because the funding advantage of insurance applies to a smaller deposit base as capital increases, while the monitoring advantage of uninsured funding becomes more important, the optimal funding mix shifts toward uninsured deposits. The optimal funding mix decreases with bank capital, explaining the observed negative association between insured financing and bank capital.

The results provide a different interpretation of the relationship between capital and deposit insur-

ance. However, they do not challenge the standard proposition that deposit insurance creates moral hazard or that capital can mitigate risk-taking incentives. Rather, they identify an additional equilibrium margin through which capital affects bank behavior. Capital does not merely offset the moral hazard associated with deposits; it also changes the relative attractiveness between the two funding modes. Once this funding choice is endogenous, capital and insured deposits can be substitutes, even though capital regulation may have been motivated by the moral hazard created by insured deposits.

The paper contributes to the literature by connecting the traditional capital-regulation mechanism to the endogenous composition of bank liabilities. A large banking literature establishes the moral-hazard rationale for capital requirements and emphasizes that deposits and capital are jointly relevant to bank capital structure. The analysis here adds the distinction between insured and uninsured deposits as an explicit monitoring margin. This distinction is important because the same increase in capital can have different implications depending on whether creditors are protected from bank losses. Our contribution is to show that the relationship between bank capital and deposit insurance depends not only on the direct effect of capital on risk-taking, but also on how capitalization changes the bank's incentives to monitor under alternative funding arrangements.

1.1 Related Literature

The relationship between bank capital and deposit funding is primarily shaped by the dual role of deposit insurance.[4] On the one hand, insurance protects depositors against liquidity shocks and thereby mitigates the possibility of self-fulfilling bank runs, as described in Diamond and Dybvig (1983). On the other hand, protection from bank runs removes an important source of private discipline: insured depositors have little incentive to monitor the bank's risk-taking or to demand compensation for risk. The value of the insurance subsidy increases with bank risk, as emphasized by Merton (1977), while the absence of depositor pricing of risk can lead banks to choose greater leverage and more risk than they would under uninsured financing (Kareken and Wallace, 1978). Consistent with theory, empirical work has provided strong evidence on how deposit insurance weakens the sensitivity of deposit funding to bank risk and can encourage greater leverage and risk-taking (Keeley, 1990; Wheelock, 1992; Wheelock and Wilson, 1995; Demirgüç-Kunt and Detragiache, 2002). Because the stabilization benefit of deposit insurance necessarily introduces moral-hazard, the bank's chosen capital structure may deviate from the social optimum (Thakor, 2014).

The conventional regulatory response to this problem is to use bank capital to substitute for the

[4] See Calomiris and Jaremski (2016) and references therein for a comprehensive survey.

discipline lost through deposit insurance. If insured depositors do not bear the consequences of excessive risk-taking, a larger equity stake leaves shareholders with more of the downside and thereby gives them stronger incentives to internalize risk (Kim and Santomero, 1988; Furlong and Keeley, 1989; Allen et al., 2015). In models of deposit-insurance-induced risk shifting, the use of capital requirements is viewed as an imperfect substitute for risk-sensitive deposit-insurance pricing (Flannery, 1991; Rochet, 1992; Hellmann et al., 2000). The broader literature on bank capital similarly emphasizes its role in mitigating agency problems and the distortions generated by limited liability and deposit insurance (Gorton, 1994; Berger et al., 1995; Thakor, 2014).

This tension between liquidity insurance and market discipline is central to the funding choice considered in this paper. Insured and uninsured deposits provide fundamentally different incentive environments for the bank. Pricing deposit insurance premiums to reflect the riskiness of a bank's portfolio is beset with problems (Diamond and Dybvig, 1986; Chan et al., 1992). The inherent limitations in pricing deposit insurance makes it unlikely that premiums reflect the true value of market insurance (Stiglitz, 1993; Pennacchi, 2006). As a result, premiums set to be "actuarially fair" tends to keep the risk-adjusted pricing of insured funding lower relative to uninsured funding (Pennacchi, 2006). In contrast, (Diamond and Rajan, 2001) argue that uninsured deposits, by creating financial fragility, permit banks to issue demand deposits at a lower cost but also create value. Such deposits are valuable because they provide liquidity and money-like claims to households and firms, which can make substantial bank leverage privately optimal DeAngelo and Stulz (2015). With uninsured funding however, depositors retain an exposure to bank performance and consequently have an incentive to monitor and price bank risk (Calomiris and Kahn, 1991).

Recent work brings these elements together by treating bank capital structure and funding (run) risk as jointly determined. Kashyap et al. (2024) extend the Diamond and Dybvig (1983) framework to demonstrate that, when jointly determined, privately optimal capital structure is more deposit-intensive than that chosen by the social planner, implying that capital regulation alone cannot generally correct the distortions arising from banks' funding and asset choices. This joint treatment of capital, deposits, and monitoring is closely related to the mechanism developed here. In both frameworks, the composition of bank liabilities is endogenous. The distinction is that the mechanism here focuses specifically on the disciplinary content of the deposit contract. Insured and uninsured deposits impose different monitoring incentives on the bank, and capital changes the relative strength of those incentives. Accordingly, a change in capital alters not only the bank's overall risk-bearing capacity but also the relative attractiveness of the two funding arrangements. The relevant margin is therefore not only how much deposit financing a bank employs, but also how the allocation of risk between the bank and its depositors affects the bank's incentive to monitor.

2 Data and Empirics

Our data spans the set of domestic commercial banks in the United States over the period 1985-2025. We obtain data on bank balance sheet variables using the FDIC's Call Report data. To accommodate the various changes that have been made to deposit insurance in the U.S. over the sample period, we adopt a time-varying measure of insured deposits (see Appendix (B.1) for details).

The primary objective here is to determine how the share of insured deposits vary with bank capital. The first line of evidence is the negative correlation observed in terms of both across variation (Figure (1a)) and within variation ((1b)) as discussed above. We supplement this evidence with evidence from the panel of U.S. banks over the sample period. We do not establish or imply a causal relationship between bank's choice of capital and insured deposits. Our goal is determine whether the share of insured deposits rises or falls with increases in bank capital.

Let $D^I_{i,t}$ denote the natural logarithms of the volume of insured deposits at bank i in quarter t. In the same vein, we use $D^U_{i,t}$, $K_{i,t}$, and $A_{i,t}$ to denote the natural logarithms of the volume of uninsured deposits, equity capital, and total assets at bank i in quarter t. We use the following fixed effects regressions

$$d^I_{i,t} = \beta_1 K_{i,t-1} + \beta_2 A_{i,t-1} + \eta_i + \eta_t + \varepsilon_{it} \tag{1}$$

where η_i and η_t denote bank and quarter fixed effects, respectively. And,

$$d^I_{i,t} = \frac{D^I_{i,t}}{D^I_{i,t} + D^U_{i,t}}$$

is the share of insured (deposit) financing.

For a given level of assets, any increase in equity capital naturally leads to a decrease in liabilities, which includes both insured and uninsured deposits. To avoid this problem, we use the lagged values of the capital, $K_{i,t-1}$ and assets, $A_{i,t-1}$, as regressors.

Table 1 reports the results of our specification in (1). Evidently, there is a negative association between bank capital and the share of deposits that are insured for *all bank sizes*. To determine the robustness of our results, we conduct the analysis for several different subsamples separately. We conduct the analysis separately for large and small banks using inflation-adjusted size based thresholds as denoted in the Dodd-Frank Act.[5] The association is statistically significant for the sample of

[5] Following the Dodd-Frank Act, we adopt a $50 billion threshold in real 2010 dollars to distinguish between small

	(1) All	(2) Large	(3) Small
Capital (t-1)	-0.020***	-0.014	-0.021***
	(0.001)	(0.033)	(0.001)
Total Assets (t-1)	-0.010***	0.040	-0.011***
	(0.002)	(0.053)	(0.002)
Bank fixed effects	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	Yes
Observations	998,576	7,332	991,244
Banks	15,289	525	15,251

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 1: Dependent variable: Share of deposits insured

all banks and the sample of small banks. The lack of statistical significance in the negative association for the sample of large banks could arguably be attributed to the differences in business models between large and small banks. Small banks tend to follow a more traditional model of banking, and compared to large banks, have a greater reliance on interest income.

The negative association obtained in Table 1 is fairly robust. Because these size thresholds were eventually revised to suit differences in size-based banking models and we adopt an alternative inflation-adjusted size based bank supervisory groupings in our second set of regressions. We use distinct groups such as large banking organizations (LBOs), regional banking organizations (RBOs), and community banking organizations (CBOs).[6] Another of regressions is run for different intervals of the sample period. The intervals are selected to avoid the periods of extreme stress in banking, such as the periods surrounding the global financial crisis and the pandemic turmoil. These periods are characterized by extraordinary fiscal and monetary policy measures that tend to disrupt the normal functioning of banking markets. The results of both sets of regressions are reported in appendix (B.2).

The negative association between capital and insured deposits can be viewed as evidence con-

and large banks.

[6] We use three distinct groups in terms of their real total assets at measured in 2019 dollars. We define CBOs as banks with real assets less than $10 billion, RBOs as banks with real assets greater than $10 billion but less than $100 billion, and LBOs as banks with at least $100 billion in real assets. See https://www.federalreserve.gov/supervisionreg/approaches-to-bank-supervision.htm for details.

	(1)	(2)
Capital(t-1): [Increasing]	-0.010***	
	(0.002)	
Capital(t-1): [Decreasing]		-0.034***
		(0.002)
Total Assets (t-1)	-0.021***	-0.009***
	(0.002)	(0.002)
Bank fixed effects	Yes	Yes
Quarter fixed effects	Yes	Yes
Observations	812,372	193,986
Banks	18,156	15,812

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2: Dependent variable: Share of deposits insured

firming the market disciplining role of uninsured deposits. A negative shock to asset quality of banks (loan impairment or drop in market value of securities due to rate increases) may bring about large withdrawals of uninsured deposits at banks. This would not only lower bank capital but also raise the share of deposits insured confirming the observed negative association between bank capital and insured deposits. For this reason, we run the regression for subsamples with positive and negative changes in (lagged) capital in in (1).

Table 2 presents the evidence on the negative association for subsamples of the data with positive and negative changes in capital. While the associations for both subsamples turn out to be negative, it is not surprising to find a stronger association for negative changes in capital given our understanding of the role of uninsured deposits in disciplining banks. The negative association between positive changes in bank capital and the share of insured deposits is less obvious. And while there are other explanations, such as unobserved heterogeneity in bank risk appetites or mechanics of loan growth, consistent with the negative association, this paper offers an alternative mechanism.

In sum, we find that there is a strong negative association between bank capital and insured financing. The association is particularly relevant for smaller banks which have tend to follow a more traditional banking model wherein, in contrast to their larger peers, a substantial portion of their net income is driven by net interest income.

3 The model

We present a theoretical model of banks as delegated monitors of depositors. All of the bank's external funding is assumed to be deposit financed. Deposit financing can be insured or uninsured. In section 4, we model the bank's choice of optimal financing mode in situations where the financing modes are mutually exclusive: that is, external funding for the bank is either fully-insured or fully-uninsured. In the section 5, we determine the optimal financing mix: that is, the split between insured and uninsured financing in situations where banks use both insured and uninsured financing.

3.1 Setup

Consider an economy with a continuum of two types of risk-neutral agents—banks (lenders) and depositors (investors).[7] We assume a one-period economy where depositors can deposit their endowment in banks at the beginning of the period and all repayments are made at the end of the period.

Each bank has access to a scaleable project whose initial outlay is \$1.[8] Banks are characterized by their equity capital $k \in [0, 1]$. All external financing is deposit financed. A bank with capital (initial equity), k, must borrow $1 - k$ from depositors to meet the invest requirement of \$1. Loans are subject to default risk, but loan interest rates are set in a competitive lending market. Aside from bank loans, all agents can invest their endowment in a risk-free asset at the beginning of the period.

We assume that there is project uncertainty—project outcome follows a binomial probability distribution.[9] With probability m, the project succeeds and yields r, which can be defined as one plus the loan rate. However, the project can fail with probability $1 - m$, in which case the project yields, ℓ, the liquidation value. In short, unit investment in a project yields a stochastic but verifiable cash flow which is given by

$$\tilde{r} = \begin{cases} r & \text{with probability } m \\ \ell & \text{with probability } 1 - m \end{cases}$$

where $r > \ell \geq 0$.

For simplicity, the variable $m \in [0, 1]$ also denotes "loan monitoring" by the bank, where higher m, or greater monitoring effort, lowers the probability of default. However, loan monitoring is costly

[7] We use the terms banks and lenders as well as depositors and investors interchangeably.

[8] In the analysis presented here, we assume an initial outlay of one dollar. All quantities can scaled up by a factor of X, where $X$is the level of investment.

[9] The two-point distribution for the loan outcome is clearly a simplification, this modeling is meant to capture the idea that lending is a risky activity, and a particular bank's portfolio might reflect limits of its ability to fully diversify loan risk.

for the bank which incurs (per dollar) costs $c(m) = m^2/2$. Furthermore, monitoring is not publicly verifiable, and hence, depositors cannot contract upon a level of monitoring. Consequently, the depositors face moral hazard since their payoff depends on the post-contractual monitoring action of the bank. We examine this bank–depositor relationship with moral hazard where banks are viewed as delegated monitors (Diamond, 1984).

The opportunity cost of funding is $r_f \geq 1$, the return on a default-free asset. We assume that $r > r_f > \ell$, that is, a project is economically viable only if it does not default. We also assume that $r_f(1-k) \geq \ell$, which asserts that no bank has sufficient equity capital to absorb losses in the default state, which opens up the possibility of bank failure. The last inequality is equivalent to

$$k \leq \frac{r_f - \ell}{r_f} \equiv k_{\max} < 1.$$

This puts an upper bound on the capital that the bank is willing to invest in.

3.2 Insuring deposits

Financing can be insured (I) or uninsured(U). Let r_u denote the return to depositors under uninsured financing. As a result, bank payoff under uninsured financing is $r - r_u(1-k)$. Financing the project with insured deposits yields the competitive (risk-free) return of r_f to the investor, regardless of the outcome of the project. We assume that the deposit insurer receives a flat per-unit deposit insurance premium, $\pi > 0$, that is paid by the bank at the end of the period when the project succeeds. Furthermore, we assume that $r \geq r_f + \pi$, that is, the project is viable under insured financing.

Any insured-deposit base requires organizational infrastructure—whose costs tend to increase with the size of the bank. These include a branch or digital acquisition platform, account administration, compliance and reporting systems, customer-service capacity, and stable operational processes. These sunk (operational) costs are critical to develop a base of retail insured deposits. They tend to increase with bank size and the share of a bank's insured funding, α. Therefore, banks face a convex cost function in raising insured (retail) deposits, as modeled in Aguirregabiria et al. (2016). We denote these sunk costs as *operating costs* and assume that the (per dollar) expense is

$$s(\alpha) = \varphi\alpha^2$$

where $\alpha \in [0, 1]$ denotes the share of insured financing and $\varphi > 0$ is a constant term. It follows that under full-insurance, the per dollar operational cost is φ.

4 Financing modes

We adopt the following solution procedure. First, we We do this individually for each mode of financing as though it were the only available alternative. Next, we derive the (optimized) expected surplus to the bank under different choices of funding. Let $\psi^U(k)$ and $\psi^I(k)$ denote the maximum expected surplus for the bank with capital k under uninsured and insured financing, respectively. It follows that the bank's choice of financing mode is that which maximizes the expected surplus at each level of paid-in capital, k. In the next section, we consider the problem of banks funding their assets with a mix of insured and uninsured financing. Our goal is to determine how the mix of insured and uninsured financing varies with banks' initial paid-in capital.

4.1 Uninsured financing

When banks' funding of $1-k$ is not insured, they promise a per unit return r_u to the depositor. Denoting this financing regime by U, the expected surplus of bank k is

$$\max_m \psi^U(m, r_u) \equiv m\left\{r - r_u(1-k)\right\} - \frac{1}{2}m^2 - kr_f.$$

banks have limited liability. So, in the event of default, a bank's asset ℓ accrues to investors.

We determine the uninsured financing rate, r_u, by using the risk neutral valuation method in Pennacchi (2006)). Using this method (see appendix (A.2.1) for details), we obtain

$$r_u(1-k) = \left(1 - \frac{kr_f}{r_f - \ell}\right) r + \left(\frac{k\ell}{r_f - \ell}\right) r_f \tag{2}$$

As in Pennacchi (2006), the promised repayments to uninsured investors is a weighted average of the return from the risky project, r, and the return from the risk-free asset, r_f. Notably, the lower the bank capital, k, the more the promised deposit return reflects the project risky return, r. As the capital approaches zero, equation (2) confirms that $r_u = r$. At the other extreme, if capital increases to absorb all loan losses, the promised deposit return tends to resemble the risk-free rate of return.

The bank's maximization problem can now be described as follows

$$\max_m \ \psi^U(m) \equiv \frac{kr_f(r-\ell)}{r_f - \ell} \cdot m - \frac{1}{2}m^2 - kr_f. \tag{3}$$

The first order condition of the maximization problem in (3) yields the optimal monitoring under

uninsured financing, U, as

$$m^U(k) = \frac{kr_f(r-\ell)}{r_f - \ell}. \tag{4}$$

When financing is uninsured, banks do not monitor unless they put up their own capital.

From (3) and (4), the bank's maximized expected surplus under uninsured financing is

$$\psi^U(k) = \frac{1}{2}\left\{m^U(k)\right\}^2 - kr_f.$$

4.2 Insured financing

Insured financing promises investors the risk-free rate, r_f, regardless of the outcome (success or failure) of the project. We denote this regime as I.

In the event of success, the insurer receives a a flat per-unit premium $\pi > 0$ payable by the bank at the end of the period. However when the project fails and the bank defaults, the insurer pays the claim $r_f(1-k) - \ell$, the difference between the promised payment to insured depositors and the liquidation value of the bank's (project's) assets. For this reason, we arrive at the following maximization problem

$$\max_m \ \psi^I(m) \equiv m\{r - (r_f + \pi)(1-k) - \varphi\} - \frac{1}{2}m^2 - kr_f \tag{5}$$

where $\varphi > 0$ is the per dollar operational cost.

From the first order condition of (5), we obtain the optimal monitoring under insured financing as

$$m^I(k) = r - (r_f + \pi)(1-k) - \varphi. \tag{6}$$

If financing is insured, then banks monitor even if they don't put up their own capital. The cost of deposit insurance imposes an additional claim to the returns of the project which the bank expects to recover by monitoring even if it does not deploy its own capital. The expression in (6) yields the bank's maximized expected surplus as

$$\psi^I(k) = \frac{1}{2}\left\{m^I(k)\right\}^2 - kr_f.$$

4.3 Choice between financing modes

We summarize the results above in terms of the following lemma:

Lemma 1 *Bank monitoring increases linearly with equity capital, k, both under insured and uninsured financing. However,* monitoring intensity *defined as the rate of change in bank monitoring with respect to bank capital, $\frac{\partial m(k)}{\partial k}$, is higher under uninsured financing relative to insured financing.*

More equity financing implies greater participation in the projects, and consequently banks exert greater monitoring effort. This is irrespective of whether the remainder of the project has insured or uninsured financing. While monitoring increases with capital irrespective of the financing mode, the financing mode matters for *monitoring intensity*, defined here as the rate of change in bank monitoring with respect to bank capital, $m'(k)$. In appendix (A.4), we show that

$$\frac{\partial m^U(k)}{\partial k} > \frac{\partial m^I(k)}{\partial k}$$

or equivalently

$$r > (r_f + \pi) - \ell \frac{r - r_f}{r_f - \ell}$$

With $\ell \frac{r-r_f}{r_f-\ell} \geq 0$, this is consistent with our assumption $r \geq r_f + \pi$. In short, monitoring intensity is higher for uninsured financing. With a higher share of equity financing, bank monitoring increases with capital at a higher rate under uninsured financing relative to insured financing. Unlike insured financing, uninsured financing does not pay out deposit premiums or operational costs, and consequently, more of the project returns accrue to the residual claimant (in this case, the bank) upon success. This creates incentives for the bank to monitor more intensely under uninsured financing.

Optimal financing mode In a setup, where the choice of financing mode is binary–being fully funded either by insured deposits or by uninsured deposits—it is instructive to see how this choice varies with bank capital, k. Any bank k chooses uninsured over insured financing if and only if

$$\psi^U(k) > \psi^I(k)$$

Appendix (A.4) shows how this translates into the following requirement in terms of paid-in capital:

$$k > \frac{(r_f - \ell)\{(r - r_f) - (\varphi + \pi)\}}{(r - r_f)r_f - \pi(r_f - \ell)} \equiv \hat{k}$$

For this reason, we can sort financing choice by the initial paid-in capital of the bank. It follows that any bank with equity capital $k > \hat{k}$ prefers uninsured financing whereas banks with $k < \hat{k}$ prefer insured financing. We restate this in terms of the following proposition.

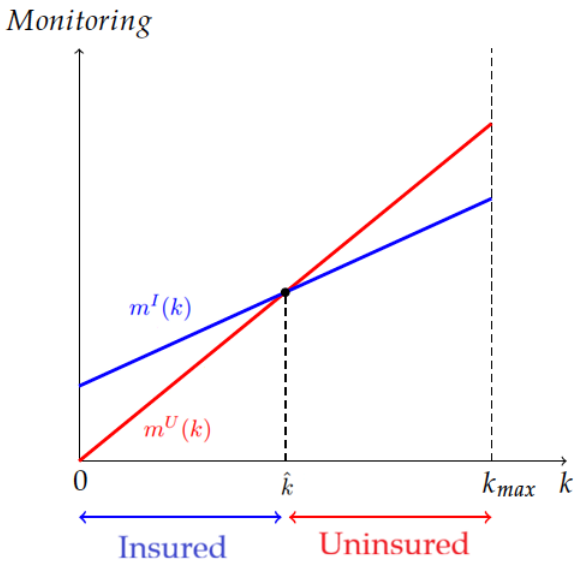


Figure 2: Bank monitoring as a function of paid-in capital.

Proposition 1 *There is a unique* $\hat{k} \in (0, k_{\max})$ *such that any bank with capital* $k < \hat{k}$ *finances their project with insured deposits, whereas those with* $k > \hat{k}$ *prefer uninsured financing. Because*

$$\psi^U(k) > \psi^I(k) \quad \textit{and } m^U(k) > m^I(k) \quad \textit{if and only if } k > \hat{k},$$

banks prefer the regime wherein endogenous monitoring effort yields the highest payoff.

Figure 2 illustrates the result in Proposition (1). Under either financing mode, more equity capital means greater stake of any bank in the project, and therefore, both $m^I(k)$and $m^U(k)$ are positively sloped—monitoring effort increases with k.

However, the monitoring intensity (magnitude of the slope) is higher under uninsured financing. From lemma 1, higher k implies greater bank margin under uninsured financing relative to insured financing. For this reason, the relative attractiveness of uninsured financing rises with capital. For banks with low capital, the incentive problem is more severe and this results in lower monitoring under uninsured financing. Consequently, banks with sufficiently low capital, that is $k < \hat{k}$, choose insured deposit financing. In contrast, if when bank capital is sufficiently high, that is $k > \hat{k}$, banks exert higher monitoring effort under uninsured financing. Clearly, $m^U(k) > m^I(k)$ if and only if $\psi^U(k) > \psi^I(k)$, and all banks with $k > \hat{k}$ choose uninsured financing.

Evidently, there is no clear dominance of any single financing mode over the other for all feasible

	Success	Failure
Project	R	ℓ
Bank	$R - r_u(1-\alpha)(1-k) - \varphi\alpha^2 - \alpha(r_f+\pi)(1-k)$	0
Insured depositor (α)	$\alpha r_f(1-k)$	$\alpha r_f(1-k)$
Uninsured depositor ($1-\alpha$)	$r_u(1-\alpha)(1-k)$	b

Table 3: Payoffs under partial insurance.

levels of paid-in capital. The model predicts that low-capitalized banks choose insured financing whereas high-capitalized banks prefer uninsured financing. For this reason, bank equity capital and deposit insurance can be viewed as substitutes.

5 Funding Mix: Insured and Uninsured Financing

In this section, we expand on this relation between financing and bank capital to scenarios in which banks fund themselves with both insured and uninsured financing. Our goal is to determine how the mix of insured and uninsured financing varies with bank capital.

We model the bank's optimal choice of funding mix, namely, the proportion of its liabilities (non-equity financing) that the bank chooses to be insured. We assume that a proportion $\alpha \in [0,1]$ of the $(1-k)$ in total deposits (external finance) required to finance the project is insured and the rest, namely $(1-\alpha)(1-k)$ consists of uninsured deposits. Accordingly, the baseline model described in Section 4 emerges as a special case of this generalized model wherein $\alpha = 0$ and $\alpha = 1$ correspond to the cases of fully-uninsured and fully-insured deposit financing, respectively.

The model setup remains the same as described in Section 4. Each bank holds $1-k$ in total deposits, a fraction $\alpha \in [0,1]$ of which is uninsured. banks promise r_u per-unit on uninsured liabilities. On the other hand, insured depositors are paid r_f per-unit deposit, and the deposit insurer charges a flat premium, $\pi > 0$.

Agent payoffs under success and failure to are summarized in terms of Table (3). We assume that the uninsured depositor gets a non-negative payoff, $b \geq 0$, where $b < r_u(1-\alpha)(1-k)$ This is largely motivated by the empirical regularity observed in the resolution of U.S. banks, wherein uninsured depositors received a non-zero payoff under failure that is typically lower than their payoff under success. On default, we assume that the liquidation value ℓ accrues to insurance fund and all payments to (insured and uninsured) depositors are made from the insurance fund. In short, this payoff structure is independent of the seniority of insured and uninsured depositors.

For a funding mix where α is the shared of insured financing, the payoff to the bank per dollar of investment is

$$\psi(m,\alpha) = m\Big\{r - (r_f+\pi)\alpha(1-k) - \varphi\alpha^2 - r_u(1-\alpha)(1-k)\Big\} - \tfrac{1}{2}m^2 - kr_f. \tag{7}$$

There are two stages. In stage 1, a bank with capital k chooses the proportion of uninsured deposits, α, to maximize the expected payoff in (7). In stage 2, the bank then chooses optimal monitoring effort, m, just as described in Section 4. We solve the model by backward induction.

Using the method in Pennacchi (2006), we begin by deriving the uninsured financing rate as

$$r_u(\alpha) = \frac{(r-\ell)r_f}{r_f-\ell} - \frac{b(r-r_f)}{(1-\alpha)(1-k)(r_f-\ell)} \tag{8}$$

The result is shown in appendix (A.2), which also gives us the upper and lower bounds for b as

$$(1-\alpha)(1-k)\ell \leq\ b\ < (1-\alpha)(1-k)r_u.$$

Note that the bounds of b are for partially insured financing, given our assumption that all payments in the failure state are made by the insurance fund. However, if funding is fully uninsured, as might be the case for a non-bank or a shadow bank, there is no role for a deposit insurance fund. In such instances, the uninsured depositor is akin to an unsecured debt-holder. As with any bankruptcy procedure wherein the debtor has limited liability, liquidation value of ℓ accrues entirely to the uninsured depositor as modeled in section (4.1). However, unlike the setting in section (4.1), our setting for partial insured funding allows for $b < \ell$.

We also simplify (8) as

$$r_u(1-\alpha)(1-k) = A(1-\alpha)(1-k) - B$$

where $A \equiv \frac{(r-\ell)r_f}{r_f-\ell}$ and $B \equiv \frac{b(r-r_f)}{(r_f-\ell)}$.

Using this form, simplifies (7) as

$$\psi(m,\alpha) = m\left\{r + B - T(\alpha,k)\right\} - \tfrac{1}{2}m^2 - kr_f$$

where $T(\alpha, k)$ is given by

$$T(\alpha, k) = (1-k)A - (1-k)\Omega\,\alpha + \varphi\alpha^2 \tag{9}$$

and we define $\Omega \equiv A - (r_f + \pi)$.

Stage 2: Optimal bank monitoring (m^*) It follows from the first order condition that

$$m^*(\alpha, k) = \{r + B - T(\alpha, k)\} \tag{10}$$

Consistent with results above, we find that monitoring effort in this case is also increasing in k

$$\frac{\partial m^*}{\partial k} = -\frac{\partial T(\alpha, k)}{\partial k} = (r_f + \pi)\alpha + A(1-\alpha) > 0.$$

Using (10), the bank's optimal monitoring payoff can now be expressed as

$$\psi(m^*, \alpha, k) = \tfrac{1}{2}[m^*(\alpha, k)]^2 - kr_f$$

so that $\psi(m^*, \alpha, k)$ is strictly increasing in m^*.

Stage 1: Optimal choice of the proportion of insured deposits (α) Given the expression above, maximizing $\psi(.)$ over α is equivalent to maximizing $m^*(\alpha, k)$, which in turn is equivalent to minimizing $T(\alpha, k)$. We get

$$\frac{dm^*}{d\alpha} = -\frac{dT}{d\alpha} = (1-k)\Omega - 2\varphi\alpha.$$

Setting $dm^*/d\alpha = 0$ for the optimum gives us

$$(1-k)\Omega = 2\varphi\alpha \tag{11}$$

The left-hand side of (11) shows the marginal benefit of insured funding. As the term $\Omega \equiv A - (r_f + \pi)$ denotes the difference between the effective per dollar price of uninsured funding and insured funding before accounting for operational costs. This difference implies insured funding is cheaper irrespective of the share of insured funding (α) in the bank's balance sheet. In contrast, the right-hand side of (11) shows the marginal operational cost of insured funding, which is rising with α. The rising

cost intersects the flat benefit line at the interior optimum given by

$$\alpha^*(k) = \frac{\Omega}{2\varphi}(1-k), \quad \alpha^{*\prime}(k) < 0 \tag{12}$$

We can state the result in terms of the following proposition.

Proposition 2 *Let $m^*(\alpha, k)$ be the optimal monitoring of a bank with paid-in capital k and the proportion of uninsured deposit α.*

- *Optimal bank monitoring is increasing in bank capital because*

$$\frac{\partial m^*}{\partial k} = (r_f + \pi)\alpha + A(1-\alpha) > 0$$

- *Optimal choice of the proportion of insured deposits is decreasing in bank capital because*[10]

$$\frac{\partial \alpha^*}{\partial k} = -\frac{\Omega}{2\varphi} < 0 \quad \textit{for } \Omega > 0.$$

The intuition is mirrors the discussion around (11) above. Raising k shrinks the need for deposit financing $(1-k)$ and the marginal benefit curve on the left-hand side of (11) shifts down. In contrast, the marginal cost curve on the right-hand side of (11), although increasing linearly in α, is unaffected by changes in k. The downward shift of the benefit curve with the cost curve unchanged lowers α^* from its previous equilibrium value. Put differently, raising capital reduces the need for deposit funding consequently lowers the overall benefit from cheaper insured funding as this benefit is now spread over fewer deposits. To balance this, the bank lowers operational costs by tilting away from insured to uninsured financing, thereby lowering the equilibrium α^*. This forms the basis of the negative relation between bank capital and insured deposit share.

The proposition above considers two different margins. In stage 1, given its deposit financing needs, we model the cheapest way to split this funding between insured and uninsured. That trade-off is on the relative prices per dollar of the (shrinking) deposit base — and it tilts toward uninsured funding as k rises, since insured funding's per-dollar price edge no longer buys much once there's fewer deposits left to reallocate. The second margin applies in stage 2. Given the optimally chose share of insured deposits, α^*, how much does the bank monitor? This depends on the $level$ of total funding costs as higher capital lowers the funding needs, and thereby weighted funding costs, for

[10] This requires $A > r_f + \pi$ which is equivalent to $r > (r_f + \pi) - \ell\frac{r - r_f}{r_f - \ell}$ and consistent with our assumption $r \geq r_f + \pi$

both insured and uninsured funding. Monitoring effort increases with bank capital irrespective of the funding mix.

In sum, capital not only substitutes for deposits but it also lowers the external financing need of the bank. While this means that the bank has to forego the payoff benefit from the pricing margin between insured and uninsured deposits, it also has to tilt away from insured deposits given their convex operational costs to make up for this foregone benefit.

6 Conclusion and policy implications

This paper documents a robust negative association between bank capital and the share of insured deposits. Using U.S. commercial-bank data from 1985–2025, the relationship appears both across banks and within banks over time. It is strongest among community banks and persists across alternative sample periods. The empirical results establish an association, not a causal effect.

The model explains this relationship through bank monitoring incentives. Capital increases monitoring under both insured and uninsured financing, but the effect is stronger when deposits are uninsured. Uninsured funding therefore becomes relatively more attractive as capital rises. Low-capital banks prefer insured funding, while sufficiently well-capitalized banks prefer uninsured funding. When both sources are available, the optimal insured-deposit share falls with capital.

The results add to the vast literature on the relationship between bank capital and insured deposits. The standard moral-hazard argument treats capital as a response to the risk-shifting incentives created by deposit insurance. Our mechanism introduces an additional margin: capital changes the bank's choice between insured and uninsured funding. Capital and insured deposits can therefore be substitutes in equilibrium, even though deposit insurance still creates moral hazard.

The policy implication is that capital regulation should be evaluated jointly with banks' funding structures. Higher capital may reduce risk-taking while also encouraging greater reliance on uninsured funding. This can strengthen market discipline but increase exposure to deposit runs. Capital requirements alone therefore do not capture the full prudential implications of banks' liability choices.

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A Appendix: Model

A.1 Financing modes (Section (4))

A.1.1 Fully uninsured financing

Under fully-uninsured funding, the payoff to the bank per dollar of investment is

$$\psi^U(m) \equiv m\left\{r - r_u(1-k)\right\} - \frac{1}{2}m^2 - kr_f. \tag{13}$$

From the first-order condition w.r.t. m

$$\frac{\partial \psi^U(m)}{\partial m} = \left\{r - r_u(1-k)\right\} - m^* = 0$$

it follows that

$$m^* \equiv m^U(k) = r - r_u(1-k) \tag{14}$$

and $\partial^2\psi^U/\partial m^2 = -1 < 0$ confirms a maximum.

This gives us

$$\psi^U(m) = \frac{1}{2}m^{*2} - kr_f = \frac{1}{2}\left\{m^U(k)\right\}^2 - kr_f$$

A.1.2 Fully insured financing

Under fully-uninsured funding, the payoff to the bank per dollar of investment is

$$\psi^I(m) \equiv m\left\{r - (r_f + \pi)(1-k) - \varphi\right\} - \frac{1}{2}m^2 - kr_f. \tag{15}$$

From the first-order condition w.r.t. m

$$\frac{\partial \psi^I(m)}{\partial m} = \left\{r - (r_f + \pi)(1-k) - \varphi\right\} - m^* = 0$$

it follows that

$$m^* \equiv m^I(k) = r - (r_f + \pi)(1-k) - \varphi \tag{16}$$

and $\partial^2\psi^I/\partial m^2 = -1 < 0$ confirms a maximum.

This give us

$$\psi^I(m) = \frac{1}{2}m^{*2} - kr_f = \frac{1}{2}\left\{m^I(k)\right\}^2 - kr_f$$

Recall, we assume $r \geq r_f + \pi$ and $r_f(1-k) \geq \ell$ so that we have

$$r \geq r_f + \pi \geq r_f \geq r_f(1-k) \geq \ell,$$

Hence $r - \ell \geq \pi \geq 0$. In fact, $r > \ell$ strictly whenever $\pi > 0$ or $k > 0$.

A.2 Derivation of r_u

To derive pricing of uninsured deposits, we use the method developed in Pennacchi (2006). Following the logic in Cox et al. (1979), initial value of these default-risky deposits can be determined by noting that their payoff can be replicated by an investment in the default-free asset and the default-risk project (loan). We assume investments the payoff from uninsured deposits can be replicated by investing λ_1 shares in the risky project and λ_2 shares in the risk-free asset. This is given by (17) and (18)

$$\lambda_1 r + \lambda_2 r_f = r_u(1-\alpha)(1-k) \tag{17}$$

$$\lambda_1 \ell + \lambda_2 r_f = b \tag{18}$$

$$\lambda_1 + \lambda_2 = (1-\alpha)(1-k) \tag{19}$$

with $\alpha \in [0, 1)$, $k < 1$, $r \geq r_f + \pi$, and $r_f(1-k) - \ell \geq 0$.

Throughout, define

$$\theta \equiv (1-\alpha)(1-k),$$

which is exactly the right-hand side of (19). Since $\alpha \in [0, 1)$ and $k < 1$, we have $\theta \in (0, 1]$ whenever $k \geq 0$, so θ is always a valid, strictly positive scale factor.

Subtracting (18) from (17), we obtain

$$\lambda_1^* = \frac{r_u\theta - b}{r - \ell} \tag{20}$$

with $\lambda_1 > 0$ and $r > \ell$, we satisfy the constraint on b

$$r_u\theta > b \Leftrightarrow b < r_u(1-\alpha)(1-k).$$

From (19) and (20), we also get

$$\lambda_2^* = \frac{b - \theta\ell}{r_f - \ell}.$$

so that $\beta_2 \geq 0$ gives us a lower bound on b

$$b \geq A\ell \Leftrightarrow b \geq (1-\alpha)(1-k)\,\ell.$$

Combining both upper and lower bounds we get

$$\begin{aligned}(1-\alpha)(1-k)\ell \leq\ & b\ < (1-\alpha)(1-k)r_u \\ \theta\ell \leq\ & b\ < \theta r_u\end{aligned}$$

Substituting $\lambda_2 = \theta - \lambda_1$ into (18) gives us

$$\lambda_1 = \frac{\theta r_f - b}{r_f - \ell}. \tag{21}$$

From (20) and (21), we get

$$r_u = \frac{\theta r_f(r-\ell) - b(r-r_f)}{\theta(r_f - \ell)} = \frac{(r-\ell)r_f}{r_f - \ell} - \frac{b(r-r_f)}{(1-\alpha)(1-k)(r_f-\ell)} \tag{22}$$

which can be written as

$$r_u = A - \frac{B}{\theta}$$

where $A \equiv \frac{(r-\ell)r_f}{r_f-\ell}$ and $B \equiv \frac{b(r-r_f)}{(r_f-\ell)}$, so that

$$r_u\theta = A\theta - B \tag{23}$$

Note that we can rewrite (22) as

$$r_u(\alpha) = w_r r + w_f r_f$$

where

$$w_r \equiv \frac{\theta r_f - b}{\theta(r_f - \ell)} \text{ and } w_f \equiv \frac{(b - \theta\ell)}{\theta(r_f - \ell)}$$

so that $w_r + w_f = 1$. As a result, the deposit rate is just the weighted average of payoffs from the risky and the risk-free assets (Pennacchi, 2006). This confirms

$$r > r_u > r_f$$

and deposit rate approaches the project return rate as bank's equity capital declines.

$$k \to 0 \;\Rightarrow r_u \to r$$

But the deposit rate approaches the risk-free rate as bank capital increases indicating that higher bank capital lowers the risk of funding the bank.

$$k \to 1 \;\Rightarrow r_u \to r_f$$

A.2.1 Value of r_u when funding is fully uninsured.

When the bank is fully funded with uninsured deposits, we can set $\alpha = 0$ in (22), so that

$$r_u(0)(1-k) = A(1-k) - B \tag{24}$$

This can be re-written as weighted averages of the risky return, r, and the risk-free return, r_f

$$r_u(0) = \frac{(1-k)r_f - b}{(1-k)(r_f - \ell)} r + \frac{b - \ell(1-k)}{(1-k)(r_f - \ell)} r_f$$

which is in the form

$$r_u = w_1 r + w_2 r_f$$

where

$$w_1 + w_2 = \frac{(1-k)r_f - b}{(1-k)(r_f - \ell)} + \frac{b - \ell(1-k)}{(1-k)(r_f - \ell)} = 1$$

If there is no role for deposit insurance, standard bankruptcy procedures apply. This means that entire liquidation value of the asset accrues to the uninsured depositor, so that $b = \ell$. If that happens, we must have

$$r_u(0) = \frac{(1-k)r_f - \ell}{(1-k)(r_f - \ell)} r + \frac{\ell - \ell(1-k)}{(1-k)(r_f - \ell)} r_f$$

which translates to

$$r_u(1-k) = \left(1 - \frac{k r_f}{r_f - \ell}\right) r + \left(\frac{k\ell}{r_f - \ell}\right) r_f \tag{25}$$

A.3 Financing Mix (Section (4))

For a funding mix where α is the shared of insured financing, the payoff to the bank per dollar of investment is

$$\psi(m, \alpha) = m\Big\{r - (r_f + \pi)\alpha(1-k) - \varphi\alpha^2 - (1-\alpha)r_u(1-k)\Big\} - \tfrac{1}{2}m^2 - k r_f. \tag{26}$$

Using (23), we can simplify as

$$\psi(m, \alpha) = m\left\{r + B - T(\alpha, k)\right\} - \tfrac{1}{2}m^2 - k r_f$$

where $T(\alpha)$ is given by

$$T(\alpha, k) = (1-k)A - (1-k)\Omega\,\alpha + \varphi\alpha^2 \tag{27}$$

Stage 2: Optimal monitoring effort, m^*, as function of k First-order condition w.r.t. m

$$\frac{\partial \psi(m, \alpha)}{\partial m} = \left\{r + B - T(\alpha, k)\right\} - m^* = 0$$

Since $\partial^2\psi/\partial m^2 = -1 < 0$, this is a maximum. We obtain

$$m^*(\alpha, k) = r + B - T(\alpha, k) = r + B - \left[(1-k)A - (1-k)\Omega\,\alpha + \varphi\alpha^2\right]$$

and

$$\psi(m^*, \alpha) = \tfrac{1}{2}(m^*)^2 - kr_f.$$

which is strictly increasing in m^*. Therefore, maximizing $\psi(m^*, \alpha)$ over α is equivalent to maximizing $m^*(\alpha, k)$ over α, and by extension, to minimizing $T(\alpha)$ over α.

We obtain

$$\begin{aligned}
\frac{\partial m^*}{\partial k} &= -\frac{\partial T(\alpha, k)}{\partial k} \\
\frac{\partial m^*}{\partial k} &= -\frac{\partial}{\partial k}\left[(r_f + \pi)\alpha(1-k) + A(1-\alpha)(1-k)\right] \\
\frac{\partial m^*}{\partial k} &= -\left[-(r_f + \pi)\alpha - A(1-\alpha)\right] \\
\frac{\partial m^*}{\partial k} &= (r_f + \pi)\alpha + A(1-\alpha) > 0
\end{aligned}$$

Optimal share of insured deposits, α^*, as function of k From (27), we get

$$\frac{dm^*}{d\alpha} = -\frac{dT}{d\alpha} = (1-k)\Omega - 2\varphi\alpha.$$

Setting $dm^*/d\alpha = 0$ for the optimum

$$\begin{aligned}
(1-k)\Omega &= 2\varphi\alpha^* \\
\alpha^*(k) &= \frac{\Omega}{2\varphi}(1-k).
\end{aligned} \tag{28}$$

For the second-order condition, we have

$$\frac{d^2 m^*}{d\alpha^2} = \frac{d^2 T}{d\alpha^2} = -2\varphi < 0$$

Note also that

$$\frac{d^2\psi}{d\alpha^2} = \left(\frac{dm^*}{d\alpha}\right)^2 + m^*\frac{d^2 m^*}{d\alpha^2}$$

and at α^* the first term vanishes, and we get

$$\frac{d^2\psi}{d\alpha^2} = -2\varphi\, m^* < 0$$

which is an interior maximum because $m^* > 0$.

Conditions for an interior maximum (α^*) For $\alpha^*(k) \in (0,1)$ over $k \in [0, k_{\max})$, we need

1. From (28), we must have $\Omega > 0$, that is

$$\begin{aligned} A &> r_f + \pi \\ r &> (r_f + \pi) - \ell \frac{r - r_f}{r_f - \ell} \end{aligned} \tag{29}$$

   Because $\ell \frac{r-r_f}{r_f-\ell} \geq 0$ this is consistent with our assumption $r \geq r_f + \pi$.

2. Also from (28), we must have $\varphi \geq \dfrac{\Omega}{2}$ so that $\alpha^*(0) = \dfrac{\Omega}{2\varphi} \leq 1$ (the binding case, since α^* is largest at $k = 0$).

Comparative statics in k We obtain that $\alpha^*(k)$ is strictly decreasing in k because

$$\begin{aligned} \frac{d\alpha^*}{dk} &= \frac{d}{dk}\left[\frac{\Omega}{2\varphi}(1-k)\right] \\ \frac{d\alpha^*}{dk} &= -\frac{\Omega}{2\varphi} < 0 \quad \text{for } \Omega > 0. \end{aligned}$$

Also optimal monitoring effort m^* evaluated at $\alpha^*(k)$ is

$$\begin{aligned} m^*(\alpha^*, k) &= r + B - T(\alpha^*) \\ m^*(\alpha^*, k) &= r + B - (1-k)A + (1-k)\Omega\alpha^* - \varphi(\alpha^*)^2. \end{aligned}$$

Substituting $\alpha^* = \Omega(1-k)/(2\varphi)$ into the last two terms

$$\begin{aligned} (1-k)\Omega\alpha^* &= (1-k)\Omega \cdot \frac{\Omega(1-k)}{2\varphi} = \frac{\Omega^2(1-k)^2}{2\varphi} \\ \varphi(\alpha^*)^2 &= \varphi \cdot \frac{\Omega^2(1-k)^2}{4\varphi^2} = \frac{\Omega^2(1-k)^2}{4\varphi}. \end{aligned}$$

This means

$$(1-k)\Omega\alpha^* - \varphi(\alpha^*)^2 = \frac{\Omega^2(1-k)^2}{2\varphi} - \frac{\Omega^2(1-k)^2}{4\varphi} = \frac{\Omega^2(1-k)^2}{4\varphi}.$$

So that

$$m^*(\alpha^*, k) = r + B - A(1-k) + \frac{\Omega^2}{4\varphi}(1-k)^2.$$

A.4 Choice of funding mode (Section (4))

The choice between a fully insured or a full uninsured funding mode is obtained by using whichever value function dominates. Since both value functions are of the form

$$\psi(m) = \frac{1}{2}m^{*2} - kr_f$$

it is clear that the one with the higher optimal monitoring effort $m^*(k)$ is chosen by the bank with capital k.

Both $m^U(k)$ and $m^I(k)$ are affine and increasing in k; their relative slopes (A versus $r_f + \pi$) and intercepts determine which regime induces more monitoring at a given capital ratio, and whether the two lines cross within $[0, k_{\max})$.

Recall that for the interior solution $\alpha^*(k) = \frac{\Omega}{2\varphi}(1-k)$ to be economically meaningful we had

$$\Omega \equiv A - (r_f + \pi) > 0$$

which from (29) translates to

$$r > (r_f + \pi) - \ell\frac{r - r_f}{r_f - \ell}.$$

Since $m^U(k)$ has slope A and $m^I(k)$ has slope $r_f + \pi$, this condition directly implies $m^U(k)$ is the steeper line.

Setting $m^U(\hat{k}) = m^I(\hat{k})$:

$$(r + B - A) + A\hat{k} = \left[r - \varphi - (r_f + \pi)\right] + (r_f + \pi)\hat{k}$$

$$B - A + A\hat{k} = -\varphi - (r_f + \pi) + (r_f + \pi)\hat{k}$$

Collecting $\hat{k}$ terms on the left and constants on the right:

$$\hat{k}\big[A-(r_f+\pi)\big]=A-(r_f+\pi)-B-\varphi$$

$$\hat{k}.\Omega=\Omega-(B+\varphi)$$
$$\hat{k}=1-\frac{B+\varphi}{\Omega}$$

To get the final form of $\hat{k}$, we expand using the values of A,B and Ω. This gives us

$$\hat{k}=\frac{(r-r_f)(r_f-b)-(\varphi+\pi)(r_f-\ell)}{(r-r_f)r_f-\pi(r_f-\ell)}$$

Note that because we are considering the case of fully uninsured deposits, we must have $b=\ell$. This means we may write the threshold as

$$\hat{k}=\frac{(r_f-\ell)\left\{(r-r_f)-(\varphi+\pi)\right\}}{(r-r_f)r_f-\pi(r_f-\ell)} \tag{30}$$

B Appendix: Data and Empirics

B.1 Data Sources

Table (4) shows the data series used to calculate the level of insured deposits. The Micro Data Reference Manual provides series details.

Date	FFIEC series for Insured Deposits
2017/03-	FFIEC 31:RCONF049+250*RCONF052+RCONF045+250*RCONF048; FFIEC 41:RCONF049+250*RCONF052+RCONF045+250*RCONF048; FFIEC 51:RCONF049+250*RCONF052+RCONF045+250*RCONF048;
2013/03-2016/12	FFIEC 31:RCONF049+250*RCONF052+RCONF045+250*RCONF048; FFIEC 41:RCONF049+250*RCONF052+RCONF045+250*RCONF048;
2010/12-2012/12	FFIEC 31:RCONF049+250*RCONF052+RCONF045+250*RCONF048+(RCONJ944-250*RCONJ945); FFIEC 41:RCONF049+250*RCONF052+RCONF045+250*RCONF048+(RCONJ944-250*RCONJ945);
2010/09-2010/09	FFIEC 31:RCONF049+250*RCONF052+RCONF045+250*RCONF048+(RCONJ651-250*RCONJ652); FFIEC 41:RCONF049+250*RCONF052+RCONF045+250*RCONF048+(RCONJ651-250*RCONJ652);
2009/09-2010/06	FFIEC 31:RCONF049+250*RCONF052+RCONF045+250*RCONF048+(RCONG167-250*RCONG168); FFIEC 41:RCONF049+250*RCONF052+RCONF045+250*RCONF048+(RCONG167-250*RCONG168);
2008/12-2009/06	FFIEC 31:RCONF049+100*RCONF052+RCONF045+250*RCONF048+(RCONG167-100*RCONG168); FFIEC 41:RCONF049+100*RCONF052+RCONF045+250*RCONF048+(RCONG167-100*RCONG168);
2006/06-2008/09	FFIEC 31:RCONF049+(100*RCONF052)+RCONF045+(250*RCONF048); FFIEC 41:RCONF049+(100*RCONF052)+RCONF045+(250*RCONF048);
2001/03-2006/03	FFIEC 31:RCON2702+(100*RCON2722); FFIEC 41:RCON2702+(100*RCON2722);
1984/09-2000/12	FFIEC 31:RCON2702+(100*RCON2722); FFIEC 32:RCON2702+(100*RCON2722); FFIEC 33:RCON2702+(100*RCON2722); FFIEC 34:RCON2702+(100*RCON2722);

Table 4: Calculation of the data series on bank insured deposits.

B.2 Additional results

Table 5 reports the results of the same specification in (1) but using somewhat different groupings of banks based on size. Again, the results show a similar pattern where there is a negative and statistically significant association between bank capital and the share of deposits that are insured for the community bank (small bank) sample. However, the association is not significant for other size groups. In this way, the results here are consistent with those in Table 1.

	(1) LBO	(2) RBO	(3) CBO
Capital (t-1)	-0.037	0.005	-0.022***
	(0.037)	(0.016)	(0.001)
Total Assets (t-1)	0.063	-0.004	-0.011***
	(0.061)	(0.024)	(0.002)
Bank fixed effects	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	Yes
Observations	4,848	28,005	965,723
Banks	357	1,936	15,009

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Dependent variable: Share of deposits insured

	(1) Pre-Crisis	(2) Post-crisis	(3) Post-Pandemic
Capital (t-1)	-0.012***	-0.009**	0.005
	(0.001)	(0.004)	(0.007)
Total Assets (t-1)	-0.025***	-0.058***	-0.011
	(0.002)	(0.005)	(0.008)
Bank fixed effects	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	Yes
Observations	616,366	169,779	88,431
Banks	14,783	6,243	4,294

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Dependent variable: Share of deposits insured

Lastly, we run the specification in (1) for different intervals of our sample period. We distinguish between a pre-crisis period which spans from the start of our sample period in 1985:Q1 to 2007:Q2, a post-crisis period from 2011: Q2 to 2019:Q4 and a post-pandemic period from 2020:Q2 onwards. Notably, the negative association between the share of insured financing and bank capital appears to be strongest in the pre-crisis period.