

Bailing out (Firms') Uninsured Deposits: A Quantitative Analysis

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Abstract

We analyze the effects of (not) bailing out uninsured deposits in a quantitative, general equilibrium model in which firms' deposits are valued for their safety and uninsured deposits might be bailed out by the government. Although an important fraction of households' deposits are uninsured, and an even larger fraction for firms, the de facto policy of the FDIC has been to bail out most uninsured deposits: only 6% of bank failures resulted in losses on uninsured deposits from 2008 to 2022. Our calibrated model implies that, had the government *not* bailed out uninsured deposits in 2023, we would have observed a negligible impact on the economy. This result is the byproduct of two forces that offset each other. On the one hand, riskier deposits reduce firms' ability to engage in production. On the other hand, the increase in the riskiness of uninsured deposits combined with financial frictions that prevent investors from quickly moving resources in and out of firms would have led firms to direct their funds away from deposits and toward investments in physical capital and employment. In work in progress, we explore the welfare effects of the bailouts and the implications for the optimal design of the deposit insurance scheme and the resolution process of failed banks.

Keywords: uninsured deposits, bailouts, firms' investments, idiosyncratic risk, safe assets
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1 Introduction

The failure of Silicon Valley Bank (SVB), Signature Bank (Signature), and First Republic Bank (First Republic) has turned the spotlight back on the resilience of the financial sector, the design of banking regulation, and the effects of bank failures on the economy. Much has been made of the government’s decision to ensure that depositors suffer no losses from these failures, even on their uninsured deposits. Although in the case of SVB and Signature, this bailout was achieved via a “systemic risk exception,” complete depositor bailouts are not uncommon: out of more than 500 bank failures after the collapse of Lehman Brothers in September 2008, in which the Deposit Insurance Fund bore losses, the FDIC imposed haircuts on uninsured deposits of fewer than 40 banks, accounting for a mere 5.5% of the assets held by the failed institutions.¹

A natural question that arises is how bank failures and the bailout of uninsured deposits affect firms’ investment and employment. The focus on firms’ outcomes is motivated by the observation that the two largest banks that failed—SVB and First Republic—catered their deposits mostly to firms, rather than households, and that the Federal Reserve stated that bailing out the uninsured deposits at SVB was meant to prevent many disruptions, including the objective to “minimize any impact on businesses [...] and the economy.”²

Specifically, we investigate how firms and the macroeconomy would have responded if the government had *not* bailed out uninsured depositors during the banking crisis of 2023. We focus on the implications that arise from the role of bank deposits as “safe assets” (Gorton and Pennacchi, 1990; Dang et al., 2017). Because bailouts affect the riskiness of deposits, the safety benefits of such assets influence firms’ production decisions and broader economic outcomes.

We answer this question in a quantitative general equilibrium model of financial regulation that builds on a growing literature (Van den Heuvel, 2008; Davydiuk, 2017; Begenau, 2020; Begenau and Landvoigt, 2021; Corbae and D’Erasmus, 2021; Elenev, Landvoigt and

¹We compute this number using FDIC data on bank failures. We measure the failed banks in which uninsured deposits take losses by considering those that have been resolved through “purchase and assumption of the insured deposits only” and “payout” (including the cases in which the FDIC established a Deposit Insurance National Bank to facilitate the payout process).

²See <https://www.federalreserve.gov/newsevents/pressreleases/monetary20230312a.htm>.

Van Nieuwerburgh, 2021; Dempsey, 2022). A common feature of these models, which we also incorporate in ours, is that deposit insurance and other government guarantees interact with banks' limited liability. The resulting moral hazard incentivizes banks to grow too large or take too much risk. We extend the model in [Pancost and Robatto \(2023\)](#)—the only quantitative general equilibrium model of banking regulation incorporating firms' deposits—by introducing uninsured deposits and the possibility of their complete bailouts at failed banks. Since the FDIC has consistently bailed out most uninsured deposits post-2008, we model our counterfactual as a reduction in the probability that the government bails out uninsured deposits, that occurs at the same time as a large shock to the rate of bank failures.

Our main result is that financial frictions that prevent firms from quickly adjusting their balance sheet and financial position ([Jermann and Quadrini, 2012](#)) counteract the negative impact of a reduction in the bailout of uninsured deposits. To understand this result, consider the extreme case where a firm is subject to large frictions that prevent it from distributing any dividends or repaying its debt for some time after a policy change. The reduction in bailouts makes deposits riskier, which in turn increases the attractiveness of alternative use of funds. However, because of the frictions, the main alternative is to increase the investments in physical capital, and with it, employment. Quantitatively, the tension is between the reduction in economic activity triggered by the lower safety of deposits and the effects of the financial frictions that prevent firms from quickly adjusting their balance sheet, thereby increasing investments and employment. In our quantitative assessment, these opposing forces offset each other, resulting in a negligible impact on the economy.

Our analysis begins by documenting some stylized facts about firms' and households' holdings of insured and uninsured deposits, using data from the FDIC, the Survey of Consumer Finances, and the Flow of Funds. We find that 79% of households' deposits are insured, and we indirectly estimate that only 43% of firms' deposits are insured. We then explain how the FDIC is allowed to bail out uninsured deposits despite its requirement to resolve failed banks using a “least-cost approach.” Besides their role in disciplining our model, the facts we document represent a contribution of our paper.

We then present the model. Firms face idiosyncratic risk, which induces volatility in their cash flow and the value of their productive assets. Deposits held by firms are beneficial

because they reduce such volatility, mitigating the negative effects of the idiosyncratic risk. In the event of a bank failure, firms know that their insured deposits are fully protected, and they are also aware that uninsured deposits are fully repaid with high probability.

In our quantitative assessment of the effects of bailouts, we simulate a shock that sharply increases bank failures, matching the 2023 bank failures, and we combine it with a policy change that reduces the bailout of uninsured deposits. We perform this experiment in two versions of the model. In a version with no frictions that prevent firms from quickly adjusting their balance sheets, large negative effects arise: output drops on impact by 0.3%, investments by 1.5%, and employment by 0.3%. In the full model with financial frictions calibrated to match the data, however, the effects on output and investments are an order of magnitude smaller, and employment increases—albeit the magnitude is very small. Overall, the full model displays a response that is economically negligible and effectively nil. In the long run, firms can fully adjust their balance sheet, and they reduce their size by holding fewer deposits. This reduction in deposits and the fewer safety benefits of the deposits they have left, in turn, dampen investments and labor demand and, at the macroeconomic level, output and wages, but the effects are again quantitatively very small.

Our current model does not include the possibility for firms to invest in financial assets other than deposits, but we are working to include the option to invest in other safe instruments such as Treasury securities. However, we note that if the supply of Treasury securities does not increase in response to shocks and other policy changes, all agents in the economy that hold deposits will likely increase their demand for Treasury debt. This should cause a decrease in Treasury yields, but little effects on agents' holdings of these assets. Hence, investing in physical capital will likely remain the main alternative use of funds for firms, and we expect little differences in our quantitative results.

We are conducting additional analyses using our model, and we plan to include the results in the next version of the paper. First, we currently do not compute the welfare effects of the reduction in the bailout probability. As the impact is limited, this policy change might be beneficial if it reduces banks' moral hazard generated by government guarantees and limited liability. Second, our framework can be used for a quantitative analysis of the optimal degree of deposit insurance.

Our work is closely related to [Dávila and Goldstein \(2023\)](#), who provide quantitative guidance for the determination of the degree of deposit insurance. There are, however, several important differences. We incorporate firms' deposits and the possibility of bailouts of uninsured deposits, and we frame the analysis in a quantitative, dynamic setting that gives rise to important novel distinctions between short- and long-run effects of policy changes. In addition, [Dávila and Goldstein \(2023\)](#) focus on bank runs in the tradition of [Diamond and Dybvig \(1983\)](#), whereas bank failures in our model are driven by fundamentals as in [Allen and Gale \(1998\)](#) and we focus on the role of deposits as safe assets.

Our paper is part of a growing literature related to the U.S. banking crisis of 2023. [Jiang et al. \(2023\)](#) show that banks' mark-to-market losses triggered by an increase in interest rates in 2022 are large and expose many banks to the risk of runs by uninsured depositors. Relatedly, [Orame, Ramcharan and Robatto \(2023\)](#) note that the balance-sheet regulations that allow banks to avoid marking to market their securities were introduced for macroprudential reasons, are akin to a reduction in capital requirements, and have a large impact on the pass-through of monetary policy onto bank lending. [Allen et al. \(2023a\)](#) build on [Allen et al. \(2023b\)](#) and estimate resolution costs for the FDIC of over \$200 billion if the banks identified by [Jiang et al. \(2023\)](#) were to fail, which is well in excess of its fund. [Cookson et al. \(2023\)](#) investigate social media's role in the run on SVB and the subsequent distress of other regional banks. [Drechsler et al. \(2023\)](#) show that the uninsured deposit franchise poses a risk management dilemma, as a bank cannot simultaneously hedge its interest rate and liquidity risk exposures.

2 Deposit insurance in the U.S.: Institutional details and stylized facts

We begin by providing some institutional details and stylized facts about the way deposit insurance is provided in the United States and the way the FDIC resolves failed banks. We focus the discussion on the elements that are relevant for firms' deposits and the bailouts

of uninsured deposits, which are the center of our analysis.³ Deposit insurance is slightly different for households on some important dimensions, but because the focus of this paper is on firms' deposits, we postpone the discussion of households' insured and uninsured deposits to the Appendix.

A firm's deposit account at a commercial bank is insured up to \$250,000. For each firm, the \$250,000 limit applies separately for each bank. Thus, in principle a firm can hold deposits at, say, two banks to obtain insurance up to twice the limit (i.e., \$500,000). In practice, however, firms do not seem to differentiate their deposit holdings across many banks, possibly because of transaction costs. Anecdotal evidence that became public after the collapse of SVB shows that some firms had very large deposit balances—some of them even on the order of billions of dollars.

To get a more precise estimate of firms' holdings of uninsured deposits, we perform the following analysis using data from the FDIC, the Survey of Consumer Finances (SCF), and the Flow of Funds. In the aggregate, only about half of the deposits of FDIC-insured institutions are uninsured—this figure has been relatively stable after 2013, when a temporary increase in deposit insurance associated with the 2008 financial crisis expired. We argue, however, that firms' share of uninsured deposits is higher. While we do not have direct data on firms' holdings of uninsured deposits, we draw indirect inference by removing households' insured and uninsured deposits from the aggregate figures. We estimate households' holdings of insured and uninsured deposits using the SCF, which provides detailed account-level data for households—including amount, bank, and ownership; see the Appendix for the technical details of the analysis. In 2019—the last year for which SCF data are available—uninsured deposits at FDIC-insured banks were 43% of the total, but households' holdings of uninsured deposits were only 21% of their total holdings. As a result, account holders other than households—including firms—had a larger-than-average share of uninsured deposits, namely, 57%. Besides firms, non-household holders include non-profit institutions, government agencies and local government, foreigners, and other financial institutions.

Next, we turn to the description of how bank failures are handled by the FDIC. When a

³The discussion in this section builds on the material available at www.fdic.gov/bank/historical/crisis/chap6.pdf, www.fdic.gov/deposit/deposits/international/guidance/, and www.fdic.gov/deposit/deposits/international/guidance/failedresolution.pdf.

bank fails, it is taken over by the FDIC, which then begins the resolution process.⁴ Typically, the FDIC can either sell the bank to another financial institution, or it can liquidate the bank. A sale could involve the whole bank or only some of its assets and liabilities, and can include an agreement in which the FDIC shares losses on certain assets with the acquirer.

The FDIC has to choose a resolution method that minimizes its costs, the so-called least-cost comparison, but such least-cost comparison has to be made only among a narrow set of alternatives. As we explain below, there are other alternatives—possibly cheaper—that the FDIC does not need to consider. During the resolution process, if other banks submit bids to purchase the whole bank or a fraction of its assets and liabilities, and if one of these bids is chosen, the cost for the FDIC has to be lower than what the FDIC would have experienced with the liquidation of the failed bank. The liquidation processes tend to be quite costly because the FDIC is not as efficient as the private sector at managing and liquidating banks' assets—especially as bank failures tend to be clustered in crisis times, in which liquidation of many banks would require the FDIC to quickly expand its staff. Hence, the resolution of failed banks since at least the 2008 financial crisis has mostly been conducted through sales to other financial institutions. The sale could include the transfer of all deposits, including the uninsured ones (i.e., “purchase and assumption”), or only the transfer of the uninsured deposits (“purchase and assumption of the insured deposits only”).

A key implication of the FDIC least-cost approach is that it allows for the full bailout of uninsured deposits. To clarify this point, consider the following simple example. Say the failed bank has \$100 million in deposits, of which \$60 million are insured and \$40 million are uninsured, assets with a liquidation value of \$80 million, and no other liabilities. Thus, the losses in this bank are \$20 million. Because the assets cover only 80% of the deposits, liquidation would imply a haircut on deposits of 20%, absent deposit insurance. With deposit insurance, if the bank is shut down and liquidated, the \$60 million in deposits are fully reimbursed by the FDIC, and a loss of $20\% \times \$60 = \12 million is borne by the FDIC. The 20% haircut is fully applied to uninsured deposits, so uninsured depositors bear the remaining loss of $20\% \times \$40 = \8 million. Say, however, that another bank bids to buy the failed one for \$10 million provided that it receives a \$10 million transfer from the FDIC.

⁴In the case of credit unions, the process is administered by the National Credit Union Administration.

The acquirer is willing to buy the whole bank, that is, purchase all assets and assume all deposits, including the uninsured ones (i.e., a purchase and assumption transaction).⁵ By selling the bank, the cost of the FDIC is only \$10 million, which is less than the \$12 the FDIC would have borne with the liquidation. Hence, the FDIC sells the failed bank, and the uninsured deposits are fully bailed out.

Note that the least-cost method process followed by the FDIC is different from a *strict* least-cost method. Under a strict least-cost method, uninsured deposits would bear a loss, and the FDIC and the possible acquirer would share the remaining losses, if any. Continuing with the example, a strict least-cost method would impose the \$8 million cost on the uninsured deposits, leaving the FDIC and the acquirer with sharing the remaining $\$20 - \$8 = \$12$ million in losses. As long as the acquirer is willing to pay \$2 million or more for the bank that does not include the uninsured deposits, the cost for the FDIC would be lower than the \$10 million that the deposit insurance fund would bear for the sale of the whole bank that does not impose losses on uninsured deposits.

Ultimately, whether the uninsured deposits are bailed out or not depends on whether the FDIC is able to find another bank that is willing to purchase the failed one and assume not only the insured deposits but also the uninsured ones. If a buyer is not found, the FDIC can also invoke the systemic risk exception, as it did in the case of SVB, to protect the uninsured deposits.

To incorporate the FDIC resolution process in our quantitative model, we assume that the government insures only a fraction of the deposits but, in case of a bank default, there is a probability that the uninsured deposits are fully bailed out and experience no losses.

3 Model

In this section, we describe our quantitative general equilibrium model which we use to construct the counterfactual dynamics under a reduced bailout probability. The model is an extension of Pancost and Robatto (2023) that allows for both partial deposit insurance and

⁵Acquirers might be willing to pay more than the assets' liquidation value because of the franchise value of the failed bank.

a positive probability that uninsured deposits at failed banks will be bailed out.

Time is discrete and infinite. There are four types of agents in the economy: firms, banks, households, and the government. Firms are subject to idiosyncratic risk and are run by a manager that holds an undifferentiated stake in the firm she runs. With some carefully chosen modeling assumption, the firms' building block of the model aggregates up to a representative firm, despite individual firms' size increases or shrinks depending on the realization of idiosyncratic risk. This feature keeps the model tractable and allows us to combine (i) rich firms' dynamics with (ii) banks and financial regulation, in (iii) a general equilibrium setting. The last feature is particularly important to recover the effects of shocks and policy changes that operate through prices such as the return on deposits or wages, in line with the arguments in [Begenau \(2020\)](#) and [Pancost and Robatto \(2023\)](#).

Before describing the model in details in the next sections, we highlight the main novel elements of the model. We focus on how we model deposit insurance and the possible bailouts of uninsured deposits.

To maintain the analysis tractable, we assume that the government insures a fraction ϕ of firms' deposits and a fraction ϕ^h of households' deposits. Assuming that deposit insurance applies to a fraction of deposits is necessary to make sure that the firms' side of the model aggregates up to a representative firm. In work in progress, we are working to relax this assumption to model the fact that deposit insurance is, in practice, provided up to a dollar limit.

To model the possible bailout of uninsured deposits, and in line with the discussion of [Section 2](#), we assume that in the event of a bank failure, uninsured deposits are bailed out with probability f (i.e., they are fully repaid), whereas they are subject to a haircut that depends on the failed banks' recovery rate with probability $1-f$. The probability f is a simple way to capture the various elements that lead the FDIC to use a resolution methods that guarantee the full repayment of uninsured deposits. In our main counterfactual experiment, we reduce f to simulate a scenario in which the FDIC suddenly and unexpectedly reduces the probability of bailing out uninsured deposits.

Bailouts and deposit insurance are distinct policies from the point of view of depositors who are unable to perfectly diversify across banks. In particular, if banks fail with probability

p_t , the return on deposits held by a firm is a random variable \hat{R}_t^d given by⁶

$$\hat{R}_t^d = \begin{cases} R_{t-1}^d & \text{with probability } 1 - p_t + p_t f \\ R_{t-1}^d [\phi + (1 - \phi)(1 - \nu_t)] & \text{otherwise.} \end{cases} \quad (1)$$

To understand this expression, note that banks in our model offer a promised return R_{t-1}^d , but such return is paid if the bank does not fail (i.e., with probability $1 - p_t$) or, conditional on failure, if the uninsured deposits are bailed out (i.e., with probability $p_t f$). Otherwise, if the bank fails and the uninsured deposits are not bailed out, the firm experiences a losses on its deposits. The fraction ϕ of deposits that are insured are fully repaid, but the fraction $1 - \phi$ that is uninsured is subject to an haircut ν_t that is determined endogenously and depends on the liquidation value of the failed bank's assets; see equation (16) in Section 3.5.

The risk inherent in equation (1) between earning the promised rate R_{t-1}^d and the reduced, failed-bank rate $R_{t-1}^d [\phi + (1 - \phi)(1 - \nu_t)]$ is idiosyncratic: any depositor who is fully diversified across banks will only care about the average return on deposits

$$R_{t-1}^d \left(1 - p_t + p_t [\phi + (1 - \phi) f + (1 - \phi)(1 - f)(1 - \nu_t)] \right) \quad (2)$$

which, in the case of either full deposit insurance ($\phi = 1$) or guaranteed bail-outs ($f = 1$) is simply R_{t-1}^d . The three terms multiplying p_t reflect the three things that can happen at failed banks. That is, for each dollar of deposit, a fraction ϕ is insured, with probability f the remaining $1 - \phi$ fraction is bailed out, and with probability $1 - f$ the remaining $1 - \phi$ fraction is hit with the haircut ν_t .

If all depositors could diversify across banks, the distinction between deposit insurance ϕ and bailouts f would not matter in equilibrium: investors would only care about the average deposit return given by equation (2). Changes in ϕ or f would result in exactly-offsetting changes in the equilibrium promised rate R_{t-1}^d and, thus, would have no real effects.

However, we assume that firms cannot diversify their deposits across banks. As discussed in Section 2, anecdotal evidence shows that many firms had massive deposit accounts at SVB

⁶For households, the expression is the same but with the term ϕ^h to capture the fraction of uninsured households' deposits, which can be different from the fraction ϕ for firms.

and other banks that failed; the most notable example is Roku, which had almost \$500 million in deposits at SVB (Maruf, 2023). More generally, we have estimated in Section 2 that 57% of firms’ deposits in the U.S. are uninsured. Because firms are also subject to uninsurable idiosyncratic risk that affect their productive assets and their output, the idiosyncratic risk inherent in equation (1) matters for firms’ decisions and affects firms’ investments and labor demand.

3.1 Firms

There is a continuum of firms in the economy that are subject to multiple sources of risk: aggregate risk that affects their output, idiosyncratic risk that affects output and their productive assets, and idiosyncratic risk arising from the possibility that the a firm’s bank defaults and its uninsured deposits are not bailed out. As discussed at the beginning of Section 3, each firm is run by a manager that holds an undifferentiate stake in the firm she manages. Shareholders (i.e, households) hold shares in all the firms in the economy and, thus, are not directly impacted by the firms’ idiosyncratic risk.

As in Pancost and Robatto (2023), we assume that shareholders (i.e., households) decide the firms’ dividend policies, whereas managers are in charge of all other firms’ decisions. This is motivated by the results of La Porta et al. (2000), who find that dividend policies in countries with good legal protections—such as the United States—are consistent with shareholders’ preferences.

At time t , the manager running firm i oversees an amount a_t^i of firms’ assets, which are allocated to productive investments (i.e., physical capital) or bank deposit

$$k_t^i + d_t^i \leq a_t^i. \tag{3}$$

The promised return on deposits is R_t^d . However, if the bank where the deposits are held fails at $t + 1$, some deposits might be subject to losses. As discussed in Section 3, we assume that a fraction ϕ of deposits are insured, and that a fraction $1 - \phi$ are uninsured. In case of bank failure, the uninsured deposits are bailed out anyway with probability f . If the uninsured deposits are not bailed out (i.e., with probability $1 - f$), they are subject to an haircut ν_{t+1} .

The manager also borrows b_t^i from banks, in the form of a loan with interest rate r_t subject to the borrowing constraint

$$b_t^i \leq \xi k_t^i, \quad (4)$$

with $0 < \xi < 1$. Bank loans are used for productive investments, so that the total physical capital used for production by firm i is $k_t^i + b_t^i$.

At $t + 1$, after the realization of aggregate productivity A_{t+1} , the manager chooses labor l_{t+1}^i with wage w_{t+1} , and then production takes place. Output is given by

$$y_{t+1}^i = A_{t+1} z_{t+1}^i (k_t^i + b_t^i)^\gamma (l_{t+1}^i)^{1-\gamma}$$

where z_{t+1}^i is a firm-specific, idiosyncratic productivity shock taking value z^L and z^H with probability $1 - p_z$ and p_z . The idiosyncratic shock z_{t+1}^i is realized after all firms' decision about physical capital and labor have been made. That is, the amount $r_t b_t^i$ that the firm has to repay to the bank and the wage bill $l_{t+1}^i w_{t+1}$ cannot be made contingent on the realization of z_{t+1}^i .

After production, the total amount of resources available to the firm is

$$x_{t+1}^i = y_{t+1}^i + (1 - \delta) z_{t+1}^i k_t^i - w_{t+1} l_{t+1}^i - r_t b_t^i + \hat{R}_{t+1}^d d_t,$$

where \hat{R}_{t+1}^d is the realized return on deposits defined in Equation (1). We make two observations about x_{t+1}^i . First, capital k_t^i is also hit by the idiosyncratic shock z_{t+1}^i , making it a risky asset. Second, we assume that \hat{R}_{t+1}^d is realized after production takes place (i.e., the firm learns whether its bank default and its uninsured deposits are subject to losses after the realization of the idiosyncratic shock z_{t+1}^i), so that the manager's hiring decision choices are made while there is still uncertainty about the realized return on deposits.

The wealth x_{t+1}^i is then used for external payouts or retained inside the firm. Specifically, a fraction α_{t+1}^i of wealth is paid out as dividends to shareholders and compensation to the manager, and a fraction $1 - \alpha_{t+1}^i$ is retained. Thus, we have

$$\pi_{t+1}^i + c_t^i \leq \alpha_{t+1}^i x_{t+1}^i.$$

The funds retained in the firm and carried to the next period are

$$a_{t+1}^i = (1 - \alpha_{t+1}^i) x_{t+1}^i - \frac{\varphi}{2} x_{t+1}^i (\alpha_{t+1}^i - \bar{\alpha})^2, \quad (5)$$

where the term $\frac{\varphi}{2} x_{t+1}^i (\alpha_{t+1}^i - \bar{\alpha})^2$ denotes a dividend adjustment cost (Jermann and Quadrini, 2012).

The manager is compensated, at $t + 1$ with a fixed component that is proportional to firms' size at t , a_t^i (i.e., a compensation that does not depend directly on the choices taken by the manager), and through an equity stake that allows her to earn a fraction of the dividends. Hence, the manager compensation at $t + 1$ is

$$c_{t+1}^i = \kappa [\theta_f a_t^i + \theta_e \alpha_{t+1}^i x_{t+1}^i]. \quad (6)$$

The parameter κ scales the total compensation, and the parameters θ_e and θ_f govern the relative importance of the fixed and equity compensation.⁷

Managers' objective function is to maximize their stream of utility from consumption. We assume that managers have log utility, although we note that the analysis remain tractable if managers have a more general CRRA utility—in future drafts, we plan to extend the analysis to a general CRRA utility to more precisely calibrate the managers' risk aversion. The manager of firm i solves

$$V_t^m(a_t^i) = \max_{k_t^i, a_t^i, b_t^i} \beta E_t \left\{ \max_{l_{t+1}^i} \log c_{t+1}^i + V_{t+1}^m(a_{t+1}^i) \right\}$$

where c_{t+1}^i is given by (6) and a_{t+1}^i is given by (5).

We can now characterize the manager's choices. We conjecture that the borrowing constraint (4) is binding, and we verify it numerically in our simulations. The optimal choices of the manager are proportional to firms' wealth, that is, $k_t^i = \phi_t^k a_t^i$ and $l_t^i = \phi_t^l a_t^i$, where ϕ_t^k and ϕ_t^l are independent of a_t^i and, thus, the same for all managers, and solve the first-order

⁷We can also add an option-like component to the manager compensation, as in Glover and Levine (2017). However, as shown by the Online Appendix in Pancost and Robatto (2023), the option compensation (as well as the fixed compensation) have limited affects on firms' choices if calibrated to match the data.

conditions

$$\mathbb{E}_{z, \hat{R}^d} \left\{ \Lambda_t^m \left[(1 - \gamma) A_t z_t^i (1 + \xi)^\gamma \left(\frac{\phi_{t-1}^k}{\phi_t^l} \right)^\gamma - w_t \right] \right\} = 0$$

and

$$\mathbb{E}_t \left\{ \Lambda_{t+1}^m \left[\gamma A_{t+1} z_{t+1}^i (1 + \xi)^\gamma \left(\frac{\phi_{t+1}^l}{\phi_t^k} \right)^{1-\gamma} + z_{t+1}^i (1 - \delta) - r_t \xi - \hat{R}_{t+1}^d \right] \right\} = 0,$$

where Λ_t^m is the manager's marginal utility of consumption, given by

$$\Lambda_t^m = \frac{\theta_e \alpha_t^i}{\theta_f + \theta_e \alpha_t^i R_t^i(\phi_{t-1}^k, \phi_t^l)} + \frac{\beta}{1 - \beta} \frac{1}{R_t^i(\phi_{t-1}^k, \phi_t^l)}.$$

and $R_t^i(\phi_{t-1}^k, \phi_t^l)$ is the return on the wealth a_t^i of firm i :

$$R_{t+1}^i(\phi_t^k, \phi_t^l) = A_{t+1} z_{t+1}^i [\phi_t^k (1 + \xi)]^\gamma (\phi_{t+1}^l)^{1-\gamma} - w_{t+1} \phi_{t+1}^l - r_t \xi \phi_t^k + z_{t+1}^i (1 - \delta) + \hat{R}_{t+1}^d (1 - \phi_t^k).$$

The choices of deposits is also proportional to a_t^i and, using the budget constraint (3), is given by $d_t^i = a_t^i (1 - \phi_t^k)$.

A key feature of the results is that the manager's choices are independent of the parameter κ that scales the level of the compensation paid to the manager. For our quantitative analysis, we consider the limit as $\kappa \rightarrow 0$, implying that all the resources devoted to consumption are consumed by households. This is motivated by the fact that the fraction of managers in the economy is small, relative to overall size of the population. In addition, this assumption facilitates our work in progress in which we perform welfare and policy analyses, as we can evaluate total welfare in the economy by focusing only on the welfare of households.

3.2 Banks

We assume that a continuum of banks are founded each period t with equity n_t ; each bank borrows deposits $d_t = d_t^h + d_t^f$ from firms and households (where d_t^f and d_t^h are the firms' and households' deposits, respectively), and invests in loans to firms b_t . The returns from banks' investment are subject to idiosyncratic shocks, which are meant to capture the fact that banks are unable to perfectly diversify their investments, so that some banks face losses

on their own investments. In particular, because banks are subject to limited liability, some banks fail each period.

Each bank lends its physical capital b_t to firms, and after production takes place at $t + 1$, firms return the undepreciated fraction $1 - \delta$ plus a return r_t . The resources $b_t(1 - \delta + r_t)$ returned by firms are then hit by the idiosyncratic shock ε , which is distributed according to the cumulative distribution function $F_{t+1}(\varepsilon)$, with $E(\varepsilon) = 1$. We assume that $F_t(\varepsilon)$ is lognormal with time-varying variance σ_t ; see Section 3.6 for the specification of the law of motion of σ_t .

As a result, banks' profits at $t + 1$ are given by the cash flow $\varepsilon b_t(1 - \delta + r_t)$ net of the repayment $R_t^d d_t$ to depositors, where R_t^d is the gross return on deposits. Thus, banks solve the problem

$$\max_{b_t, d_t} E_t \int_{\underline{\varepsilon}_{t+1}}^{\infty} \{\varepsilon b_t(1 - \delta + r_t) - R_t^d d_t\} dF_{t+1}(\varepsilon) \quad (7)$$

subject to the budget and capital requirement constraints:

$$b_t = d_t + n_t \quad (8)$$

$$n_t \geq \zeta b_t. \quad (9)$$

where ζ is the capital requirement, and $\underline{\varepsilon}_{t+1} \equiv \frac{R_t^d d_t}{b_t(1 - \delta + r_t)}$ is the threshold of the idiosyncratic shock ε below which a bank defaults. Because the return on deposits will always be less than the return on bank's capital, the capital requirement constraint (9) will always be binding.

To characterize the return on equity, we note that households can diversify their equity holdings across banks, and failed banks return zero to their equity holders. Thus, the return on bank equity R_{t+1}^n is given by

$$R_{t+1}^n = \frac{1}{n_t} \int_{\underline{\varepsilon}_{t+1}}^{\infty} \{\varepsilon b_t(1 - \delta + r_t) - R_t^d d_t\} dF_{t+1}(\varepsilon). \quad (10)$$

When a bank fails, it is taken over by the government, which repays insured deposits and might or might not bailout uninsured deposits. The fraction p_{t+1} of banks that fail at time $t + 1$ is given by

$$p_{t+1} = \int_{-\infty}^{\underline{\varepsilon}_{t+1}} dF_{t+1}(\varepsilon). \quad (11)$$

The details of the resolution process of failed banks is described in Section 3.5.

3.3 Households

Households are infinitely-lived agents who consume c_t , save in the form of bank equity n_t and deposits d_t^h , and supply labor l_t . As in Van den Heuvel (2008) and Begenau (2020), households gain some direct utility from their deposit holdings. To maintain the representative agent framework and thus the tractability of the model, we follow Gertler and Kiyotaki (2015) by assuming that each household consists of a large “family” in which each member has access to a deposit account at a specific bank in the economy. Family members with deposits at a bank that does not fail or that is bailed out benefit from the liquidity value of deposits (in the form of a utility benefit) whereas members with accounts at banks that fail do not get any liquidity value. In addition, because the members pool their wealth at the end of the period, they are effectively risk-neutral with respect to the idiosyncratic risk that affects the return on deposits. In work in progress, we are considering how to relax this assumption to expose households to the risk that their uninsured deposits are not bailed out.

Households own both banks and firms; from the former they receive a return R_{t+1}^n on their holdings of bank equity, while from the latter they receive a fraction of total firm wealth α_t as a dividend. As discussed in Section 3.1, households’ choose the firms’ dividend policies α_t^i in their role as firms’ shareholders. A household that starts with wealth a_t^h solves the problem

$$V_t^h(a_t^h) = \max_{c_t, l_t, n_t, d_t^h, \{\alpha_t^i\}, l_t} \frac{c_t^{1-\gamma_c} - 1}{1 - \gamma_c} + \hat{\psi}_{t+1} \frac{(d_t^h/c_t)^{1-\gamma_d}}{1 - \gamma_d} - \chi \frac{l_t^{1+\frac{1}{\eta}}}{1 + \frac{1}{\eta}} + \beta E_t \{V_{t+1}^h(a_{t+1}^h)\} \quad (12)$$

where γ_c , γ_d , and η parameterize risk aversion, the curvature of the deposit utility benefits, and the Frisch elasticity of labor supply, respectively, and $\hat{\psi}_{t+1} = \psi(1 - p_{t+1} + p_{t+1}f)$ is the product of a the parameter ψ that governs the utility benefit of deposits and the fraction of banks at which deposits are fully repaid (i.e., the fraction $1 - p_{t+1}$ of banks that do not fail, and the fraction $p_{t+1}f$ of banks that fail but at which uninsured deposits are bailed out). The term $\hat{\psi}_{t+1}$ captures the assumption, discussed above, that only family members with deposits at banks that do not fail or that are bailed out receive the liquidity benefits

of deposits. The problem is subject to the budget constraint

$$c_t + n_t + d_t^h \leq a_t^h + w_t l_t + \pi_t^f - T_t \quad (13)$$

and the law of motion of wealth

$$a_{t+1}^h = n_t R_{t+1}^n + d_t^h \hat{R}_{t+1}^d + T_{t+1}^{acq}. \quad (14)$$

At time t , the household has access to its wealth a_t^h , its labor income $w_t l_t$, and the profits received from firms π_t^f , net of the lump-sum taxes T_t paid to the government. These resources are allocated to consumption c_t , deposits d_t^h , and investment in bank equity n_t . Wealth at $t + 1$, a_{t+1}^h , is the sum of the gross return on banks' equity $n_t R_{t+1}^n$ and deposits $d_t^h R_{t+1}^d$, plus the lump-sum transfers T_{t+1}^{acq} that represent the profits generated by the purchase of banks that are liquidated at a fire-sale value (see Section 3.5).

3.4 Labor Market

To produce accurate short-term dynamics in the labor market, we introduce wage rigidities in line with the evidence provided by the macro-labor literature (Shimer, 2005; Gertler and Trigari, 2009; Gertler, Huckfeldt and Trigari, 2020). We assume that households supply labor in a competitive market, but wages are rigid and adjust slowly over time according to the formulation

$$w_t = \omega w_{t-1} + (1 - \omega) w_t^f. \quad (15)$$

The parameter ω indexes the degree to which wages are sluggish and depends on last period's wages w_{t-1} , and w_t^f is the flexible wage that would prevail absent wage rigidities and that is determined by the households' first-order condition

$$w_t^f \Lambda_t = \chi l_t^{1/\eta},$$

where Λ_t is the households' marginal utility of consumption. The formulation in Equation (15) is similar to the one that Gertler, Huckfeldt and Trigari (2020) derive in a framework

in which wage rigidities are microfounded through infrequent renegotiations.

3.5 Government

Along the lines of the literature that studies financial regulation in quantitative general equilibrium models, we assume that the government consists of a bank resolution mechanism that is financed by lump-sum taxes. Our novelty is that when a bank fails and is taken over by the government, only a fraction of the deposits are repaid—as opposed to all the deposits as in other papers in the literature. Specifically, the government pays off the insured deposit and, in addition, bails out the uninsured deposits with probability f .

We model the bank resolution mechanism along the lines of how the FDIC resolves failed banks in practice. As noted in Section 2, a failed bank can either be liquidated or sold to another bank. If a liquidation occurs, the FDIC reimburse insured deposits immediately and it becomes one of the claimant of the resources recovered through the liquidation of the assets, together with uninsured deopists (and possibly other liability holders). The FDIC and uninsured deopsits have the same priority, meaning that losses must be shared equally by these two groups of claimants. If a bank is sold, uninsured deposits might or might not be guaranteed.

In the model, we define ν_{t+1} to be the haircut imposed on the uninsured deposits that are not bailed out. We assume that the haircut is the same for all the banks that fail, that is, as if we were considering an “average” failed bank. Given the above discussion about the resolution of failed banks, we have

$$(1 - \nu_{t+1}) \int_{-\infty}^{\varepsilon_{t+1}} R_t^d d_t dF_{t+1}(\varepsilon) = \int_{-\infty}^{\varepsilon_{t+1}} \varepsilon b_t (1 - \delta + r_t - \mathcal{Y}^{tot}) dF_{t+1}(\varepsilon), \quad (16)$$

where \mathcal{Y}^{tot} captures the bankruptcy cost associated with the liquidation of a failed bank. As discussed below, however, we will assume that only a fraction of such costs are deadweight losses for the society, and we will parameterize such losses with $\mathcal{Y}^{dwl} \leq \mathcal{Y}^{tot}$. The difference between the bankruptcy costs \mathcal{Y}^{tot} and the deadweight losses \mathcal{Y}^{dwl} represents a gain for the acquirer of the failed banks (Granja, Matvos and Seru, 2017) which are then redistributed lump-sum to households; see the term T_{t+1}^{acq} in Equation (14).

Finally, any remaining loss is borne by the government, which finances its operations through lump-sum taxes. Thus, the government budget constraint is given by

$$T_{t+1} = \nu_{t+1} \left[\phi + (1 - \phi) f \right] \int_{-\infty}^{\varepsilon_{t+1}} R_t^d d_t dF_t(\varepsilon), \quad (17)$$

where the left-hand side is the total amount collected from households through taxes, and the right-hand side is the total amount paid to depositors at failed banks to make insured deposits whole and to bailout a fraction f of uninsured deposits at failed banks.

3.6 Aggregate risk

There are two aggregate shocks in the model: the productivity of firms, A_t , and the variance σ_t of the idiosyncratic bank shock ε . We assume that these two variables follow a VAR(1) process in logs:

$$\begin{bmatrix} \log A_t \\ \log \sigma_t \end{bmatrix} = (\mathbf{I} - \boldsymbol{\rho}) \begin{bmatrix} \log \bar{A} \\ \log \bar{\sigma} \end{bmatrix} + \boldsymbol{\rho} \begin{bmatrix} \log A_{t-1} \\ \log \sigma_{t-1} \end{bmatrix} + \boldsymbol{\Sigma} \vec{\varepsilon}_t, \quad (18)$$

where $\bar{A}, \bar{\sigma} > 0$, $\boldsymbol{\rho}$ is a 2×2 matrix of drift parameters, $\boldsymbol{\Sigma}$ is a 2×2 positive definite covariance matrix, and $\vec{\varepsilon}_t \sim \mathbb{N}(\vec{0}, \mathbf{I})$ is a 2×1 standard normal random vector.

3.7 Aggregate resource constraint and deadweight losses of bank default

When describing the resolution of failed banks in Section 3.5, we introduced a default cost Υ^{tot} that reduces the recovery value of the assets of failed banks; see Equation (16). A fraction $\Upsilon^{dwl} \leq \Upsilon^{tot}$ of the assets of the failed bank is a deadweight loss that reduces the resources available to the society. The aggregate resource constraint is given by

$$c_t + i_t + \Upsilon^{dwl} \int_{-\infty}^{\varepsilon_t} b_{t-1} dF_t(\varepsilon) + \frac{\varphi}{2} x_t (\alpha_t - \bar{\alpha}) \leq A_t (k_{t-1} + b_{t-1})^\gamma l_t^{1-\gamma}. \quad (19)$$

The left-hand side includes, in addition to the deadweight losses of default, consumption c_t , investments $i_t = (k_t + b_t) - (1 - \delta)(k_{t-1} + b_{t-1})$, and the dividend adjustment costs. In our quantitative analysis, we follow the standard practice of defining the gross domestic product as the sum of consumption and investments.

4 Calibration and simulation

We now calibrate the model and simulate it using standard perturbation methods. We then conduct our main counterfactual analysis in Section 5, in which we ask what would have happened had regulators not bailed out uninsured deposits during the banking crisis of 2023.

In this version of the model, we calibrate the model with only the shock to aggregate productivity. Hence, we set the variance of the shock to σ_t to zero. In work in progress, we are extending the calibration to include both shocks to aggregate productivity and to σ_t .

Table 1 presents the value of the parameters that we use for our quantitative analysis. We set each period in the model to be one year.

The top panel of Table 1 include the parameters that are pre-set based on values commonly employed in the literature or external evidence. We further divide these parameters in two sets. First, we follow the calibration in Pancost and Robatto (2023) to set the values of η , β , δ , $\bar{\alpha}$, θ_e , γ , γ_c , ρ_A , ζ , θ_f , γ_d , and κ , and we normalize \bar{A} , $E\{z^i\}$, and χ to one. Second, we use the evidence discussed in Section 2 to set the bailout probability f to 94.5%, the share of insured firms' deposits ϕ to 43%, and the share of insured households' deposits ϕ^h to 79%. To set the liquidation costs and the deadweight losses of bank default, we follow the approach of Elenev, Landvoigt and Van Nieuwerburgh (2021) and use the evidence in Bennett and Unal (2015) to set the liquidation cost parameter \mathcal{Y}^{tot} to 15.79% and the deadweight loss parameter \mathcal{Y}^{tot} to 4.5%, based on data about the total resolution costs and the total receivership expenses of failed banks, respectively, weighted by assets.

The bottom panel of Table 1 lists the value of the parameters that are chosen to match selected data moments. These moments are computed using U.S. data from 1986 to 2010; see Pancost and Robatto (2023) for details. We begin our sample in 1986 because most regulations that prevented banks from paying interests on their deposits were phased out

Panel A: Pre-Set Parameters					
Parameter	Value	Parameter	Value	Parameter	Value
η	1	γ	0.3	\bar{A}	1
β	0.95	γ_c	3	$E\{z^i\}$	1
δ	0.1	ρ_A	0.95	χ	1
$\bar{\alpha}$	0.05	ζ	0.08	γ_d	1.4
θ_e	1	θ_f	0.0297	κ	0
f	0.945	ϕ	0.43	ϕ^h	0.79
γ^{tot}	0.1579	γ^{dwt}	0.045		

Panel B: Parameters chosen to match data moments			
Parameter	Value	Moment Target	Moment Value
z^l	0.772	Deposit premium, $R^f - R^d$	1.12%
ξ	0.3002	Deposits-to-GDP ratio	0.43
$\bar{\sigma}$	0.03385	Average bank default rate	0.61%
ω	0.51	Vol(employment)/vol(GDP)	0.58
σ_A	0.0172	Volatility log GDP	1.75%
ψ	0.002525	Fraction of households' deposits	66.4%
p_z	0.9235	Continuers employment growth	2.50%
φ	1.525	Vol(firm deposits)/vol(GDP)	3.49

Table 1. Calibrated Parameter Values. All volatilities are computed by taking logs and applying the HP-filter with parameter 100, both in the model and in the data.

by 1985 (Gilbert, 1986), and end it in 2010 because Dodd-Frank was signed that year, resulting in large regulatory changes. Note that we calibrate the model to the level of capital requirement that was prevalent before Basel III (i.e., $\zeta = 8\%$), but when we run our counterfactual analysis in Section 5, we increase the capital requirement to match the level of equity that banks had in 2022 in order to interpret our counterfactual in relation to the 2023 U.S. banking crisis.

5 Counterfactual analysis: The 2023 banking crisis and the reduction in bailout probability

Our main objective is to show what would have happened had regulators not bailed out uninsured deposits during the banking crisis of 2023. We thus use the calibrated model to compute the impulse responses to two shocks: a *default shock* that increases the default rate of banks, to produce the 2023 banking crisis, and a *reduced bailout shock* that permanently lowers the probability f that the government bails out the uninsured deposits of failed banks.

We include the default shock in all our experiments, but we include the reduced bailout shock only in some of them. This allows us to gauge the effects of what would have happened with or without the change in bailout probability. Finally, we run some experiments in which we shock a version of the economy in which we set the dividend adjustment cost φ to zero, to highlight the key role played by this friction.

5.1 The magnitude of the default and reduced bailout shocks

To produce the 2023 banking crisis in the model, we proceed as follow. First, as discussed in Section 4, we increase the capital requirement ζ from the original 8% value used in the calibration to 9.34%, based on FDIC data at the end of 2022.

We then subject the economy to the following default shock. Starting from the economy in steady state, we set the second element of $\bar{\varepsilon}_t$ (i.e., the shock to σ_t) to 0.52, inducing the failure of 3.7% of banks in the economy (weighted by assets). We choose this value to match the failure that took place in the first quarter of 2023 (which account for 2.3% of the assets of FDIC-insured banks) as well as half of the at-risk banks identified by Allen et al. (2023a) (which account for 1.35% of the assets of FDIC-insured banks). The set of at-risk banks identified by Allen et al. (2023a) is very similar to that of Jiang et al. (2023). We add the at-risk banks because our paper is been written in June 2023, and the model is calibrated at yearly frequency. Hence, setting the value of the shock to match only the first-quarter bank failures is likely to provide an underestimation of the effects. In comparison to bank failure in recent times, the 3.7% figure we use is the highest since at least 1986 but is similar

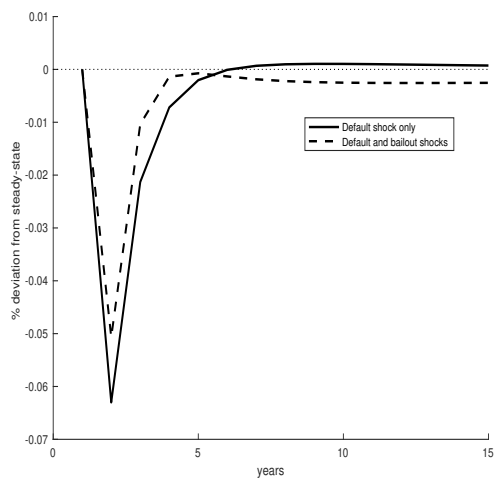
in magnitude to the 3.5% figure observed in 1989, at the peak of the S&L crisis. We set the autocorrelation of σ_t to 0.6. With this value, the default rate drops below 0.5% three years after the shock—in the data, the default rate is below 0.5% in non-crisis times (i.e., outside the 2008 and S&L crisis years; see [Pancost and Robatto, 2023](#)).

Disciplining the shock to the probability that insured deposits are bailed out, f , is subject to a higher degree of freedom. The calibrated value of f , which is 94.5%, arises as the byproduct of institutional features such as legal restrictions that the FDIC is subject to and the design of the process through which the FDIC sells failed banks. We consider a shock that reduces f to one-third of its initial value, that is, the shock reduces f from 94.5% to 31.5%. This choice is consistent with the counterfactual we want to run: if uninsured deposits at the banks that failed in 2023 had not been bailed out, the ratio of banks receiving a bailout of uninsured deposits in the data would have dropped from 94.5% to about 35%, considering bank failures weighted by assets from mid-September 2008 until the end of the first quarter of 2023.

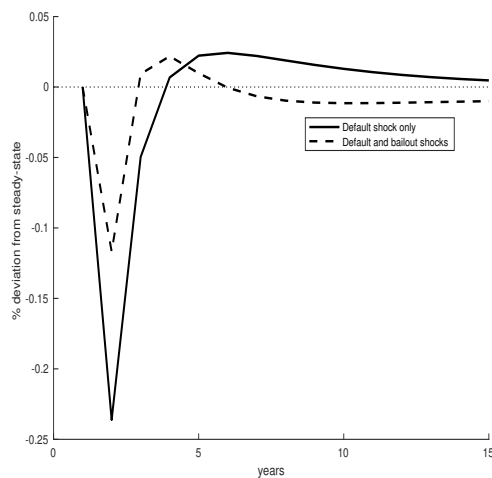
5.2 Results

In [Figure 1](#) we compute the dynamic responses of output, investment, employment, and consumption in two cases. First, the solid line shows the results of an economy that is subject to the default shock, but in which regulators keep the bailout rate of uninsured deposits $f\%$ unchanged. Second, the dotted line considers the case in which the default shock is coupled with a permanent reduction of the probability f that uninsured deposits will be bailed out in the event of a bank failure.

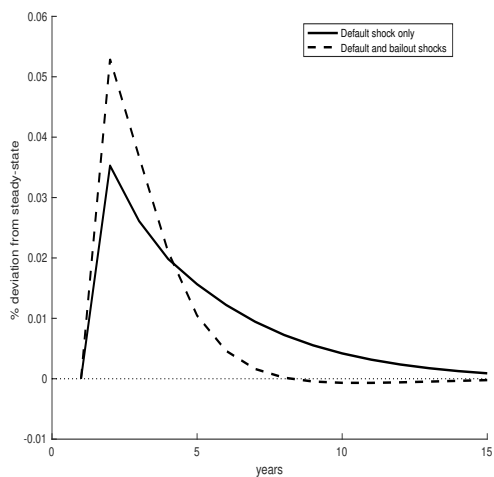
The shock to bank failure rates, on its own, induces a very mild recession in this economy. Output and consumption drop by about 0.06% and 0.02% on impact, reverting slowly back to their original levels. The drop in investment is larger at -0.25%. Employment actually increases by about 0.03%. The increase in employment arises because the default shock produces deadweight losses that reduce the resources available in the economy, and similar to standard real business cycle (RBC) models, the response of households is to decrease both consumption and leisure (i.e., increase employment) because they are both normal goods. Overall, these effects are very small. The deadweight losses from default have an impact



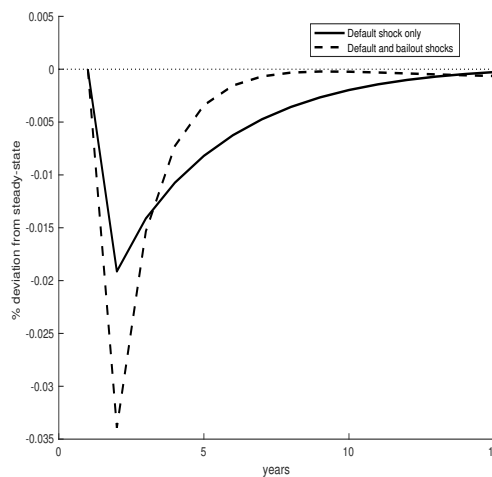
(a) Output



(b) Investment



(c) Employment



(d) Consumption

Figure 1. Response to the default and reduced bailout shocks

The figure plots the dynamics of output (top left panel), investment (top right panel), and employment (bottom left panel), and consumption (bottom right panel) in percent deviations from steady state. The solid lines in each figure plot the dynamics for the baseline case where there is only a shock that increases the probability of bank default; the dotted lines plots dynamics with the shock that increases the probability of bank default and the shock that permanently reduces the probability f that uninsured deposits are bailed out.

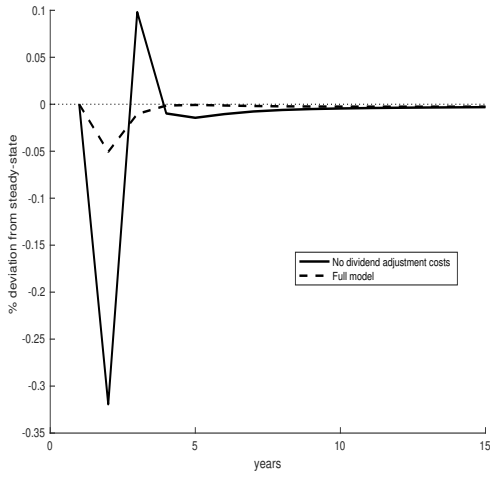
on the economy, but because the default rate is slightly less than 4% and deadweight losses are 4.5%, such losses are not large. In addition, because the bailout probability is set at $f = 94.5\%$, the bank failures have little impact on the safety of deposits.

When we add the reduced bailout shocks to the default shocks (dotted lines in Figure 1), we observe that the reduction in the bailout probability f dampens the effects of the default shocks on output and investments but amplifies those on employment and consumption. To understand these results, consider the effects relative to the baseline case with only the default shock. Firms' investments increase, and such an increase is financed at the economy-wide level through lower consumption and an increase in labor.

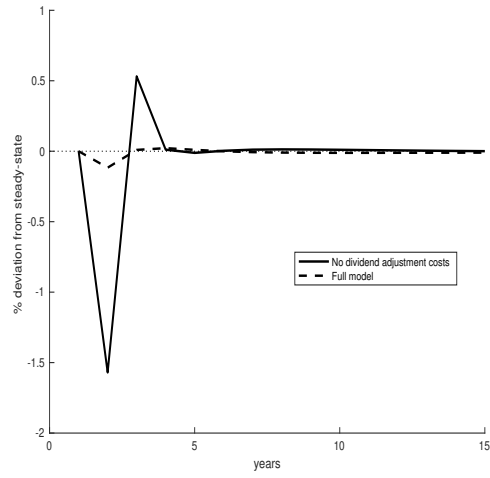
The higher investments when the economy is subject to both shocks is the result of a shift of firms' resources from deposits to productive capital. After production, firms' resources can be paid out as dividends, saved in the form of deposits, or invested in productive capital. However, because of the dividend adjustment cost (Jermann and Quadrini, 2012), most resources are kept inside the firms. Hence, because the negative shock to f makes deposits less attractive, firms redirect some of their resources toward investments.

We observe that without the dividend adjustment cost, the model would produce a too-low volatility of firms' deposits. The adjustment cost, by reducing the volatility of dividends, increases that of resources that are held inside the firms as deposits, and we calibrate it to match the volatility of firm deposits in the data. We also note that our model does not have adjustment costs to physical capital k_t , because it generates a volatility of investments that is close to but less than the data (3.17 in the model versus 3.77 in the data).

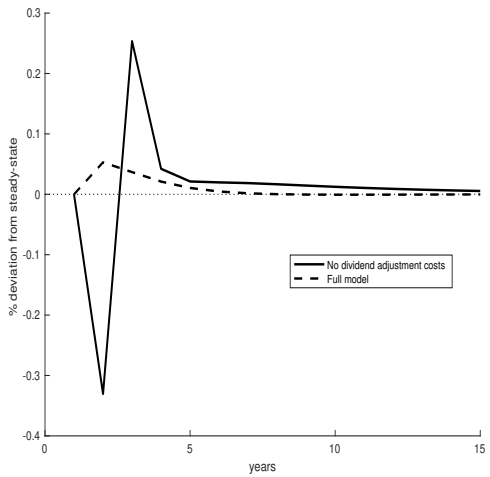
To see the importance of the dividend adjustment costs in driving the dynamic of investments, Figure 2 plots the response to the default and bailout shocks for both the full model (i.e., with the dividend adjustment cost calibrated at $\varphi = 1.525$) and a version of the model in which we shut down the dividend adjustment cost (i.e., $\varphi = 0$). The solid line shows the results of the model with no dividend adjustment costs. The economy experiences a substantial reduction of output on impact (-0.3%) as well as of investments (-1.5%) and labor (-0.3%). The dotted lines show the results in the full model that includes the adjustment costs. The presence of adjustment costs offsets the drop in output, investments, and employment, resulting in movements in these quantities that are economically close to zero.



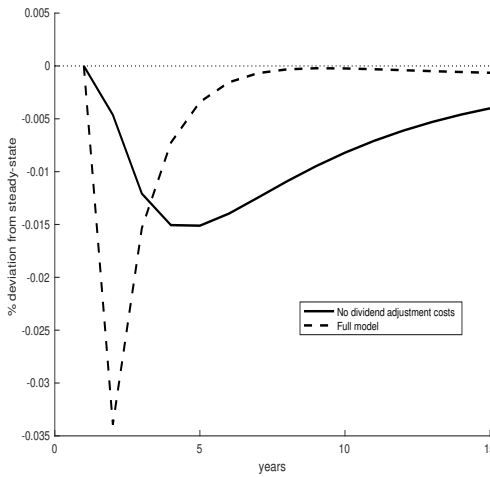
(a) Output



(b) Investment



(c) Employment



(d) Consumption

Figure 2. Response to the shocks with and without dividend adjustment costs. The figure plots the dynamics of output (top left panel), investment (top right panel), and employment (bottom left panel), and consumption (bottom right panel) in percent deviations from steady state, in response to the shock that increases the banks' default probability and the simultaneous reduction in the bailout probability f . The dotted lines plot the dynamics for the full model with the dividend adjustment cost set to $\varphi = 1.525$ —which are identical to the dotted lines plotted in Figure 1—while the solid lines plot the dynamics for the case when $\varphi = 0$.

Differently, the drop consumption is amplified, but the magnitude is very small (-0.015% at the trough without adjustment cost versus -0.035% in the full model).

The logic of the results is again related to the use of firms' resources. Absent dividend adjustment costs, firms return cash to shareholders, or stepping a bit outside the model, firms could also use the deposits to repay some of their debt. In the full model, however, most resources are kept inside the firms, and because deposits become riskier, firms react by investing relatively more in physical capital, and with it, labor. Hence, the presence of the financial frictions that limit firms' ability to adjust quickly their balance sheets dampens the effects of the reduced bailout probability.

Figure 3 plots the dynamics of deposits held by both households and firms in response to the two shocks, with and without dividend adjustment costs. In the long run, which is unaffected by dividend adjustment costs, the reduction in f makes deposits less attractive for firms, which means that firms reduce their deposit holdings by about 1%, while household deposit holdings rise by about 0.5%. With dividend adjustment costs, this transition is relatively smooth, occurring over a period of several years. In the economy without dividend adjustment costs, however, both deposits overshoot their long-run target. In particular, firms' deposits drop by about 10%, reducing firms' ability to invest in productive project and managers' willingness to take risk, resulting in the large negative effects that we observe in the economy without dividend adjustment costs.⁸

6 Conclusion

We have documented some novel stylized facts about households' and firms' holdings of insured and uninsured deposits, the process used by the FDIC to resolve failed banks, and the bailout of uninsured deposits at failed banks. In particular, uninsured deposits have been bailed out nearly all times since at least the 2008 crisis, and firms' holdings of uninsured deposits (relative to their total holdings) are higher than those of households. We have then

⁸The difference between households' and firms' long-run response is in part related to our assumption that households—as a large family—are able to differentiate their risk of holdings uninsured deposits. While this result might change if we expose households to the idiosyncratic risk of default on deposits, we conjecture that the qualitative response of firms will not be affected.

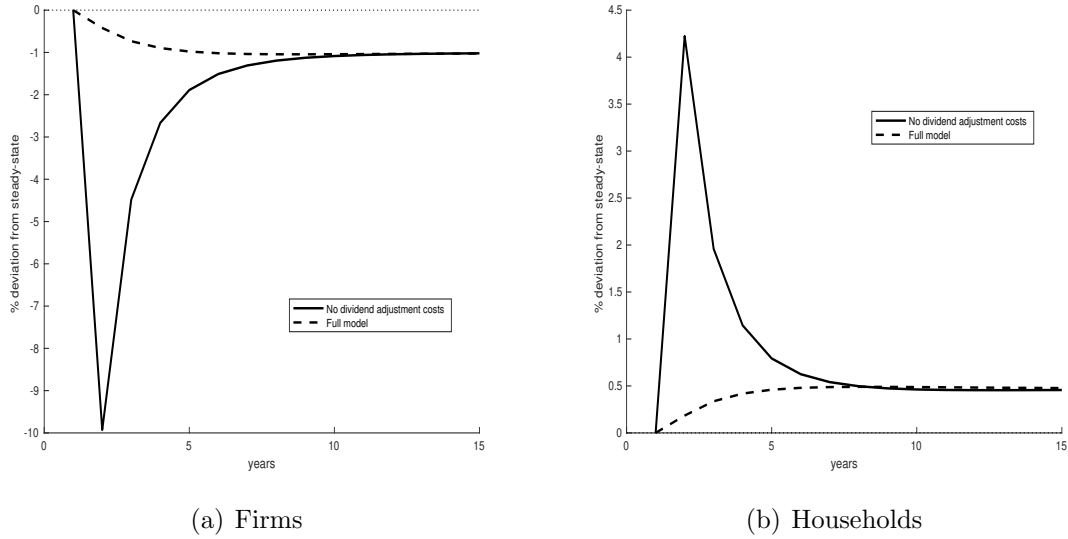


Figure 3. Dynamics of Firm and Household Deposits

The figure plots the dynamics of firms’ deposits (left panel) and households’ deposits (right panel) in percent deviations from steady state, in response to the shock that increases banks’ default probability and the simultaneous reduction in the bailout probability f . The dotted lines plot the dynamics for the full model with the dividend adjustment cost set to $\varphi = 1.525$, while the solid lines plot the dynamics for the case when $\varphi = 0$.

used a quantitative general equilibrium model to analyze the effects of bank defaults and of the bailout of uninsured deposits on firms’ investments, employment, and macroeconomic outcomes. Our focus is on the implications related to the role of deposits as “safe assets.”

Our main result is that a sudden reduction in the probability that uninsured deposits are bailed out has little or no effects on firms and macroeconomic outcomes. The result is the byproduct of two effects. On the one hand, a lower bailout probability increases the riskiness of deposits, hindering firms’ ability to engage in productive activities. On the other hand, frictions that prevent investors from quickly moving resources in and out of firms play an important role. That is, as deposits become riskier, firms redirect their internal funds to investments in physical capital, and with it, employment. In work in progress, we are exploring the welfare effects of uninsured deposit bailouts and the implications for the optimal design of the deposit insurance scheme and of the resolution process of failed banks.

References

- Allen, Franklin, and Douglas Gale.** 1998. “Optimal Financial Crises.” *The Journal of Finance*, 53(4): 1245–1284.
- Allen, Jason, Robert Clark, Brent Hickman, and Eric Richert.** 2023a. “Banking fragility and resolution costs.” Working Paper.
- Allen, Jason, Robert Clark, Brent Hickman, and Eric Richert.** 2023b. “Resolving Failed Banks: Uncertainty, Multiple Bidding & Auction Design.” *Review of Economic Studies*, 0–0.
- Begenau, J, and T Landvoigt.** 2021. “Financial Regulation In A Quantitative Model Of The Modern Banking System.” *The Review of Economic Studies*, 89(4): 1748–1784.
- Begenau, Juliane.** 2020. “Capital Requirements, Risk Choice, And Liquidity Provision In A Business-Cycle Model.” *Journal of Financial Economics*, 136(2): 355–378.
- Bennett, Rosalind L, and Haluk Unal.** 2015. “Understanding the components of bank failure resolution costs.” *Financial Markets, Institutions & Instruments*, 24(5): 349–389.
- Cookson, J Anthony, Corbin Fox, Javier Gil-Bazo, Juan Felipe Imbet, and Christoph Schiller.** 2023. “Social media as a bank run catalyst.” Working Paper.
- Corbae, Dean, and Pablo D’Erasmus.** 2021. “Capital Buffers In A Quantitative Model Of Banking Industry Dynamics.” *Econometrica*, 89(6): 2975–3023.
- Dang, Tri Vi, Gary Gorton, Bengt Holmström, and Guillermo Ordoñez.** 2017. “Banks As Secret Keepers.” *American Economic Review*, 107(4): 1005–29.
- Dávila, Eduardo, and Itay Goldstein.** 2023. “Optimal deposit insurance.” *Journal of Political Economy*, 131(7): 000–000.
- Davydiuk, Tetiana.** 2017. “Dynamic Bank Capital Requirements.” Working paper.
- Dempsey, Kyle.** 2022. “Capital requirements with Non-Bank Finance.” Working Paper.

- Diamond, Douglas W., and Philip H. Dybvig.** 1983. “Bank Runs, Deposit Insurance, and Liquidity.” *The Journal of Political Economy*, 91(3): 401–419.
- Drechsler, Itamar, Alexi Savov, Philipp Schnabl, and Olivier Wang.** 2023. “Banking On Uninsured Deposits.” National Bureau of Economic Research Working Paper 31138.
- Elenev, Vadim, Tim Landoigt, and Stijn Van Nieuwerburgh.** 2021. “A Macroeconomic Model With Financially Constrained Producers And Intermediaries.” *Econometrica*, 89(3): 1361–1418.
- Gertler, Mark, and Antonella Trigari.** 2009. “Unemployment fluctuations with staggered Nash wage bargaining.” *Journal of political Economy*, 117(1): 38–86.
- Gertler, Mark, and Nobuhiro Kiyotaki.** 2015. “Banking, Liquidity, And Bank Runs In An Infinite Horizon Economy.” *American Economic Review*, 105(7): 2011–43.
- Gertler, Mark, Christopher Huckfeldt, and Antonella Trigari.** 2020. “Unemployment Fluctuations, Match Quality, And The Wage Cyclicity Of New Hires.” *The Review of Economic Studies*, 87(4): 1876–1914.
- Gilbert, R Alton.** 1986. “Requiem for Regulation Q: What it did and why it passed away.” *Federal Reserve Bank of St. Louis Review*, 68.
- Glover, Brent, and Oliver Levine.** 2017. “Idiosyncratic Risk And The Manager.” *Journal of Financial Economics*, 126(2): 320–341.
- Gorton, Gary, and George Pennacchi.** 1990. “Financial Intermediaries and Liquidity Creation.” *The Journal of Finance*, 45(1): 49–71.
- Granja, Joao, Gregor Matvos, and Amit Seru.** 2017. “Selling Failed Banks.” *The Journal of Finance*, 72(4): 1723–1784.
- Jermann, Urban, and Vincenzo Quadrini.** 2012. “Macroeconomic Effects Of Financial Shocks.” *American Economic Review*, 102(1): 238–271.

- Jiang, Erica Xuewei, Gregor Matvos, Tomasz Piskorski, and Amit Seru.** 2023. “Monetary Tightening and U.S. Bank Fragility in 2023: Mark-to-Market Losses and Uninsured Depositor Runs?” National Bureau of Economic Research Working Paper 31048.
- La Porta, Rafael, Florencio Lopez-De-Silanes, Andrei Shleifer, and Robert W. Vishny.** 2000. “Agency Problems And Dividend Policies Around The World.” *The Journal of Finance*, 55(1): 1–33.
- Maruf, Ramishah.** 2023. “These companies held money at Silicon Valley Bank and arent sure if theyll recover the funds.” *CNN Business*.
- Orame, Andrea, Rodney Ramcharan, and Roberto Robatto.** 2023. “Macroprudential Regulation, Quantitative Easing, and Bank Lending.” Working Paper.
- Pancost, N Aaron, and Roberto Robatto.** 2023. “The Effects Of Capital Requirements On Good And Bad Risk-Taking.” *The Review of Financial Studies*, 36(2): 733–774.
- Shimer, Robert.** 2005. “The Cyclical Behavior Of Equilibrium Unemployment And Vacancies.” *The American Economic Review*, 95(1): 25–49.
- Van den Heuvel, Skander J.** 2008. “The Welfare Cost Of Bank Capital Requirements.” *Journal of Monetary Economics*, 55(2): 298–320.

Appendix

A Deposit insurance in the U.S. and households' holdings of insured and uninsured deposits

We begin by providing some institutional details about the way deposit insurance is provided in the United States, in Section A.1. We then describe, in Section A.2 how we determine the uninsured deposits held by households.

A.1 How FDIC deposit insurance works

A common statement about FDIC-provided deposit insurance is that the government provides a guarantee for up to \$250,000. The rules that govern deposit insurance, however, are somewhat more complex, and they allow households to *de facto* obtain insurance—in some cases—on deposit holdings that exceed the \$250,000 limit.

The FDIC provides insurance up to \$250,000 *per depositor, per FDIC-insured bank, and per ownership category*. We explain the implications of these rules with a few examples.

First, consider a single-person wealthy household with \$600,000 in deposits. If all the deposits are held in one or more accounts at one bank, only \$250,000 are insured. But with accounts at two different banks, the depositor can increase the effective insurance limit to \$500,000. And with accounts at three different banks, the household can fully insure all the deposits, provided that the amount deposited at each bank does not exceed the \$250,000 limit.

As a second example, consider a married couple with deposits at one single bank. The FDIC treats separately single accounts and joint accounts for the purpose of providing deposit insurance—single and joint accounts are two types of *ownership categories*. Hence, the couple could insure up to \$1,000,000 in deposits at one single bank. This can be done with one individual account per person (\$250,000 insurance per depositor, or \$500,000 in total) and one joint account (\$250,000 per depositor, or \$500,000 in total).

Besides individual and joint accounts, there are many other ownership categories. The

other categories that are relevant for households are *trust accounts* (with a distinction between revocable and irrevocable ones) and *certain retirement accounts*. There are also additional ownership categories such as those for firms' deposits and for deposits held by government entities.

A.2 Households' holdings of insured and uninsured deposits: data construction

We now provides details on the data and methods used to estimate households' holdings of insured and uninsured deposits. We use the 2019 wave of the Survey of Consumer Finances (SCF), which contains information about checking accounts, saving accounts, and CDs held by the households that are interviewed.

Let us discuss checking accounts first. The SCF contains detailed data about up to six checking accounts held by members of the households that are interviewed: amount, bank, and ownership. With respect to the bank, the SCF records up to seven institutions at which respondents can have their accounts, as well as additional institutions depending on their type (e.g., commercial banks vs. savings and loans vs. foreign institution). With respect to the ownership, accounts are recorded as being owned by the respondent, or the spouse, or a child/grandchild, or another family member, or another person that is not a family member. The SCF also specifies whether the account is owned individually or is joint. For trust accounts—which are in separate ownership categories for the purpose of FDIC insurance, we only know that the account is part of a trust, but no information about ownership is provided. We thus assume that trust accounts are held by the respondent—which implies a \$250,000 limit on them.

Saving accounts include the same information recorded for checking accounts, plus a few others. For instance, we know if the account is an health savings account, and respondents are asked if the account is invested in stocks—we exclude all accounts that are not proper saving accounts at banks, as discussed below.

For CDs, we have more limited information. That is, we only know the total amount invested in CDs by the household, the ownership of the total amount (with the question

and answers designed the same way as for checking accounts), and a list of up to seven institutions at which the CDs are held. We thus assume that holdings at each institution that is reported is an equal fraction of the total holdings, and that ownership is the same at all institutions.

To make sure that we are focusing on accounts at traditional banks, we exclude accounts other than typical checking and savings such as educational accounts (“Coverdell/Education IRA” and “529/State-sponsored education account”) and health/medical savings accounts, as well as accounts not held at banks such as those at at brokerage and other investment institutions, at institutions classified as “person or other non-institution,” at finance or loan companies, at store or other businesses, at insurance companies, at mortgage companies/brokers, at schools/colleges/universities, at the federal government/IRS, at specialized education lending, at foreign institutions, and at other investment/management companies. We also exclude accounts for which we cannot determine the ownership (answer “other”) and accounts held for business purposes.

For accounts held jointly by “child/grandchild and respondent/spouse/partner,” we assume that there are three account owners: a child/grandchild, the respondent, and the spouse. We treat similarly accounts held jointly by the respondent/spouse with other family member and non-family members.