Banks, accounting standards, and macroeconomic fluctuations

Joachim Jungherr and Immo Schott*

March 20, 2025

PRELIMINARY AND INCOMPLETE
PLEASE DO NOT CIRCULATE

Lenient accounting rules allow banks to delay the recognition of financial losses. A common view is that this practice stabilizes the real economy by supporting the book value of bank capital during downturns. Using a macroeconomic model with a regulated banking sector, we identify circumstances under which the opposite is true. After financial losses, delayed loss recognition allows banks to operate at increased risk of bank failure and thereby lowers their incentive to provide safe loans. If safe loans are important for real activity, delayed loss recognition destabilizes the real economy. If banks have accounting discretion, they choose to account for financial gains quickly but defer the recognition of financial losses. This asymmetry contributes to skewed business cycle dynamics with mild expansions but severe contractions.

Keywords: business cycles, bank regulation, accounting standards, accounting discretion.
JEL classifications: E32, E44, G28.

* Jungherr: Department of Economics, University of Bonn, Adenauerallee 24-42, 53113 Bonn, Germany (e-mail: joachim.jungherr@uni-bonn.de). Schott: Federal Reserve Board. Division of International Finance, 20th and C Streets, NW, Washington, DC 20551, United States (e-mail: immoschott@gmail.com). We thank Timor Hülsmann for helpful comments.

1. Introduction

The financial crisis of 2007-08 and its aftermath showed that financial losses in the banking sector can cause severe and prolonged macroeconomic downturns. These events gave rise to widespread regulatory reform and substantial increases of minimum bank capital requirements (e.g., Dodd-Frank, Basel III). At the same time, an active macroeconomic research agenda developed which introduced a non-trivial role of financial intermediaries (e.g., Gertler and Kiyotaki, 2010; Gertler and Karadi, 2011; Brunnermeier and Sannikov, 2014; Boissay, Collard, and Smets, 2016) and which studied the effects of bank capital requirements (e.g., Corbae and D'Erasmo, 2021; Elenev, Landvoigt, and Van Nieuwerburgh, 2021; Begenau and Landvoigt, 2022).

However, less attention has been paid to the question whether the accounting standards used to calculate regulatory bank capital might also require revision. Calomiris (2012) points out that Citibank required a large government bailout in 2008 even though it had a Tier 1 capital ratio of 11.8% (far above the regulatory requirement of 4% in place at the time). Similarly, Begenau, Bigio, Majerovitz, and Vieyra (2024) report that the aggregate book value of equity of large U.S. banks remained stable during the Financial Crisis of 2007-08 (or even increased because of public equity injections) whereas their market capitalization collapsed by more than 50%. More recently, high book values of bank capital failed to prevent the banking crisis of 2023, which included the failure of Silicon Valley Bank (Jiang, Matvos, Piskorski, and Seru, 2024).

One important reason for this disconnect between the book value of bank equity and the actual strength of bank balance sheets lies in the accounting rules used to calculate book values. These rules grant banks ample discretion over the size and timing of loss recognition (Vyas, 2011; Huizinga and Laeven, 2012; Bischof, Laux, and Leuz, 2021; Blattner, Farinha, and Rebelo, 2023). This flexibility reduces the precision of the book value of bank equity as an indicator of the actual financial health of a bank's balance sheet.

In this paper we argue that macroeconomic models of the banking sector miss something important by disregarding the role of accounting discretion. To show this, we develop a stylized macroeconomic framework with a regulated banking sector. Accounting standards matter because of two key model ingredients: capital requirements and public deposit insurance. We distinguish between two stylized types of accounting standards. Under *static* accounting, the book value of assets is computed using long-term historical averages of default rates and prices. In contrast, *dynamic* accounting standards use all currently available information about expected future default rates and prices.

We then introduce aggregate shocks to this model that lead to exogenous fluctuations in default rates. We find that *static* accounting standards stabilize banks' book values but lead to more macroeconomic volatility: rates of bank failures and bank bailouts, bank lending, labor demand, and output are all more volatile. In contrast, *dynamic* accounting lead to larger fluctuations in banks' book values but more macroeconomic stability in terms of default, labor demand, and output. If we allow banks to choose between *static* and *dynamic* accounting, banks choose to account for financial gains quickly but

choose to defer the recognition of financial losses. This asymmetry contributes to skewed business cycle dynamics with mild expansions and severe contractions.

In the model, banks provide loans to firms and households. Banks finance these loans through deposits and equity. If a bank suffers from high default rates on its loans, the bank may fail. In that case the public deposit insurance system takes over the bank's assets and pays all insured deposits. Bank bailouts reduce the risk faced by depositors and imply that deposits are a cheaper source of financing for banks compared to equity. Bank capital requirements are therefore always binding.

When negative news about future default rates arrive, *static* accounting rules allow banks to maintain high book values of assets and bank equity. They can maintain high levels of deposit financing without violating bank capital requirements. However, the stability in the book value of bank equity does not change the fact that future bank income is reduced by the negative news about future default rates. In combination with high levels of deposit financing, the risk of bank failure and bank bailouts increases. Importantly, the higher bailout probability reduces banks' incentive to provide safe loans, that is, loans which generate income in states of the world with a bailout. If these loans are an important financing source for firms, delayed loss recognition and increased bailout risk lead to a reduction in the supply of firm loans, a reduction in firms' labor demand, and a fall in output.

In contrast, *dynamic* accounting standards force banks to immediately reduce the book values of assets and bank equity in response to negative news about future default rates. Because of binding bank capital requirements, this reduces the amount of deposits which they are allowed to offer and thereby stabilizes the risk of bank failure and bank bailouts. Through this mechanism, banks' lending incentives are left undistorted which results in stable bank lending, labor demand, and production.

In this paper we argue that banks' accounting standards not only matter for the size of macroeconomic fluctuations, but can also explain business cycle asymmetry. Morley and Piger (2012) document that empirical business cycles are characterized by mild expansions and large contractions. Adrian, Boyarchenko, and Giannone (2019) and Jensen, Petrella, Ravn, and Santoro (2020) relate this empirical regularity to amplification mechanisms in the financial sector. We show that bank accounting discretion can contribute to skewed business cycle fluctuations. If banks are allowed to choose between *static* and *dynamic* accounting, they always choose the option which maximizes the book value of their assets and thereby allows them to offer as much deposits as possible. This means that after negative shocks they choose *static* accounting resulting in high risk of bank failure and depressed lending and production. However, after positive shocks they choose *dynamic* accounting because this allows them to increase the book value of their assets and their deposit financing. The increase in bank deposits keeps bank leverage stable and avoids that the risk of bank failure drops after the positive shock. Without a reduction in bank failure risk, the positive shock does not change banks' lending incentives and does not give rise to a lending boom and increased labor demand and production. Positive financial shocks therefore have no effect on the macroeconomy whereas negative shocks give rise to a macroeconomic contraction.

Related literature. Our paper contributes to the macroeconomic literature which studies the transmission of financial losses in the banking sector to the real economy.[1] Accounting standards matter in our model because of regulatory bank capital requirements. Existing macroeconomic models of the banking sector do not study the role of accounting standards, either because they abstract from regulatory bank capital requirements (Gertler and Kiyotaki, 2010; Gertler and Karadi, 2011; Brunnermeier and Sannikov, 2014) or because they do not compare outcomes across different accounting standards (Elenev et al., 2021; Begenau and Landvoigt, 2022; Bianchi and Bigio, 2022).

The important role of accounting discretion in the banking sector is highlighted by the empirical banking literature (e.g., Vyas, 2011; Huizinga and Laeven, 2012; Bischof et al., 2021; Blattner et al., 2023; Begenau et al., 2024).[2] Milbradt (2012), Bulow and Klemperer (2021), and Begenau et al. (2024) model the incentives and the financial effects of bank accounting discretion. Our contribution with respect to this literature is that we develop a quantitative macroeconomic model which allows to study the role of accounting standards for macroeconomic stability.

Gorton and Ordonez (2014), Dang, Gorton, Holmström, and Ordonez (2017), Monnet and Quintin (2017), and Goldstein and Leitner (2018) study the effects of bank transparency and disclosure. In contrast to this literature, information frictions do not play any role in our setup. Accounting standards only matter in our model because of regulatory bank capital requirements.

2. Model

The economy consists of a representative firm, a banking sector with heterogeneous banks, a representative household, and a government. Firms hire labor and produce output. They finance their operations with loans from banks. Banks provide loans and offer deposits to households. Households work, consume, and save using bank deposits. They own all firms and banks in the economy. The government provides public deposit insurance funded through lump-sum taxes.

[1] For empirical studies of the transmission of bank losses to the macroeconomy, see Jiménez, Ongena, Peydró, and Saurina (2012), Schularick and Taylor (2012), Chodorow-Reich (2014), Huber (2018), Ottonello and Song (2022), or Jamilov, König, Müller, and Saidi (2024).

[2] Discussions of the role of bank accounting standards for financial stability are provided by Laux and Leuz (2010), Acharya and Ryan (2016), and Bushman (2016). Closely related are the issues of evergreening (Peek and Rosengren, 2005; Caballero, Hoshi, and Kashyap, 2008; Giannetti and Simonov, 2013; Acharya, Eisert, Eufinger, and Hirsch, 2019; Schivardi, Sette, and Tabellini, 2022; Bonfim, Cerqueiro, Degryse, and Ongena, 2023; Faria-e Castro, Paul, and Sánchez, 2024) and regulatory forbearance (Loveland, 2016; Cole and White, 2017).

2.1. Households

The representative household supplies labor, consumes, and saves. Preferences over consumption and labor are given by

$$\mathbb{E}_t \sum_{\tau=t}^{\infty} \beta^{\tau-t} \left(\frac{C_\tau^{1-\sigma}}{1-\sigma} - \frac{N_\tau^{1+\theta}}{1+\theta} \right), \quad \text{with:} \quad \sigma, \theta \geq 0. \tag{1}$$

The household's budget constraint is given by

$$\begin{aligned} C_t + \int_0^1 p_{jt}^D D_{jt} dj \leq \\ w_t N_t + \int_0^1 D_{jt-1} R_{jt}^D dj - \gamma(1-\Phi_t^H) H_{t-1} + p_t^H \left[H_t - (1-\gamma)(1-\Phi_t^H) H_{t-1} \right] \\ + \pi_t^F + \int_0^1 \pi_{jt}^B dj - T_t, \end{aligned} \tag{2}$$

where D_{jt} denotes deposit claims against bank j and p_{jt}^D is the price paid for such a claim in period t.[3] The first term on the right-hand side of (2) is the household's labor income $w_t N_t$. The second term denotes income from deposits, where R_{jt}^D is the household's period t payoff from deposits at bank j. In case of bank failure (and incomplete deposit insurance), R_{jt}^D may be different from one. We assume that the representative household can borrow funds from banks. The third and fourth terms on the right-hand side of (2) capture the associated financial flows. H_{t-1} denotes the previously issued amount of outstanding household debt at the end of period $t-1$. In period t, a fraction $\gamma \in [0,1]$ of this amount is due. But not all of it is actually paid by the household. We assume that a fraction $1-\Phi_t^H$ of outstanding household debt H_{t-1} is forgiven in period t. The household therefore only needs to pay $\gamma(1-\Phi_t^H)H_{t-1}$ in period t. The following term denotes the cash flow from newly issued household debt sold to banks at time t at price p_t^H. In the absence of new debt issuance (or repurchases of outstanding debt), the amount of outstanding household debt in period $t+1$ would be $H_t = (1-\gamma)(1-\Phi_t^H)H_{t-1}$. Finally, dividend payments from the representative firm and from bank j are given by π_t^F and π_{jt}^B. T_t is a government lump-sum tax.

Individually optimal household behavior is characterized by maximizing (1) subject to (2). Optimal labor supply N_t satisfies:

$$N_t^\theta = w_t C_t^{-\sigma} \tag{3}$$

The interpretation is standard: the marginal disutility of work must be equal to the marginal benefit in terms of consumption. The household's first order condition with

[3] We model deposits as zero-coupon bonds because it simplifies analytical expressions. Note that this notation does not change the economic interpretation of the deposit contract: in period t, the household deposits an amount $p_{jt}^D D_{jt}$ at bank j; in period $t+1$, the household can demand a deposit payout from bank j of D_{jt}. Accordingly, the interest rate on this deposit contract is $D_{jt}/p_{jt}^D D_{jt} - 1 = 1/p_{jt}^D - 1$.

respect to D_{jt} (i.e., her holdings of bank deposits at bank j) pins down the equilibrium price of deposits:

$$p_{jt}^D = \mathbb{E}_t \Lambda_{t,t+1} R_{jt+1}^D, \tag{4}$$

where $\Lambda_{t,t+1}$ denotes the households' stochastic discount factor

$$\Lambda_{t,t+1} \equiv \frac{\beta C_{t+1}^{-\sigma}}{C_t^{-\sigma}}. \tag{5}$$

The amount of household debt H_t is exogenous and specified below.

2.2. Firms

The representative firm produces output using labor. In period $t+1$, output Y_{t+1} is produced using N_t^d units of labor that were hired in period t:

$$Y_{t+1} = N_t^d \tag{6}$$

Importantly, the wage bill $w_t N_t^d$ must be paid in period t before the firm can sell its output in period $t+1$. This cash flow mismatch generates a demand for bank loans in period t. The firm raises funds by selling an amount L_t of one-period zero-coupon bonds to banks at price p_t^F. Just as in the case of household loans, we assume that only a fraction $1 - \Phi_{t+1}^L$ of these loans will actually be paid back by the firm. The amount $\Phi_{t+1}^F L_t$ will be forgiven in period $t+1$. Accordingly, shareholder value of a firm is:

$$W(N_{t-1}^d, L_{t-1}) = \max_{N_t^d, L_t} \quad \pi_t^F + \mathbb{E}_t \Lambda_{t,t+1} W(N_t^d, L_t) \tag{7}$$

$$\text{subject to:} \quad \pi_t^F = Y_t - (1 - \Phi_t^F) L_{t-1} - w_t N_t^d + p_t^F L_t \tag{8}$$

$$Y_t = N_{t-1}^d \tag{9}$$

$$w_t N_t^d = p_t^F L_t \tag{10}$$

Using $Y_t = N_{t-1}^d$ and the fact that the cash flow constraint (10) implies $L_t = w_t N_t^d / p_t^F$, the firm's first order condition with respect to N_t pins down the equilibrium price of firm bonds:

$$\mathbb{E}_t \Lambda_{t,t+1} \left[1 - (1 - \Phi_{t+1}^F) \frac{w_t}{p_t^F} \right] = 0 \quad \Leftrightarrow \quad p_t^F = w_t \, \mathbb{E}_t \left[1 - \Phi_{t+1}^F \right] \tag{11}$$

This implies a tight relationship between the wage rate w_t and the pricing of corporate bonds p_t^F.

2.3. Banks

There is a continuum of ex-ante identical banks with unit mass. They provide loans to firms and households and offer deposits to households. Banks are subject to idiosyncratic default risk on firm and household loans. This generates ex-post heterogeneity across banks and can cause some banks to default themselves on their deposit liabilities.

Consider a bank $j \in [0,1]$ and its period-t cash flow constraint:

$$\pi_{jt}^B + p_t^F l_{jt} + p_t^H \left[h_{jt} - (1-\gamma)(1-\tilde{\Phi}_{jt}^H) h_{jt-1} \right] - p_{jt}^D d_{jt} \\ \leq (1-\tilde{\Phi}_{jt}^F) l_{jt-1} + (1-\tilde{\Phi}_{jt}^H) \gamma h_{jt-1} - d_{jt-1} \tag{12}$$

In period t, bank j can use available funds to pay dividends π_{jt}^B, purchase one-period firm bonds l_{jt} at price p_t^F, and increase its stock of household debt h_{jt} relative to its existing holdings $(1-\gamma)(1-\tilde{\Phi}_{jt}^H)h_{jt-1}$. The bank raises new funds by offering the amount d_{jt} of deposits at price p_{jt}^D. The amount of available funds is given by the right-hand side of (12). In period t, a fraction $1-\tilde{\Phi}_{jt}^F$ of firm loans and $1-\tilde{\Phi}_{jt}^H$ of household loans are paid and generate income. However, some part of these funds must be used to service current deposit liabilities d_{jt-1}.

We assume that the idiosyncratic repayment risk on firm and household loans depends on the i.i.d. bank-specific random variable η_{jt} with support $[0,1]$:

$$1-\tilde{\Phi}_{jt}^F = [1-\xi^F(1-\eta_{jt})]\varepsilon_t \qquad \text{and} \qquad 1-\tilde{\Phi}_{jt}^H = [1-\xi^H(1-\eta_{jt})]\varepsilon_t \tag{13}$$

A high realization η_{jt} implies a high repayment rate for bank j at time t both on firm and household loans. The parameters $\xi^F, \xi^H \in [0,1]$ indicate how strongly the two types of loans co-vary with η_{jt}. Low parameter values ξ^F and ξ^H reduce the idiosyncratic risk associated with the two assets. Besides the bank-specific idiosyncratic shock η_{it}, the repayment rate for both types of loans depends on the aggregate shock ε_t. By the law of large numbers, the repayment rate in the aggregate economy is:

$$1-\Phi_t^F = \int_0^1 \int_{-\infty}^{\infty} [1-\tilde{\Phi}_{jt}^F] d\varphi(\eta) dj = \left[1-\xi^F \left(1 - \int_0^1 \int_{-\infty}^{\infty} \eta_{jt} d\varphi(\eta) dj \right) \right] \varepsilon_t \tag{14}$$

Similarly:

$$1-\Phi_t^H = \int_0^1 \int_{-\infty}^{\infty} [1-\tilde{\Phi}_{jt}^H] d\varphi(\eta) dj = \left[1-\xi^H \left(1 - \int_0^1 \int_{-\infty}^{\infty} \eta_{jt} d\varphi(\eta) dj \right) \right] \varepsilon_t \tag{15}$$

Bank failure. Shareholder value of bank j at time t depends on the income received from firm and household loans and on current deposit liabilities. The idiosyncratic state of the bank is therefore $s_{jt} \equiv \{l_{jt-1}, h_{jt-1}, d_{jt-1}; \eta_{jt}\}$ and shareholder value is $V(s_{jt}, S_t)$, where S_t is the aggregate state of the economy (which includes the aggregate shock ε_t). We assume that bank shareholders have limited liability. If $V(s_{jt}, S_t)$ falls below zero, they prefer that the bank defaults on its deposits even if this means that they lose ownership of the bank. It follows that the bank defaults if and only if:

$$\eta_{jt} < \bar{\eta}_{jt}, \tag{16}$$

where the threshold value $\bar{\eta}_{jt}$ is defined as:

$$\bar{\eta}_{jt}: \quad V(s_{jt}, S_t) = 0. \tag{17}$$

Capital requirements. Banks can finance loans trough offering deposits and through outside equity issuance (i.e., a negative dividend π^B_{jt}). But their financing choices are constrained by minimum bank capital requirements which specify that the ratio of bank equity over total assets must not fall below the fraction $\alpha \in [0,1]$. Importantly, capital requirements are specified in terms of book values. Let the book value of bank j's firm and household loans be denoted by $\hat{l}_{jt}$ and $\hat{h}_{jt}$, respectively, and let $\hat{d}_{jt}$ be the book value of deposit liabilities. Then the capital requirement is:

$$\frac{\hat{l}_{jt} + \hat{h}_{jt} - \hat{d}_{jt}}{\hat{l}_{jt} + \hat{h}_{jt}} \geq \alpha \tag{18}$$

The numerator on the left-hand side of (18) is bank j's book equity, i.e., the book value of its assets $\hat{l}_{jt} + \hat{h}_{jt}$ minus the book value of liabilities $\hat{d}_{jt}$. The denominator is the total book value of bank j's assets. Note that this constraint can be re-written as: $\hat{d}_{jt} \leq (1-\alpha)(\hat{l}_{jt} + \hat{h}_{jt})$.[4]

Bank problem. Accordingly, shareholder value of bank j at time t is

$$V(s_{jt}, S_t) = \max_{\substack{\pi^B_{jt}, l_{jt}, \\ h_{jt}, d_{jt}}} \quad \pi^B_{jt} + \mathbb{E}_t \Lambda_{t,t+1} \int_{\bar{\eta}_{jt+1}}^{\infty} V(s_{jt+1}, S_{t+1})\, d\varphi(\eta) \tag{19}$$

$$\text{subject to:} \quad \pi^B_{jt} = (1 - \tilde{\Phi}^F_{jt}) l_{jt-1} + (1 - \tilde{\Phi}^H_{jt}) \gamma h_{jt-1} - d_{jt-1}$$
$$- p^F_t l_{jt} - p^H_t \left[h_{jt} - (1-\gamma)(1 - \tilde{\Phi}^H_{jt}) h_{jt-1} \right] + p^D_{jt} d_{jt} \tag{20}$$

$$\bar{\eta}_{jt+1}: \quad V(s_{jt+1}, S_{t+1}) = 0 \tag{21}$$

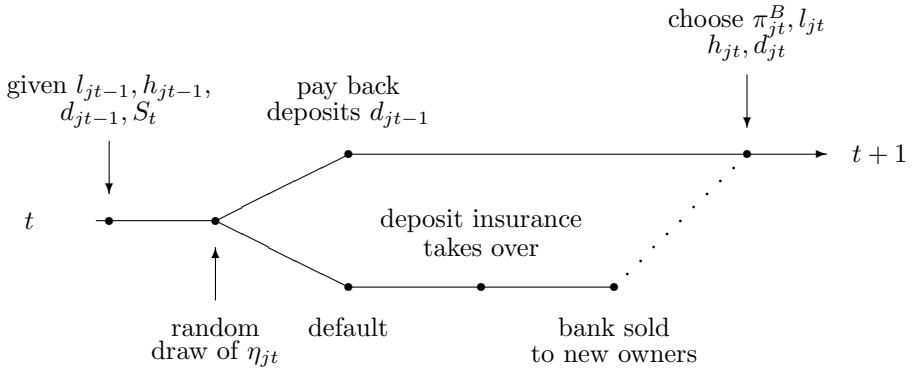
$$\hat{d}_{jt} \leq (1-\alpha)(\hat{l}_{jt} + \hat{h}_{jt}) \tag{22}$$

The exact way in which the bank capital requirement (22) constrains the bank's choice of d_{jt} depends on the accounting standard used to calculate the book values $\hat{d}_{jt}$, $\hat{l}_{jt}$, and $\hat{h}_{jt}$.

[4] Equivalently, banks' leverage ratio $\hat{d}_{jt}/(\hat{l}_{jt} + \hat{h}_{jt})$ must not exceed $1-\alpha$. This constraint resembles the leverage ratio of Basel III. As shown below, deposit insurance distorts the equilibrium allocation in the model (as in Kareken and Wallace, 1978). This generates a role for welfare improving bank capital requirements (as in Van den Heuvel, 2008; Bahaj and Malherbe, 2020; Begenau, 2020; Malherbe, 2020; Corbae and D'Erasmo, 2021; Elenev et al., 2021; Begenau and Landvoigt, 2022). The socially optimal policy in this model is to set α sufficiently high such that the deposit insurance system never has to step in. Of course, the optimal level of α in this model depends on various assumptions. For instance, if there are additional frictions (e.g. between creditors and firms) which increase credit costs for firms it may be socially beneficial to counteract these additional distortions through a subsidy such as public deposit insurance (as a second-best policy). Similarly, if bank deposits provide special liquidity services to society this reduces the optimal value of α. On the other hand, if the social costs of firm default and bank failure are positive (as opposed to zero as in this model), this may increase the optimal value of α. An exhaustive study of the optimal level of bank capital requirements is beyond the scope of this paper. For important contributions on this topic, see also Admati, DeMarzo, Hellwig, and Pfleiderer (2011) and Gale and Gottardi (2020).

Timing of bank problem. The timing of events is summarized in Figure 1. Bank j enters period t with assets (outstanding firm and household loans) and with liabilities (i.e., bank deposits). The aggregate state of the economy is S_t. The idiosyncratic random variable η_{jt} determines the bank's income generated from outstanding firm and household loans. At this point, the bank decides whether to default or whether to service all current deposit claims. In this case, depositors are fully paid and the bank decides about the current dividend as well as the new level of firm loans, household loans, and bank deposits. If, however, the bank chooses default, shareholders lose ownership of the bank and the public deposit insurance system takes over (see below).

Figure 1: Timing of bank problem



2.4. Government

The government insures bank deposits against financial losses. A fraction $\psi \in [0, 1]$ of each deposit is insured. If a bank defaults, the deposit insurance system assumes ownership of the bank, writes off all bank liabilities, and sells all remaining bank assets to new owners. The deposit insurance system uses the proceeds to fully pay out all *insured* deposits. If the proceeds from the sale of remaining bank assets exceed the claims of insured deposits, depositors may receive an additional pro rata pay-out on the uninsured part of deposits.[5]

[5] As we show below, public deposit insurance distorts the market allocation in this model. In principle, efficiency could be restored through an insurance premium which depends on a bank's leverage choice. In practice, insurance premiums charged by the U.S. Federal Deposit Insurance Corporation are unlikely to reflect the true bank-specific cost of the government's guarantee (e.g. Pennacchi, 2006). Information frictions and other constraints make it difficult to timely and appropriately adjust bank-specific insurance premia to individual bank behavior (Chan, Greenbaum, and Thakor, 1992). Additional forms of public guarantees (e.g. lender-of-last-resort policies, anticipated public bail-outs) are even harder to implement without moral hazard effects on bank behavior. O'Hara and Shaw (1990), Gandhi and Lustig (2015), Acharya, Anginer, and Warburton (2016), and Atkeson, d'Avernas, Eisfeldt, and Weill (2019) provide empirical evidence which is consistent with 'too-big-to-

Let $V^d(s_{jt}, S_t)$ denote the asset value of a bank j in default after all bank liabilities (i.e., bank deposits d_{jt}) are written off. This is the revenue received by the deposit insurance system from selling the assets of bank j to new owners. If $V^d(s_{jt}, S_t)$ is smaller than the amount of bank j's insured deposits ψd_{jt}, the deposit insurance system needs to use public funds to make sure that depositors receive the full amount of insured deposit claims. We call this event a *bailout*. Small realizations of η_{jt} make bailouts more likely. We define the threshold value $\tilde{\eta}_{jt}$ such that bailouts of insured deposits occur if and only if $\eta_{jt} < \tilde{\eta}_{jt}$, where:

$$\tilde{\eta}_{jt}: \quad V^d(s_{jt}, S_t) = \psi d_{jt-1} \tag{23}$$

If bank j defaults (i.e., whenever $\eta_{jt} < \bar{\eta}_{jt}$ as defined in (17) above) and additionally η_{jt} is below the threshold value $\tilde{\eta}_{jt}$ defined in (23), only the insured fraction ψ of deposits receives a positive payout. If the bank defaults but $\eta_{jt} > \tilde{\eta}_{jt}$, insured deposits are fully served and additional payments are made on the uninsured part of deposits. We can write households' period-t payoff from bank deposits R^D_{jt} as[6]

$$R^D_{jt} = \begin{cases} 1 & \text{, if } \eta_{jt} \geq \bar{\eta}_{jt} \\ \frac{V^d(s_{jt}, S_t)}{d_{jt-1}} & \text{, if } \bar{\eta}_{jt} \geq \eta_{jt} \geq \tilde{\eta}_{jt} \\ \psi & \text{, if } \eta_{jt} \leq \tilde{\eta}_{jt}. \end{cases} \tag{26}$$

Bailouts are costly for the government. The associated costs for the public deposit insurance system are:

$$DI_t = \int_0^1 \int_{-\infty}^{\tilde{\eta}_{jt}} \left[\psi d_{jt-1} - V^d(s_{jt}, S_t)\right] d\varphi(\eta) dj \tag{27}$$

The costs of bailouts DI_t are financed through a lump-sum tax T_t paid by households. The government balances its budget period-by-period:

$$T_t = DI_t \tag{28}$$

---

fail' effects for individual banks. Kelly, Lustig, and Van Nieuwerburgh (2016) use option pricing data to identify a 'too-systemic-to-fail' effect for the U.S. banking sector as a whole. For a quantitative assessment of the 2008 U.S. government interventions in the banking sector, see Veronesi and Zingales (2010), Calomiris and Khan (2015), and Lucas (2019).

[6] If $\bar{\eta}_{jt} \geq \eta_{jt}$, the payout is:

$$R^D_{jt} = \psi + (1-\psi) \max\left\{0, \frac{V^d(s_{jt}, S_t) - \psi d_{jt-1}}{(1-\psi) d_{jt-1}}\right\}. \tag{24}$$

If $\bar{\eta}_{jt} \geq \eta_{jt} \geq \tilde{\eta}_{jt}$, this is:

$$R^D_{jt} = \psi + (1-\psi)\frac{V^d(s_{jt}, S_t) - \psi d_{jt-1}}{(1-\psi) d_{jt-1}} = \psi + \frac{V^d(s_{jt}, S_t)}{d_{jt-1}} - \psi = \frac{V^d(s_{jt}, S_t)}{d_{jt-1}}. \tag{25}$$

2.5. Equilibrium

This section characterizes key aspects of the equilibrium in this economy. How do banks decide about bank leverage and bank lending in the presence of public deposit insurance and bank capital requirements? All proofs and derivations are deferred to Appendix B.

Definition of equilibrium. Given an aggregate state of the economy S_t and given bank regulation characterized by the fraction of insured deposits ψ and bank capital requirements α, the equilibrium consists of *i)* the representative household's consumption C_t, labor supply N_t, deposit holdings D_{jt}, and household debt H_t, *ii)* the representative firm's output Y_t, labor demand N_t^d, loan demand L_t, and dividend π_t^F, *iii)* bank choices for the amount of firm loans l_{jt}, household loans h_{jt}, deposits d_{jt}, dividends π_{jt}^B, and the bank default threshold $\bar{\eta}_{jt}$, *iv)* a deposit insurance system defined by a cutoff value $\tilde{\eta}_{jt}$ and deposit payoffs R_{jt}^D, accounting standards specifying the book values $\hat{l}_{jt}$, $\hat{h}_{jt}$, and $\hat{d}_{jt}$, a lump-sum tax T_t, and *iv)* prices w_t, p_t^F, p_t^H, and p_{jt}^D, such that:

1. *Households:* The representative household maximizes lifetime utility (1) subject to the budget constraint (2). Household debt is exogenous and constant at $H_t = H_0$.

2. *Firms:* The representative firm maximizes shareholder value in (7), subject to (8)-(10).

3. *Banks:* Banks solve the problem in (19) subject to (20)-(22).

4. *Government:* The government offers deposit insurance as characterized by the bailout threshold $\tilde{\eta}_{jt}$ in (23) and deposit payoffs R_{jt}^D in (26), and raises a lump-sum tax T_t according to (28).

5. *Market clearing:* The labor market clears ($N_t = N_t^d$), the firm loan market clears ($L_t = \int_0^1 l_{jt} dj$), the household debt market clears ($H_t = \int_0^1 h_{jt} dj$), and the deposit market clears ($\int_0^1 D_{jt} dj = \int_0^1 d_{jt} dj$). By Walras' law, the goods market also clears, i.e., $C_t = Y_t$.

Choice of bank leverage. The first main result is that public deposit insurance implies that banks strictly prefer deposit financing over bank equity. The bank capital requirement (18) is therefore always binding in this model.

Proposition 1. *If there are feasible choices of bank leverage (given bank capital requirements) which allow for a positive payout of public funds by the deposit insurance system, then banks choose the maximum amount of leverage and the bank capital requirement* (18) *is binding. If the probability of a positive payout of public funds by the deposit insurance system is zero for any feasible choice of bank leverage, banks are indifferent regarding the choice of leverage and the Modigliani-Miller theorem applies.*

The intuition for Proposition 1 is straightforward. If the deposit insurance system never pays out any public funds to depositors (for instance because $\psi = 0$), the bank

is indifferent with respect to its financing choice. Bank shareholder value is identical for high- and low-leverage banks and the Modigliani-Miller theorem applies. However, if the deposit insurance system uses public funds to pay out depositors with positive probability, then households' expected deposit payoff is strictly higher than banks' cost of delivering this payoff because part of depositors' expected payoff is paid through public bailouts. In this way, the government subsidizes deposit financing and bank leverage. This makes deposits a cheaper source of financing compared to bank equity and implies that banks choose to maximize leverage subject to bank capital requirements in place.

Choice of firm loans. In the following, we assume that the probability of a bailout of depositors by the deposit insurance system is strictly positive. This implies that the bank capital requirement is always binding. In this case, a bank's decision to increase the amount of loans has two effects. On the one hand, it increases the bank's future income from loans. On the other hand, it increases the bank's book value of assets which allows it to offer more deposits to households. These two effects shape the bank's first-order condition with respect to new firm loans l_{jt}:

$$-p_t^F + p_{jt}^D \frac{\partial d_{jt}}{\partial l_{jt}} + \frac{\partial p_{jt}^D}{\partial l_{jt}} d_{jt} + \mathbb{E}_t \Lambda_{t,t+1} \int_{\tilde{\eta}_{jt+1}}^{\infty} \left[(1 - \tilde{\Phi}_{jt+1}^F) - \frac{\partial d_{jt}}{\partial l_{jt}} \right] d\varphi(\eta) = 0. \tag{29}$$

The bank buys an additional firm loan at price p_t^F. This additional loan relaxes the bank capital requirement (18) and allows the bank to issue more deposits: $\partial d_{jt}/\partial l_{jt}$. The exact amount of additional deposits d_{jt} allowed by the additional loan l_{jt} depends on the accounting standard used to calculate the book values $\hat{d}_{jt}$, $\hat{l}_{jt}$, and $\hat{h}_{jt}$. In addition, the additional loan may affect the expected payout to depositors and therefore have an impact on the price of bank deposits: $\partial p_{jt}^D/\partial l_{jt}$. If the bank does not fail next period, both the firm loan and the additional deposits raised are paid back. If we combine the bank's first order condition (29) with respect to firm loans l_{jt} with households' demand for bank deposits (4) and the deposit payoff (26), this yields:

$$p_t^F = \mathbb{E}_t \Lambda_{t,t+1} \left[\int_{\tilde{\eta}_{jt+1}}^{\infty} (1 - \tilde{\Phi}_{jt+1}^F) d\varphi(\eta) + \frac{\partial d_{jt}}{\partial l_{jt}} \psi \int_{-\infty}^{\tilde{\eta}_{jt+1}} d\varphi(\eta) \right] \tag{30}$$

For details, see Appendix B.2. The right hand side of (30) directly shows the two distinct benefits for the bank of buying one additional firm loan. (1) A fraction $1 - \tilde{\Phi}_{jt+1}^F$ of the firm loan will be repaid in $t+1$ and generate income for the bank. This benefit accrues whenever bank failure is avoided, but even in case the bank fails but its asset value is high enough to avoid that the deposit insurance system needs to use public funds to pay out insured deposits (i.e., whenever $\eta_{jt+1} \geq \tilde{\eta}_{jt+1}$). In this case, bank depositors remain the residual claimants of the bank's portfolio. Through the price of bank deposits p_{jt}^D, the increase in the asset value of bank j associated with the increase in l_{jt} is priced and internalized by bank shareholders as long as $\eta_{jt+1} \geq \tilde{\eta}_{jt+1}$. (2) Whenever the bank's asset value at time $t+1$ turns out to be sufficiently low, the deposit insurance system needs to use public funds to bailout insured deposits ($\eta_{jt+1} < \tilde{\eta}_{jt+1}$). In this

case, bank shareholders receive a payout of zero. The deposit insurance system becomes the residual claimant of the bank. Bank depositors only receive a payout on insured deposits. Granting the additional firm loan at time t has no marginal effect on the payout of shareholders or depositors in this case, but it allows the bank to offer an amount $\partial d_{jt}/\partial l_{jt}$ of additional deposits at time t of which a fraction ψ is insured and fully paid at time $t+1$ if $\eta_{jt+1} < \tilde{\eta}_{jt+1}$.

Choice of household loans. The bank's first-order condition with respect to household loans h_{jt} is:

$$-p_t^H + p_{jt}^D \frac{\partial d_{jt}}{\partial h_{jt}} + \frac{\partial p_{jt}^D}{\partial h_{jt}} d_{jt} + \mathbb{E}_t \Lambda_{t,t+1} \int_{\bar{\eta}_{jt+1}}^{\infty} \left[(1 - \tilde{\Phi}_{jt+1}^H)[\gamma + (1-\gamma) p_{t+1}^H] - \frac{\partial d_{jt}}{\partial h_{jt}} \right] d\varphi(\eta) = 0 \tag{31}$$

The bank buys an additional household loan at price p_t^H. As in the case of firm loans, the additional household loan relaxes the bank capital requirement (18) and allows the bank to issue more deposits: $\partial d_{jt}/\partial h_{jt}$. In addition, the additional household loan may affect the expected payout to depositors and therefore have an impact on the price of bank deposits: $\partial p_{jt}^D/\partial h_{jt}$. If the bank does not fail next period, a fraction γ of the household loan is due. The remaining fraction $1-\gamma$ remains in the bank's book and is worth p_{t+1}^H. If we combine the bank's first order condition (31) with households' demand for bank deposits (4) and the deposit payoff (26), this yields:

$$p_t^H = \mathbb{E}_t \Lambda_{t,t+1} \left[\int_{\tilde{\eta}_{jt+1}}^{\infty} (1 - \tilde{\Phi}_{jt+1}^H)[\gamma + (1-\gamma) p_{t+1}^H] d\varphi(\eta) + \frac{\partial d_{jt}}{\partial h_{jt}} \psi \int_{-\infty}^{\tilde{\eta}_{jt+1}} d\varphi(\eta) \right] \tag{32}$$

For details, see Appendix B.3. The economic intuition for (32) is similar to the pricing of firm loans. Buying an additional unit of household debt generates future income for bank shareholders and bank depositors as long as a bank bailout is avoided. In case of a bailout of insured deposits, the additional income generated by the household loan in period $t+1$ has no margianl effect on the payoff of bank shareholders or depositors. However, there is a benefit of granting an additional household loan even in this case. It allows the bank to offer an amount $\partial d_{jt}/\partial h_{jt}$ of additional deposits at time t of which a fraction ψ is insured and fully paid at time $t+1$ if $\eta_{jt+1} < \tilde{\eta}_{jt+1}$.

Accounting standards. Capital requirements are binding in this environment and they are specified in book values. This means that accounting standards matter. The rules which banks have to follow when calculating the book value of their assets and liabilities determine how much leverage banks can choose and how high is the risk of bank failure and bank bailouts. In the following we will show that through these channels accounting standards can shape macroeconomic fluctuations.

To capture the complexity of real-world accounting standards in a tractable, yet realistic way, we consider in our model two stylized types: (1) *static* and (2) *dynamic* accounting standards. Under *static* accounting standards, the book value of assets is computed using long-term historical averages of default rates and prices. In contrast,

dynamic accounting standards use all currently available information about expected future default rates and prices.[7]

Both under *static* and *dynamic* accounting standards, the book value of assets and liabilities is the expected net present discounted value of future payments:

$$\hat{l}_{jt} = \frac{\hat{\mathbb{E}}_t(1-\tilde{\Phi}^F_{jt+1})l_{jt}}{1+r_t} \tag{33}$$

$$\hat{h}_{jt} = \frac{\hat{\mathbb{E}}_t(1-\tilde{\Phi}^H_{jt+1})\left[\gamma+(1-\gamma)p^H_{t+1}\right]h_{jt}}{1+r_t} \tag{34}$$

$$\hat{d}_{jt} = \frac{d_{jt}}{1+r_t} \tag{35}$$

The only difference between *static* and *dynamic* accounting standards is in the expectation operator $\hat{\mathbb{E}}_t$:

Definition. *Consider the expectation operator $\hat{\mathbb{E}}_t$ used to compute the book values $\hat{l}_{jt}$, $\hat{h}_{jt}$, and $\hat{d}_{jt}$:*

1. *Static accounting standards use the long-term historical, or unconditional, expectation: $\hat{\mathbb{E}}_t = \mathbb{E}$.*

2. *Dynamic accounting standards use the current rational expectation conditional on all available information at time t: $\hat{\mathbb{E}}_t = \mathbb{E}_t$.*

How do accounting standards matter for bank behavior? Consider the bank capital requirement (22):

$$\begin{aligned}&\hat{d}_{jt} \leq (1-\alpha)(\hat{l}_{jt}+\hat{h}_{jt})\\ \Leftrightarrow\quad &d_{jt} \leq (1-\alpha)\left[\hat{\mathbb{E}}_t(1-\tilde{\Phi}^F_{jt+1})l_{jt}+\hat{\mathbb{E}}_t(1-\tilde{\Phi}^H_{jt+1})\left[\gamma+(1-\gamma)p^H_{t+1}\right]h_{jt}\right]\end{aligned} \tag{36}$$

After any shock which increases the expected future default rates on firm or household loans, *dynamic* accounting forces banks to immediately adjust downwards the book values $\hat{l}_{jt}$ and $\hat{h}_{jt}$. This reduces the amount of deposits d_{jt} they are allowed to offer to households. If they want to maintain the same amount of lending, they need to make up for the shortfall in deposits through reduced dividends or outside equity issuance. Under *static* accounting, this is very different. Banks are not forced to adjust the book values of their assets and can therefore leave the amount of deposits d_{jt} unchanged. This may suggest that *static* accounting contributes to stability in this economy. But note that the shock has reduced the true expected value of banks' future income. Allowing banks to maintain the same amount of deposits increases the risk of bank failure and bank bailouts. As we show below, this can have important effects for financial and macroeconomic stability.

[7]For more institutional details about accounting standards and their application to banks, see Appendix A.

2.6. Accounting standards and macroeconomic fluctuations

The aggregate shock ε_{t+1} affects the repayment rates on firm and household loans. Consider the scenario that agents learn at time t that ε_{t+1} will be lower (without changes in the expected values of ε_{t+2}, ε_{t+3}, etc.). In a model without financial frictions (or without public deposit insurance), this shock merely redistributes future resources between firms, households, and banks. It would have no effect whatsoever on real variables such as labor or output. However, in the model presented above the real effects of this financial shock crucially depend on the accounting standards applied in bank regulation.

Proposition 2. *Consider the scenario that agents learn at time t that ε_{t+1} will be lower (without changes in the expected values of ε_{t+2}, ε_{t+3}, etc.). Under dynamic accounting standards, this has no effect on the probability of bank failure, bank bailouts, labor N_t or output Y_{t+1}. Under static accounting standards, the shock to ε_{t+1} increases the probability of bank failure and bank bailouts, and triggers inefficient fluctuations in labor N_t and output Y_{t+1}.*

For the formal proof, see Appendix B.5. Under *dynamic* accounting, the book values $\hat{l}_{jt}$ and $\hat{h}_{jt}$ respond one-for-one to the news in ε_{t+1} about future repayment rates. This means that the bank capital requirement (36) becomes tighter and forces banks to strongly reduce deposits d_{jt} in a way which keeps the risk of bank failure and bank bailout unchanged. With an unchanged bailout probability, banks' lending incentives, as captured by the equilibrium price of firm loans p_t^F in (30), remain unchanged as well. They pay less for firm loans (p_t^F falls) because they expect less repayment, but the fall in p_t^F is proportional to the fall in the expected repayment rate $\mathbb{E}_t\left[1-\Phi_{t+1}^F\right]$ and therefore leaves the equilibrium wage rate w_t in (11) unchanged. Because the wage rate w_t remains constant, so does labor supply N_t and output Y_{t+1}. Under *static* accounting, the effects of the negative news about ε_{t+1} are very different. Banks are not forced to adjust the book values of their assets $\hat{l}_{jt}$ and $\hat{h}_{jt}$ and can therefore leave the amount of offered deposits d_{jt} unchanged. Because the expected value of banks' income at time $t+1$ is lowered and the amount of deposits d_{jt} remains unchanged, the risk of bank failure and bank bailouts increases. This changes banks' lending incentives and the equilibrium price of firm loans p_t^F in (30). If the fall in p_t^F is sufficiently strong, the wage rate w_t falls as well with negative effects on labor N_t and output Y_{t+1}.

The result of Proposition 2 may seem paradoxical. If the book values $\hat{l}_{jt}$ and $\hat{h}_{jt}$ respond one-for-one to the financial shock, the real economy remains stable. If the book values $\hat{l}_{jt}$ and $\hat{h}_{jt}$ remain stable, the real economy responds. What is more, this result runs against the view commonly held in the banking community that shielding the book value of bank assets from negative shocks supports lending and thereby stabilizes the macroeconomy. However, this view disregards the possibility that banks' lending incentives not only depend on the availability of deposits as a cheap source of funding but also on the probability of bank failure and bank bailouts. Proposition 2 therefore highlights an economic mechanism which so far is absent from the policy debate about accounting standards.

2.7. Accounting discretion and macroeconomic fluctuations

In practice, accounting standards do not always force banks to calculate the book values of their assets in a unique way. In many cases, they rather offer a menu of rules which banks can choose from when calculating book values. Real-world accounting standards allow banks to choose whether they account for certain assets at their fair or market value or whether they classify them as 'held-to-maturity' valued at amortized cost. Huizinga and Laeven (2012) highlight the role of this option during the U.S. mortgage crisis of 2007-08. It also played a key role during the 2023 banking crisis triggered by the strong increase of interest rates (Jiang et al., 2024). Using data from the 2013 ECB Asset Quality Review audit exercise, Bischof et al. (2021) find that European banks used discretion in the rules to over-report the values of their loan portfolios and to under-report their loan losses.

To capture this empirically relevant accounting margin, we allow banks in the model to choose in each period whether to use the *static* or the *dynamic* accounting standard. Proposition 3 describes banks' accounting choice.

Proposition 3. *If banks can choose between static and dynamic accounting, they always choose the option which results in a higher book value of bank assets.*

The intuition for this results is straightforward. Accounting standards matter for the bank because they determine the capital requirement. Given a positive probability of bank bailouts in the future, deposits are the preferred financing source of banks. Because a higher book value of bank assets allows banks to offer more deposits, they choose the accounting standard which currently maximizes the book value of their assets. Proposition 4 shows that this preference of banks for high book values of assets generates asymmetric macroeconomic fluctuations characterized by stability after positive financial shocks and volatility after negative shocks.

Proposition 4. *Whenever aggregate repayment rates are expected to lie above the long-run mean (i.e., ε_{t+1} is high), banks choose dynamic accounting. Positive news about ε_{t+1} therefore do not affect the probability of bank failure, bank bailouts, labor N_t or output Y_{t+1}. Whenever aggregate repayment rates are expected to lie below the long-run mean (i.e., ε_{t+1} is low), banks choose static accounting. Negative news about ε_{t+1} therefore increase the probability of bank failure and bank bailouts, and trigger inefficient fluctuations in labor N_t and output Y_{t+1}.*

This is an interesting result which may help to explain why empirically business cycles are characterized by mild expansions and large contractions (Morley and Piger, 2012). Adrian et al. (2019) and Jensen et al. (2020) relate this empirical regularity to amplification mechanisms in the financial sector. Proposition 4 highlights that accounting discretion in bank regulation may contribute to the observed skewness of real-world macroeconomic fluctuations.

3. Quantitative analysis

We now present a quantitative analysis of our model. We discuss our calibration and then show results for how accounting standards impact the macroeconomy, both in the steady state and with aggregate fluctuations. The solution algorithm used to solve the model numerically is explained in Appendix C.

3.1. Calibration

We parameterize the model using largely standard values from the literature. In a future draft, we plan to include a calibration and simulated method of moments to match the model to the data. One change relative to the previous section is that we use the following functional form for the firm- and household loan default probabilities:

$$\tilde{\Phi}^F_{jt} = \xi^F \left(1 - \eta_{jt} + \varepsilon_t\right) \qquad \text{and} \qquad \tilde{\Phi}^H_{jt} = \xi^H \left(1 - \eta_{jt} + \varepsilon_t\right) \tag{37}$$

This implies that a higher realization of ε_t leads to higher default risk. The increase in default risk depends on the asset-specific sensitivity parameters ξ^F and ξ^H.

Table 1: Parameters

Parameter	Value	Description
β	0.99	Discount factor
σ	2	Risk aversion
θ	2	Labor disutility
H	1	Household loan demand
γ	1	Debt maturity of household loans
ξ^H	0.9	Riskiness of household loans
ξ^F	0.1	Riskiness of firm loans
ψ	0.95	Fraction of insured deposits
α	0.05	Bank capital requirement
σ_ω	0.6	Standard deviation of underlying Normal
$\bar{\omega}$	0	Upper truncation of underlying Normal
ρ_ε	0.65	Serial correlation AR(1) for ε
σ_ε	0.01	Standard deviation of AR(1) for ε

The choice of $\gamma = 1$ implies that household loans are short-term. Our choices of ξ^F and ξ^H imply that firm loans are safer than household loans. We model the distribution of bank-specific idiosyncratic shocks, η_{jt} as follows. Similarly to Ottonello and Winberry (2020) we assume that $\eta = \exp(\omega)$, where ω is drawn from a truncated Normal distribution with mean zero, standard deviation σ_ω, an upper bound of zero, and a lower bound of $-\infty$. This ensures that η lies between zero and one.

We model the aggregate shock ε_t as an autoregressive process of order one, defined as $\varepsilon_t = \rho_\varepsilon \varepsilon_{t-1} + \nu_t$, where ρ_ε is the serial correlation and ν_t is white noise with mean zero and variance σ^2_ε.[8]

3.2. Results: Steady state

In this section we show how banks' portfolio allocations are determined and how the steady state of the model with deposit insurance compares to the frictionless solution. Note that in the steady state of the model, there is no distinction between static and dynamic accounting rules. This is because absent aggregate shocks, there are no variations in the future default rates expected by banks.

Figure 2 shows the balance sheet of the banking sector. On the asset side are loans to households and firms. On the other side are bank liabilities (deposits) and equity. The value of bank equity constrains how many deposits bank are allowed to issue. This is expressed in the capital requirement (18) and the policy parameter α.

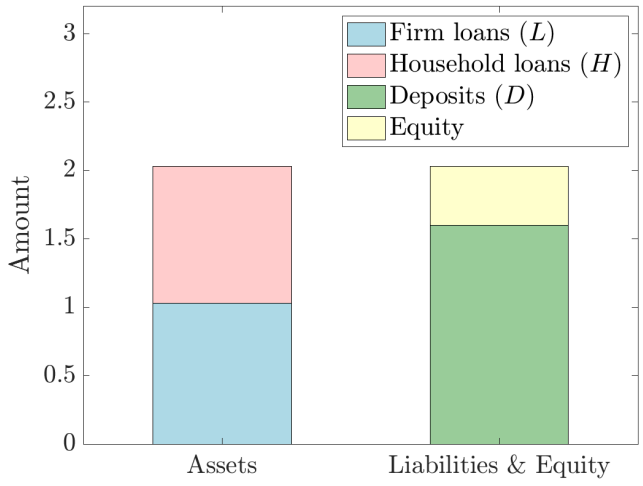


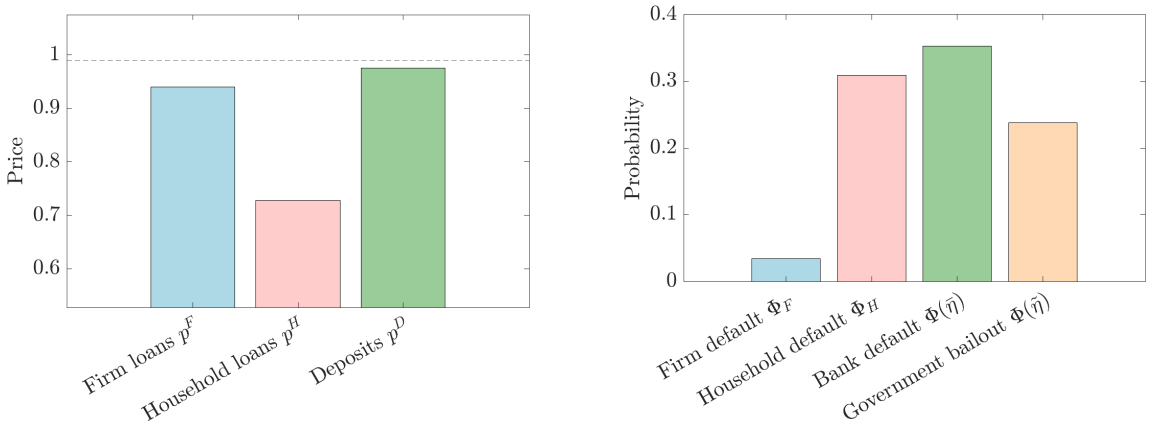
Figure 2: Bank equity constrains bank deposits

Panel a) of Figure 3 shows the prices of loans and deposits. It also includes a dashed horizontal line which denotes the price of a frictionless bond. The market clearing prices of loans are determined via the bank's optimality conditions, shown in (30) and (32). Those conditions say that the price of a loan adjusts to the inherent riskiness of the underlying asset, as well as the presence of the deposit insurance system.[9] The riskiness of an asset is determined by the parameters ξ^F and ξ^H. Lower risk implies that it is more likely that the bank gets repaid, which increases the price of the underlying asset. Given our parameterization, firm loans are safer than household loans. As panel a) of

[8] We ensure that default rates stay between zero and one following aggregate shocks.

[9] In the model with aggregate fluctuations, the accounting rule also influences the price of loans.

Figure 3 shows, this implies that the price of firm loans is higher than that of household loans.



(a) Prices (b) Probabilities

Note: The dashed horizontal line at β in panel a) represents the price of a frictionless bond.

Figure 3: Steady state prices and probabilities of various events

Panel a) also shows the price of deposits, p^D. From (41), this price is both a function of the default risk of banks, as well as the probability of a government bailout of defaulting banks. Because deposit owners of defaulting banks still receive a partial compensation in case of bank default (either from the remaining asset value or from the deposit insurance system), the expected return on deposits is higher that what would be implied by banks' expected default probability. This explains why, given our parameterization, the price of deposits is higher than the prices of loans, although, as shown in panel b) of Figure 3, the default probability of banks is higher than that of households or firms.

3.3. Results: Aggregate fluctuations

We now study the effects of aggregate fluctuations in ε_t, which can be interpreted as exogenous changes in the riskiness of firm- and household loans. From (37) the size of a change in ε_t on firm and household default rates depends on the inherent riskiness of those loans, pinned down by ξ^F and ξ^H.

In what follows, results are presented for both static and dynamic accounting standards. Static accounting standards imply that following an increase in expected default rates, banks are *not* required to reevaluate their assets by taking the higher expected losses into account.

In Figure 4 we show the impulse response functions of key variables after a 3.5 standard deviation shock to ε_t, following which the shock evolves according to its AR(1) process. The positive shock to ε_t implies that default rates of firm and household loans increase. Variables under the static accounting rule are plotted as the blue, solid lines, while those

under dynamic accounting rules are shown as the dashed, red lines. The first panel shows the exogenous shock, while the second panel shows output. A key result is that under *static* accounting rules, output falls by *more* in reaction to a negative aggregate shock.

This result is explained by the fact that under static accounting rules, banks issue relatively more deposits because they do not have to recognize the reduction in asset value that comes from higher default rates. Higher deposits mean higher bank liabilities and therefore lead to higher bank default and bailout probabilities $\Phi(\bar{\eta})$ and $\Phi(\tilde{\eta})$. This in turn leads to lower prices for firm loans, which results in fewer loans and hence less labor demand and output.

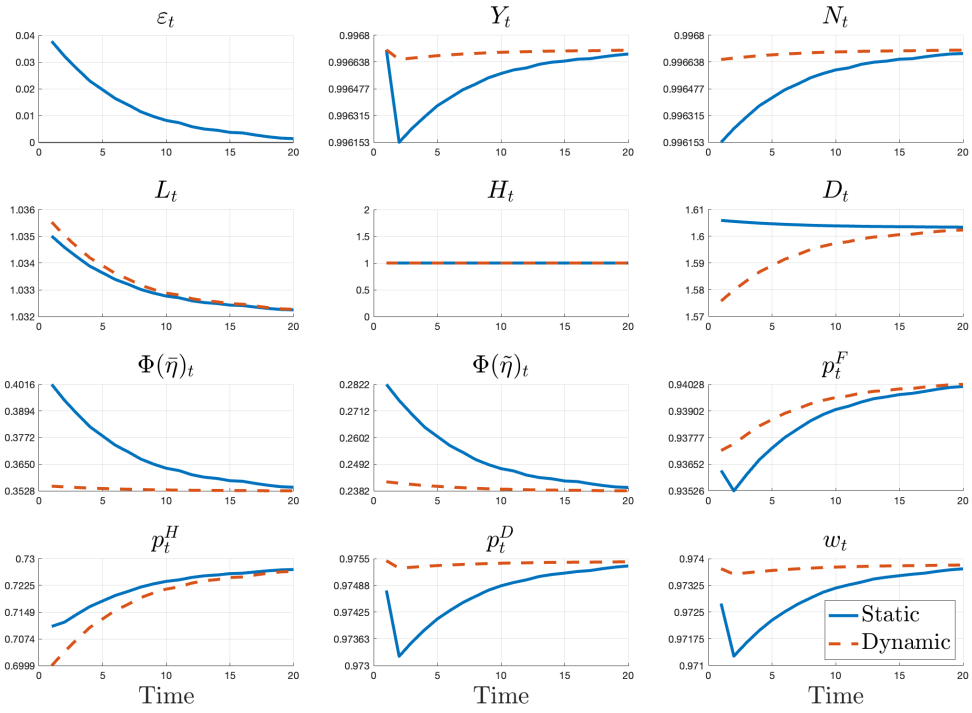


Figure 4: Impulse response functions

3.4. Results: Business cycle asymmetry

If banks have discretion in choosing their accounting standard (static vs. dynamic) they will always choose the accounting standard that lets them obtain the maximum amount of deposits. Given our previous discussion and the impulse response functions in Figure 4, this implies that banks would choose static accounting standards when faced with positive shocks to ε_t (i.e., shocks that increase default rates). When faced with negative shocks to ε_t, i.e., lower than expected default rates of loans, banks would choose dynamic accounting standards, because this would increase the valuation of their assets and allow the bank to raise more deposits. The consequence of accounting discretion is

hence an asymmetry over the business cycle: Positive shocks (i.e., lower default rates) lead to small increases in output, while negative shocks lead to large declines in output. This is shown in Figure 5. As before, the blue, solid lines represent an economy with static accounting rules, while the dashed, red lines represent an economy with dynamic accounting rules. The first panel shows an example series of symmetric positive and negative exogenous shocks. The second and third panels show the resulting time series of deposits and output under static and dynamic accounting rules. Figure 5 reiterates the point that the economy is more volatile under static accounting standards. In line with the intention of static accounting rules, deposits remain significantly more stable over the business cycle. However, this leads to a larger cyclicality in output. Different accounting rules can lead to vastly different macroeconomic fluctuations, given the same exogenous shocks.

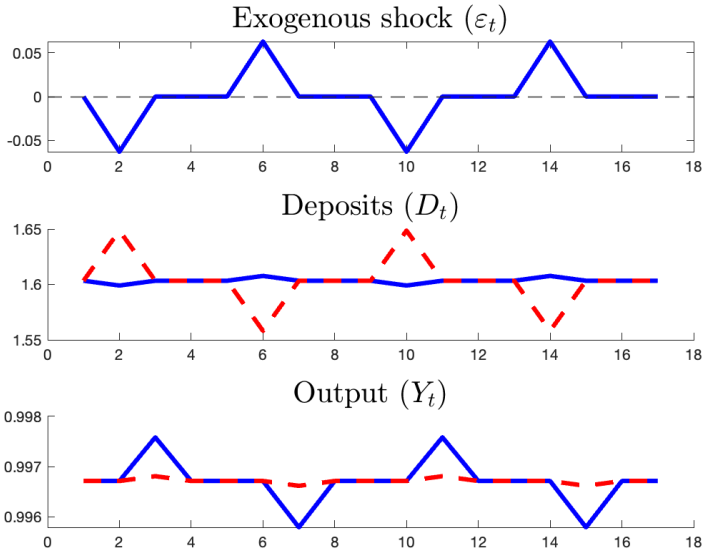


Figure 5: Deposits and output under different accounting rules

Note: The blue solid lines represent static accounting rules. The dashed red lines represent dynamic accounting rules.

Figure 6 plots the time series of output that results if banks have discretion over their accounting standards. This implies that the blue, solid lines are chosen from Figure 5 if the level of ε_t is high (representing high default rates), while the red, dashed lines would be chosen if the level of ε_t is low (representing low default rates). The result is an asymmetric business cycle: Despite the perfectly symmetric exogenous shocks, the resulting output series exhibits moderate booms together with pronounced recessions.

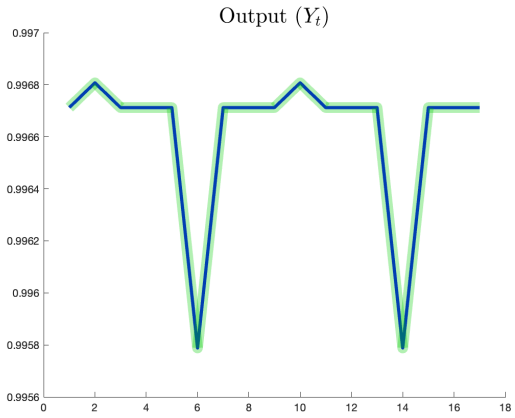


Figure 6: Business cycle asymmetry

4. Conclusion

The paper presents a macroeconomic model with public deposit insurance and bank capital requirements. Because capital requirements are specified in terms of book values, accounting standards matter for macroeconomic outcomes. We have shown that *static* accounting standards generate stable book values of bank assets but volatile risk of bank failure and bank bailouts, as well as large fluctuations in labor demand and output. In contrast, *dynamic* accounting generates volatile book values of bank assets but stable rates of bank failure and bank bailouts, and small fluctuations in labor demand and output. If banks can choose between *static* and *dynamic* accounting, they quickly account for financial gains and delay the recognition of financial losses. This asymmetry contributes to skewed business cycle dynamics with mild expansions but severe contractions.

The stylized framework presented above can be extended to study various real-world applications, e.g., the accounting of losses on mortgages during the Financial Crisis of 2007–08, the valuation of sovereign debt during the Euro crisis in 2012, or the treatment of bank losses on long-term securities during the recent U.S. banking crisis of 2023 including the failure of Silicon Valley Bank. An additional potential application is regulatory forbearance applied during the Covid recession of 2020.

References

Acharya, V., D. Anginer, and J. Warburton (2016): "The end of market discipline? Investor expectations of implicit government guarantees," Working Paper.

Acharya, V. V., T. Eisert, C. Eufinger, and C. Hirsch (2019): "Whatever it takes: The real effects of unconventional monetary policy," *Review of Financial Studies*, 32, 3366–3411.

Acharya, V. V. and S. G. Ryan (2016): "Banks' financial reporting and financial system stability," *Journal of Accounting Research*, 54, 277–340.

Admati, A. R., P. M. DeMarzo, M. Hellwig, and P. Pfleiderer (2011): "Fallacies, irrelevant facts, and myths in the discussion of capital regulation: Why bank equity is not expensive," Working Paper.

Adrian, T., N. Boyarchenko, and D. Giannone (2019): "Vulnerable growth," *American Economic Review*, 109, 1263–1289.

Atkeson, A. G., A. d'Avernas, A. L. Eisfeldt, and P.-O. Weill (2019): "Government guarantees and the valuation of american banks," *NBER Macroeconomics Annual*, 33, 81–145.

Bahaj, S. and F. Malherbe (2020): "The forced safety effect: How higher capital requirements can increase bank lending," *Journal of Finance*, 75, 3013–3053.

Begenau, J. (2020): "Capital requirements, risk choice, and liquidity provision in a business-cycle model," *Journal of Financial Economics*, 136, 355–378.

Begenau, J., S. Bigio, J. Majerovitz, and M. Vieyra (2024): "A Q-theory of banks," *Review of Economic Studies*, forthcoming.

Begenau, J. and T. Landvoigt (2022): "Financial regulation in a quantitative model of the modern banking system," *Review of Economic Studies*, 89, 1748–1784.

Bianchi, J. and S. Bigio (2022): "Banks, liquidity management, and monetary policy," *Econometrica*, 90, 391–454.

Bischof, J., C. Laux, and C. Leuz (2021): "Accounting for financial stability: Bank disclosure and loss recognition in the financial crisis," *Journal of Financial Economics*, 141, 1188–1217.

Blattner, L., L. Farinha, and F. Rebelo (2023): "When losses turn into loans: The cost of weak banks," *American Economic Review*, 113, 1600–1641.

Boissay, F., F. Collard, and F. Smets (2016): "Booms and banking crises," *Journal of Political Economy*, 124, 489–538.

Bonfim, D., G. Cerqueiro, H. Degryse, and S. Ongena (2023): "On-site inspecting zombie lending," *Management Science*, 69, 2547–2567.

Brunnermeier, M. K. and Y. Sannikov (2014): "A macroeconomic model with a financial sector," *American Economic Review*, 104, 379–421.

Bulow, J. I. and P. D. Klemperer (2021): "Misdiagnosing bank capital problems," NBER Working Paper No. 29223.

Bushman, R. M. (2016): "Transparency, accounting discretion, and bank stability," *Economic Policy Review, Issue Aug*, 129–149.

Caballero, R. J., T. Hoshi, and A. K. Kashyap (2008): "Zombie lending and depressed restructuring in Japan," *American Economic Review*, 98, 1943–77.

Calomiris, C. W. (2012): "How to regulate bank capital," *National Affairs*, 10.

Calomiris, C. W. and U. Khan (2015): "An assessment of TARP assistance to financial institutions," *Journal of Economic Perspectives*, 29, 53–80.

Chan, Y.-S., S. I. Greenbaum, and A. V. Thakor (1992): "Is fairly priced deposit insurance possible?" *Journal of Finance*, 47, 227–245.

Chodorow-Reich, G. (2014): "The employment effects of credit market disruptions: Firm-level evidence from the 2008–9 financial crisis," *Quarterly Journal of Economics*, 129, 1–59.

Cole, R. A. and L. J. White (2017): "When time is not on our side: The costs of regulatory forbearance in the closure of insolvent banks," *Journal of Banking & Finance*, 80, 235–249.

Corbae, D. and P. D'Erasmo (2021): "Capital buffers in a quantitative model of banking industry dynamics," *Econometrica*, 89, 2975–3023.

Dang, T. V., G. Gorton, B. Holmström, and G. Ordonez (2017): "Banks as secret keepers," *American Economic Review*, 107, 1005–1029.

Elenev, V., T. Landvoigt, and S. Van Nieuwerburgh (2021): "A macroeconomic model with financially constrained producers and intermediaries," *Econometrica*, 89, 1361–1418.

Faria-e Castro, M., P. Paul, and J. M. Sánchez (2024): "Evergreening," *Journal of Financial Economics*, 153, 103778.

Gale, D. and P. Gottardi (2020): "A general equilibrium theory of banks' capital structure," *Journal of Economic Theory*, 186.

Gandhi, P. and H. Lustig (2015): "Size anomalies in US bank stock returns," *Journal of Finance*, 70, 733–768.

Gertler, M. and P. Karadi (2011): "A model of unconventional monetary policy," *Journal of Monetary Economics*, 58, 17–34.

Gertler, M. and N. Kiyotaki (2010): "Financial intermediation and credit policy in business cycle analysis," in *Handbook of Monetary Economics*, Elsevier, vol. 3, 547–599.

Giannetti, M. and A. Simonov (2013): "On the real effects of bank bailouts: Micro evidence from Japan," *American Economic Journal: Macroeconomics*, 5, 135–67.

Goldstein, I. and Y. Leitner (2018): "Stress tests and information disclosure," *Journal of Economic Theory*, 177, 34–69.

Gorton, G. and G. Ordonez (2014): "Collateral crises," *American Economic Review*, 104, 343–378.

Huber, K. (2018): "Disentangling the effects of a banking crisis: Evidence from German firms and counties," *American Economic Review*, 108, 868–898.

Huizinga, H. and L. Laeven (2012): "Bank valuation and accounting discretion during a financial crisis," *Journal of Financial Economics*, 106, 614–634.

Jamilov, R., T. König, K. Müller, and F. Saidi (2024): "Two centuries of systemic bank runs," ECONtribute Discussion Paper No. 333.

Jensen, H., I. Petrella, S. H. Ravn, and E. Santoro (2020): "Leverage and deepening business-cycle skewness," *American Economic Journal: Macroeconomics*, 12, 245–281.

Jiang, E. X., G. Matvos, T. Piskorski, and A. Seru (2024): "Monetary tightening and US bank fragility in 2023: Mark-to-market losses and uninsured depositor runs?" *Journal of Financial Economics*, 159, 103899.

Jiménez, G., S. Ongena, J.-L. Peydró, and J. Saurina (2012): "Credit supply and monetary policy: Identifying the bank balance-sheet channel with loan applications," *American Economic Review*, 102, 2301–2326.

Kareken, J. H. and N. Wallace (1978): "Deposit insurance and bank regulation: A partial-equilibrium exposition," *Journal of Business*, 51, 413–438.

Kelly, B., H. Lustig, and S. Van Nieuwerburgh (2016): "Too-systemic-to-fail: What option markets imply about sector-wide government guarantees," *American Economic Review*, 106, 1278–1319.

Laux, C. and C. Leuz (2010): "Did fair-value accounting contribute to the financial crisis?" *Journal of Economic Perspectives*, 24, 93–118.

Loveland, R. (2016): "How prompt was regulatory corrective action during the financial crisis?" *Journal of Financial Stability*, 25, 16–36.

Lucas, D. (2019): "Measuring the cost of bailouts," *Annual Review of Financial Economics*, 11, 85–108.

Malherbe, F. (2020): "Optimal capital requirements over the business and financial cycles," *American Economic Journal: Macroeconomics*, 12, 139–174.

Milbradt, K. (2012): "Level 3 assets: Booking profits and concealing losses," *Review of Financial Studies*, 25, 55–95.

Monnet, C. and E. Quintin (2017): "Rational opacity," *Review of Financial Studies*, 30, 4317–4348.

Morley, J. and J. Piger (2012): "The asymmetric business cycle," *Review of Economics and Statistics*, 94, 208–221.

O'Hara, M. and W. Shaw (1990): "Deposit insurance and wealth effects: The value of being "too big to fail"," *Journal of Finance*, 45, 1587–1600.

Ottonello, P. and W. Song (2022): "Financial intermediaries and the macroeconomy: Evidence from a high-frequency identification," NBER Working Paper No. 29638.

Ottonello, P. and T. Winberry (2020): "Financial heterogeneity and the investment channel of monetary policy," *Econometrica*, 88, 2473–2502.

Peek, J. and E. S. Rosengren (2005): "Unnatural selection: Perverse incentives and the misallocation of credit in Japan," *American Economic Review*, 95, 1144–1166.

Pennacchi, G. (2006): "Deposit insurance, bank regulation, and financial system risks," *Journal of Monetary Economics*, 53, 1–30.

Schivardi, F., E. Sette, and G. Tabellini (2022): "Credit misallocation during the European financial crisis," *Economic Journal*, 132, 391–423.

Schularick, M. and A. M. Taylor (2012): "Credit booms gone bust: monetary policy, leverage cycles, and financial crises, 1870–2008," *American Economic Review*, 102, 1029–1061.

Van den Heuvel, S. J. (2008): "The welfare cost of bank capital requirements," *Journal of Monetary Economics*, 55, 298–320.

Veronesi, P. and L. Zingales (2010): "Paulson's gift," *Journal of Financial Economics*, 97, 339–368.

Vyas, D. (2011): "The timeliness of accounting write-downs by US financial institutions during the financial crisis of 2007–2008," *Journal of Accounting Research*, 49, 823–860.

A. Accounting standards

The international accounting standards most relevant today are the International Financial Reporting Standards published by the International Accounting Standards Board. In the U.S., the default accounting standard used follows the Generally Accepted Accounting Principles established by the Financial Accounting Standards Board.

During past periods of financial stress (e.g., the 2008 financial crisis), banks often reported asset book values that assumed eventual recovery of assets, despite clear market signals of heightened default risk. This delay in recognizing risk arises from a combination of factors. First, impairment is only triggered by specific evidence. Under amortized cost accounting, banks do not need to adjust book values unless there is specific, observable evidence of impairment (e.g., missed payments or explicit downgrades).[10] Rising default risk alone (e.g., through worsening macroeconomic conditions) may not trigger immediate adjustments unless the asset's expected cash flows are explicitly revised downward. Second, banks may assume that economic conditions will normalize and the asset will ultimately be repaid in full, even if market prices have fallen due to perceived risk.

For example, when the housing market collapsed, market prices of MBS plummeted as investors priced in expected losses. However, banks often delayed impairments, arguing that the declines were temporary or due to illiquid markets rather than actual credit deterioration. By avoiding impairment recognition, banks maintained higher book values for their assets, which helped them meet regulatory capital requirements during a period of extreme stress. This regulatory forbearance was, in some cases, tacitly encouraged by policymakers to prevent a banking collapse, even though it undermined transparency.[11]

In the context of our model, we capture book value based accounting rules through what we call *static* accounting rules. Under static accounting rules, new information about the underlying default risk of a bank's asset need not be incorporated. This con-

[10] Under the current International Financial Reporting Standards (IFRS 9) or Generally Accepted Accounting Principles (GAAP), bank assets are generally accounted for using the amortized cost method. Amortized cost accounting refers to the method of valuing financial instruments at the amount at which they were initially recognized, adjusted for repayments of principal, the amortization of any premium or discount, and any impairment losses. This approach smooths out fluctuations in reported earnings by systematically allocating costs over the life of the asset. The term impairment refers to the recognition of a loss when the carrying value of a bond exceeds its estimated recoverable amount through future cash flows. This typically involves an assessment of credit risk and market conditions, leading to a write-down when necessary.

[11] Accounting rules have changed since the financial crisis. Prior to it, accounting rules (e.g., under IAS 39 and earlier U.S. GAAP standards) required incurred loss models: Impairments were recognized only when a specific loss event had occurred (e.g., default or missed payment). Rising probabilities of default or deteriorating economic conditions alone were insufficient to require impairments. In the wake of the financial crisis, expected credit loss models (IFRS 9) were introduced to address the delayed recognition of risks under incurred loss models. Now, impairments are recognized based on expected credit losses (ECL), even before a specific loss event occurs. Banks are required to adjust book values for changes in default probabilities and macroeconomic conditions, reducing the scope for delaying risk recognition. However, expected credit loss models rely on internal models and forward-looking assumptions, which can vary significantly between banks. This introduces room for optimism or subjectivity, allowing banks to potentially underestimate risks.

trasts with fair value accounting, where the market's perception of risk directly impacts valuation. Instruments classified as fair value are always marked to market. In the context of our model, we refer to the alternative accounting standard as *dynamic* accounting rules. Agents' updated expectations about future default risk of an asset immediately affect its valuation in this case.

B. Proofs and derivations

B.1. Proof of Proposition 1

Consider the case that the bank capital requirement (18) is not binding in equilibrium. For bank j, the marginal benefit of increasing deposits (holding firm loans l_{jt} and household loans h_{jt} constant) is given by the derivative of (19) with respect to d_{jt}:

$$p_{jt}^D + \frac{\partial p_{jt}^D}{\partial d_{jt}} d_{jt} + \mathbb{E}_t \Lambda_{t,t+1} \int_{\bar{\eta}_{jt+1}}^{\infty} \frac{\partial V\left(s_{jt+1}, S_{t+1}\right)}{\partial d_{jt}} d\varphi(\eta) \tag{38}$$

We know:

$$\frac{\partial V\left(s_{jt}, S_t\right)}{\partial d_{jt-1}} = -1 \tag{39}$$

Accordingly, the marginal benefit of increasing deposits in (38) becomes:

$$p_{jt}^D + \frac{\partial p_{jt}^D}{\partial d_{jt}} d_{jt} - \mathbb{E}_t \Lambda_{t,t+1} \int_{\bar{\eta}_{jt+1}}^{\infty} d\varphi(\eta) \tag{40}$$

Combining households' demand for bank deposits (4) with the deposit payoff (26), the price of bank deposits p_{jt}^D is:

$$p_{jt}^D = \mathbb{E}_t \Lambda_{t,t+1} \left[\int_{\bar{\eta}_{jt+1}}^{\infty} d\varphi(\eta) + \int_{\tilde{\eta}_{jt+1}}^{\bar{\eta}_{jt+1}} \frac{V\left(s_{jt+1}, S_{t+1}\right)}{d_{jt}} d\varphi(\eta) + \int_{-\infty}^{\tilde{\eta}_{jt+1}} \psi d\varphi(\eta) \right] \tag{41}$$

This implies

$$\frac{\partial p_{jt}^D}{\partial d_{jt}} = -\mathbb{E}_t \Lambda_{t,t+1} \int_{\tilde{\eta}_{jt+1}}^{\bar{\eta}_{jt+1}} \frac{V\left(s_{jt+1}, S_{t+1}\right)}{d_{jt}^2} d\varphi(\eta) \tag{42}$$

The marginal benefit of increasing bank deposits d_{jt} in (40) becomes:

$$\begin{aligned} &\mathbb{E}_t \Lambda_{t,t+1} \left[\textstyle\int_{\bar{\eta}_{jt+1}}^{\infty} d\varphi(\eta) + \int_{\tilde{\eta}_{jt+1}}^{\bar{\eta}_{jt+1}} \frac{V(s_{jt+1}, S_{t+1})}{d_{jt}} d\varphi(\eta) + \int_{-\infty}^{\tilde{\eta}_{jt+1}} \psi d\varphi(\eta) \right] \\ &\quad - d_{jt} \mathbb{E}_t \Lambda_{t,t+1} \textstyle\int_{\tilde{\eta}_{jt+1}}^{\bar{\eta}_{jt+1}} \frac{V(s_{jt+1}, S_{t+1})}{d_{jt}^2} d\varphi(\eta) - \mathbb{E}_t \Lambda_{t,t+1} \int_{\bar{\eta}_{jt+1}}^{\infty} d\varphi(\eta) \,, \end{aligned} \tag{43}$$

which simplifies to

$$\mathbb{E}_t \Lambda_{t,t+1} \psi \int_{-\infty}^{\tilde{\eta}_{jt+1}} d\varphi(\eta) \geq 0 \tag{44}$$

Whenever there is a positive probability $\int_{-\infty}^{\tilde{\eta}_{jt+1}} d\varphi(\eta)$ that η_{jt+1} falls below $\tilde{\eta}_{jt+1}$ meaning that the deposit insurance system must use public funds to pay out depositors, the marginal benefit of increasing deposits d_{jt} is strictly positive. A corner solution with a binding capital requirement (18) is the optimal choice in this case. But note that even if the bailout probability $\int_{-\infty}^{\tilde{\eta}_{jt+1}} d\varphi(\eta)$ is zero for low values of d_{jt}, the bank will strictly prefer maximum leverage as long as there is some feasible choice of d_{jt} such that the bailout probability $\int_{-\infty}^{\tilde{\eta}_{jt+1}} d\varphi(\eta)$ becomes positive. Only if the fraction of insured deposits ψ is sufficiently low and the bank capital requirement α is sufficiently high such that the bailout probability $\int_{-\infty}^{\tilde{\eta}_{jt+1}} d\varphi(\eta)$ is zero for any feasible choice of d_{jt}, banks are indifferent with respect to their financing mix between bank equity and deposits.

B.2. Banks' first-order condition (30)

Here we derive the bank's first-order condition with respect to firm loans l_{jt}. We start with (29):

$$-p_t^F + p_{jt}^D \frac{\partial d_{jt}}{\partial l_{jt}} + \frac{\partial p_{jt}^D}{\partial l_{jt}} d_{jt} + \mathbb{E}_t \Lambda_{t,t+1} \int_{\bar{\eta}_{jt+1}}^{\infty} \left[(1 - \tilde{\Phi}_{jt+1}^F) - \frac{\partial d_{jt}}{\partial l_{jt}} \right] d\varphi(\eta) = 0 \tag{45}$$

We know p_{jt}^D from (41). From (41), we derive:

$$\frac{\partial p_{jt}^D}{\partial l_{jt}} = \mathbb{E}_t \Lambda_{t,t+1} \int_{\tilde{\eta}_{jt+1}}^{\bar{\eta}_{jt+1}} \frac{\partial}{\partial l_{jt}} \frac{V\left(s_{jt+1}, S_{t+1}\right)}{d_{jt}} d\varphi(\eta) \tag{46}$$

Applying the quotient rule yields:

$$\frac{\partial p_{jt}^D}{\partial l_{jt}} = \mathbb{E}_t \Lambda_{t,t+1} \int_{\tilde{\eta}_{jt+1}}^{\bar{\eta}_{jt+1}} \left[\frac{\frac{\partial V(s_{jt+1}, S_{t+1})}{\partial l_{jt}} d_{jt} - V\left(s_{jt+1}, S_{t+1}\right) \frac{\partial d_{jt}}{\partial l_{jt}}}{{d_{jt}}^2} \right] d\varphi(\eta) \tag{47}$$

Using (19), this becomes:

$$\frac{\partial p_{jt}^D}{\partial l_{jt}} = \mathbb{E}_t \Lambda_{t,t+1} \int_{\tilde{\eta}_{jt+1}}^{\bar{\eta}_{jt+1}} \left[\frac{(1 - \tilde{\Phi}_{jt+1}^F) d_{jt} - V\left(s_{jt+1}, S_{t+1}\right) \frac{\partial d_{jt}}{\partial l_{jt}}}{{d_{jt}}^2} \right] d\varphi(\eta) \tag{48}$$

Accordingly, we can re-write bank's first-order condition with respect to firm loans l_{jt} in (45) as:

$$\begin{aligned} p_t^F =& \frac{\partial d_{jt}}{\partial l_{jt}} \mathbb{E}_t \Lambda_{t,t+1} \left[\int_{\bar{\eta}_{jt+1}}^{\infty} d\varphi(\eta) + \int_{\tilde{\eta}_{jt+1}}^{\bar{\eta}_{jt+1}} \frac{V\left(s_{jt+1}, S_{t+1}\right)}{d_{jt}} d\varphi(\eta) + \int_{-\infty}^{\tilde{\eta}_{jt+1}} \psi d\varphi(\eta) \right] \\ &+ \mathbb{E}_t \Lambda_{t,t+1} \int_{\tilde{\eta}_{jt+1}}^{\bar{\eta}_{jt+1}} \left[\frac{(1 - \tilde{\Phi}_{jt+1}^F) d_{jt} - V\left(s_{jt+1}, S_{t+1}\right) \frac{\partial d_{jt}}{\partial l_{jt}}}{d_{jt}} \right] d\varphi(\eta) \\ &+ \mathbb{E}_t \Lambda_{t,t+1} \int_{\bar{\eta}_{jt+1}}^{\infty} \left[(1 - \tilde{\Phi}_{jt+1}^F) - \frac{\partial d_{jt}}{\partial l_{jt}} \right] d\varphi(\eta) \end{aligned} \tag{49}$$

The term $\partial d_{jt}/\partial l_{jt}\mathbb{E}_t\Lambda_{t,t+1}\int_{\bar{\eta}_{jt+1}}^{\bar{\eta}_{jt+1}}\frac{V(s_{jt+1},S_{t+1})}{d_{jt}}d\varphi(\eta)$ cancels out:

$$\begin{aligned}p_t^F =&\frac{\partial d_{jt}}{\partial l_{jt}}\mathbb{E}_t\Lambda_{t,t+1}\left[\int_{\bar{\eta}_{jt+1}}^{\infty}d\varphi(\eta)+\int_{-\infty}^{\tilde{\eta}_{jt+1}}\psi d\varphi(\eta)\right]\\&+\mathbb{E}_t\Lambda_{t,t+1}\int_{\tilde{\eta}_{jt+1}}^{\bar{\eta}_{jt+1}}\left[\frac{(1-\tilde{\Phi}_{jt+1}^F)d_{jt}}{d_{jt}}\right]d\varphi(\eta)\\&+\mathbb{E}_t\Lambda_{t,t+1}\int_{\bar{\eta}_{jt+1}}^{\infty}\left[(1-\tilde{\Phi}_{jt+1}^F)-\frac{\partial d_{jt}}{\partial l_{jt}}\right]d\varphi(\eta)\end{aligned}\tag{50}$$

Again, the term $\partial d_{jt}/\partial l_{jt}\mathbb{E}_t\Lambda_{t,t+1}\int_{\bar{\eta}_{jt+1}}^{\infty}d\varphi(\eta)$ cancels out. Accordingly, we can write:

$$\begin{aligned}p_t^F =&\frac{\partial d_{jt}}{\partial l_{jt}}\mathbb{E}_t\Lambda_{t,t+1}\int_{-\infty}^{\tilde{\eta}_{jt+1}}\psi d\varphi(\eta)\\&+\mathbb{E}_t\Lambda_{t,t+1}\int_{\tilde{\eta}_{jt+1}}^{\bar{\eta}_{jt+1}}(1-\tilde{\Phi}_{jt+1}^F)d\varphi(\eta)+\mathbb{E}_t\Lambda_{t,t+1}\int_{\bar{\eta}_{jt+1}}^{\infty}(1-\tilde{\Phi}_{jt+1}^F)d\varphi(\eta)\end{aligned}\tag{51}$$

Further simplifying this expression yields:

$$p_t^F=\mathbb{E}_t\Lambda_{t,t+1}\left[\int_{\tilde{\eta}_{jt+1}}^{\infty}(1-\tilde{\Phi}_{jt+1}^F)d\varphi(\eta)+\frac{\partial d_{jt}}{\partial l_{jt}}\psi\int_{-\infty}^{\tilde{\eta}_{jt+1}}d\varphi(\eta)\right]\tag{52}$$

This is identical to equation (30) in the main text.

B.3. Banks' first-order condition (32)

Here we derive the bank's first-order condition with respect to household loans h_{jt}. We start with (31):

$$-p_t^H+p_{jt}^D\frac{\partial d_{jt}}{\partial h_{jt}}+\frac{\partial p_{jt}^D}{\partial h_{jt}}d_{jt}+\mathbb{E}_t\Lambda_{t,t+1}\int_{\bar{\eta}_{jt+1}}^{\infty}\left[(1-\tilde{\Phi}_{jt+1}^H)[\gamma+(1-\gamma)p_{t+1}^H]-\frac{\partial d_{jt}}{\partial h_{jt}}\right]d\varphi(\eta)=0\tag{53}$$

We know p_{jt}^D from (41). From (41), we derive:

$$\frac{\partial p_{jt}^D}{\partial h_{jt}}=\mathbb{E}_t\Lambda_{t,t+1}\int_{\tilde{\eta}_{jt+1}}^{\bar{\eta}_{jt+1}}\frac{\partial}{\partial h_{jt}}\frac{V\left(s_{jt+1},S_{t+1}\right)}{d_{jt}}d\varphi(\eta)\tag{54}$$

Applying the quotient rule yields:

$$\frac{\partial p_{jt}^D}{\partial h_{jt}}=\mathbb{E}_t\Lambda_{t,t+1}\int_{\tilde{\eta}_{jt+1}}^{\bar{\eta}_{jt+1}}\left[\frac{\frac{\partial V(s_{jt+1},S_{t+1})}{\partial h_{jt}}d_{jt}-V\left(s_{jt+1},S_{t+1}\right)\frac{\partial d_{jt}}{\partial h_{jt}}}{{d_{jt}}^2}\right]d\varphi(\eta)\tag{55}$$

Using (19), this becomes:

$$\frac{\partial p_{jt}^{D}}{\partial h_{jt}} = \mathbb{E}_t \Lambda_{t,t+1} \int_{\tilde{\eta}_{jt+1}}^{\bar{\eta}_{jt+1}} \left[\frac{(1-\tilde{\Phi}_{jt+1}^{H})[\gamma + (1-\gamma)p_{t+1}^{H}]d_{jt} - V\left(s_{jt+1}, S_{t+1}\right) \frac{\partial d_{jt}}{\partial h_{jt}}}{{d_{jt}}^{2}} \right] d\varphi(\eta) \tag{56}$$

Accordingly, we can re-write bank's first-order condition with respect to household loans h_{jt} in (53) as:

$$\begin{aligned} p_t^H =& \frac{\partial d_{jt}}{\partial h_{jt}} \mathbb{E}_t \Lambda_{t,t+1} \left[\int_{\bar{\eta}_{jt+1}}^{\infty} d\varphi(\eta) + \int_{\tilde{\eta}_{jt+1}}^{\bar{\eta}_{jt+1}} \frac{V\left(s_{jt+1}, S_{t+1}\right)}{d_{jt}} d\varphi(\eta) + \int_{-\infty}^{\tilde{\eta}_{jt+1}} \psi d\varphi(\eta) \right] \\ &+ \mathbb{E}_t \Lambda_{t,t+1} \int_{\tilde{\eta}_{jt+1}}^{\bar{\eta}_{jt+1}} \left[\frac{(1-\tilde{\Phi}_{jt+1}^{H})[\gamma + (1-\gamma)p_{t+1}^{H}]d_{jt} - V\left(s_{jt+1}, S_{t+1}\right) \frac{\partial d_{jt}}{\partial h_{jt}}}{d_{jt}} \right] d\varphi(\eta) \\ &+ \mathbb{E}_t \Lambda_{t,t+1} \int_{\bar{\eta}_{jt+1}}^{\infty} \left[(1-\tilde{\Phi}_{jt+1}^{H})[\gamma + (1-\gamma)p_{t+1}^{H}] - \frac{\partial d_{jt}}{\partial h_{jt}} \right] d\varphi(\eta) \end{aligned} \tag{57}$$

The term $\partial d_{jt}/\partial h_{jt} \mathbb{E}_t \Lambda_{t,t+1} \int_{\tilde{\eta}_{jt+1}}^{\bar{\eta}_{jt+1}} \frac{V(s_{jt+1}, S_{t+1})}{d_{jt}} d\varphi(\eta)$ cancels out:

$$\begin{aligned} p_t^H =& \frac{\partial d_{jt}}{\partial h_{jt}} \mathbb{E}_t \Lambda_{t,t+1} \left[\int_{\bar{\eta}_{jt+1}}^{\infty} d\varphi(\eta) + \int_{-\infty}^{\tilde{\eta}_{jt+1}} \psi d\varphi(\eta) \right] \\ &+ \mathbb{E}_t \Lambda_{t,t+1} \int_{\tilde{\eta}_{jt+1}}^{\bar{\eta}_{jt+1}} \left[\frac{(1-\tilde{\Phi}_{jt+1}^{H})[\gamma + (1-\gamma)p_{t+1}^{H}]d_{jt}}{d_{jt}} \right] d\varphi(\eta) \\ &+ \mathbb{E}_t \Lambda_{t,t+1} \int_{\bar{\eta}_{jt+1}}^{\infty} \left[(1-\tilde{\Phi}_{jt+1}^{H})[\gamma + (1-\gamma)p_{t+1}^{H}] - \frac{\partial d_{jt}}{\partial h_{jt}} \right] d\varphi(\eta) \end{aligned} \tag{58}$$

Again, the term $\partial d_{jt}/\partial h_{jt} \mathbb{E}_t \Lambda_{t,t+1} \int_{\bar{\eta}_{jt+1}}^{\infty} d\varphi(\eta)$ cancels out. Accordingly, we can write:

$$\begin{aligned} p_t^H =& \frac{\partial d_{jt}}{\partial h_{jt}} \mathbb{E}_t \Lambda_{t,t+1} \psi \int_{-\infty}^{\tilde{\eta}_{jt+1}} d\varphi(\eta) \\ &+ \mathbb{E}_t \Lambda_{t,t+1} \int_{\tilde{\eta}_{jt+1}}^{\bar{\eta}_{jt+1}} (1-\tilde{\Phi}_{jt+1}^{H})[\gamma + (1-\gamma)p_{t+1}^{H}] d\varphi(\eta) \\ &+ \mathbb{E}_t \Lambda_{t,t+1} \int_{\bar{\eta}_{jt+1}}^{\infty} (1-\tilde{\Phi}_{jt+1}^{H})[\gamma + (1-\gamma)p_{t+1}^{H}] d\varphi(\eta) \end{aligned} \tag{59}$$

Further simplifying this expression yields:

$$p_t^H = \mathbb{E}_t \Lambda_{t,t+1} \left[\int_{\tilde{\eta}_{jt+1}}^{\infty} (1-\tilde{\Phi}_{jt+1}^{H})[\gamma + (1-\gamma)p_{t+1}^{H}] d\varphi(\eta) + \frac{\partial d_{jt}}{\partial h_{jt}} \psi \int_{-\infty}^{\tilde{\eta}_{jt+1}} d\varphi(\eta) \right] \tag{60}$$

This is identical to equation (32) in the main text.

B.4. Default and bailout thresholds

The proof of Proposition 2 will use properties of the threshold realization $\tilde{\eta}_{jt+1}$. Both the threshold for bank default $\bar{\eta}_{jt+1}$ and for bank bailouts $\tilde{\eta}_{jt+1}$ are used in the quantitative analysis of the model in Section 3. It will be convenient to explicitly derive them here.

Bank failure. The threshold realization associated with bank failure is characterized by (17):

$$\tilde{\eta}_{jt}: \quad V\left(s_{jt}, S_t\right) = 0 \tag{61}$$

From (19), we derive the following:

$$\frac{\partial V\left(l_{jt-1}, h_{jt-1}, d_{jt-1}, \eta_{jt}, S_t\right)}{\partial l_{jt-1}} = 1 - \tilde{\Phi}^F_{jt} \tag{62}$$

$$\frac{\partial V\left(l_{jt-1}, h_{jt-1}, d_{jt-1}, \eta_{jt}, S_t\right)}{\partial h_{jt-1}} = (1 - \tilde{\Phi}^H_{jt})[\gamma + p^H_t(1-\gamma)] \tag{63}$$

$$\frac{\partial V\left(l_{jt-1}, h_{jt-1}, d_{jt-1}, \eta_{jt}, S_t\right)}{\partial d_{jt-1}} = -1 \tag{64}$$

Furthermore:

$$V(l_{jt-1}, h_{jt-1}, d_{jt-1}, \eta_{jt}, S_t) = 0 \quad \text{if:} \quad l_{jt-1} = h_{jt-1} = d_{jt-1} = 0 \tag{65}$$

It follows:

$$V(l_{jt-1}, h_{jt-1}, d_{jt-1}, \eta_{jt}, S_t) = [1 - \tilde{\Phi}^F_{jt}] l_{jt-1} + (1 - \tilde{\Phi}^H_{jt})[\gamma + p^H_t(1-\gamma)] h_{jt-1} - d_{jt-1} \tag{66}$$

It follows for the threshold value $\bar{\eta}_{jt+1}$:

$$(1 - \tilde{\Phi}^F_{jt+1}) l_{jt} + (1 - \tilde{\Phi}^H_{jt+1})[\gamma + p^H_{t+1}(1-\gamma)] h_{jt} - d_{jt} = 0 \tag{67}$$

$$\Leftrightarrow \left[1 - \xi^F\left(1 - \bar{\eta}_{jt+1}\right)\right] \varepsilon_{t+1} l_{jt} + \left[1 - \xi^H\left(1 - \bar{\eta}_{jt+1}\right)\right] \varepsilon_{t+1}[\gamma + p^H_{t+1}(1-\gamma)] h_{jt} = d_{jt} \tag{68}$$

$$\Leftrightarrow \left[1 - \xi^F\right] \varepsilon_{t+1} l_{jt} + \left[1 - \xi^H\right] \varepsilon_{t+1}[\gamma + p^H_{t+1}(1-\gamma)] h_{jt} + \xi^F \bar{\eta}_{jt+1} \varepsilon_{t+1} l_{jt} + \xi^H \bar{\eta}_{jt+1} \varepsilon_{t+1}[\gamma + p^H_{t+1}(1-\gamma)] h_{jt} = d_{jt} \tag{69}$$

$$\Leftrightarrow \bar{\eta}_{jt+1} = \frac{d_{jt} - \left[1 - \xi^F\right] \varepsilon_{t+1} l_{jt} - \left[1 - \xi^H\right] \varepsilon_{t+1}[\gamma + p^H_{t+1}(1-\gamma)] h_{jt}}{\xi^F \varepsilon_{t+1} l_{jt} + \xi^H \varepsilon_{t+1}[\gamma + p^H_{t+1}(1-\gamma)] h_{jt}} \tag{70}$$

Bank bailout. The threshold realization associated with a public bailout of insured deposits is characterized by (23):

$$\tilde{\eta}_{jt}: \quad V^d\left(s_{jt}, S_t\right) = \psi d_{jt-1} \tag{71}$$

The asset value of the bank gross of deposit liabilities $V^d\left(s_{jt}, S_t\right)$ is:

$$V^d\left(s_{jt}, S_t\right) = V\left(s_{jt}, S_t\right) + d_{jt-1} = [1 - \tilde{\Phi}^F_{jt}] l_{jt-1} + (1 - \tilde{\Phi}^H_{jt})[\gamma + p^H_t(1-\gamma)] h_{jt-1} \tag{72}$$

It follows for the threshold value $\tilde{\eta}_{jt+1}$:

$$(1-\tilde{\Phi}^F_{jt+1})l_{jt} + (1-\tilde{\Phi}^H_{jt+1})[\gamma + p^H_{t+1}(1-\gamma)]h_{jt} = \psi d_{jt} \tag{73}$$

$$\Leftrightarrow \left[1-\xi^F\left(1-\tilde{\eta}_{jt+1}\right)\right]\varepsilon_{t+1}l_{jt} + \left[1-\xi^H\left(1-\tilde{\eta}_{jt+1}\right)\right]\varepsilon_{t+1}[\gamma + p^H_{t+1}(1-\gamma)]h_{jt} = \psi d_{jt} \tag{74}$$

$$\Leftrightarrow \left[1-\xi^F\right]\varepsilon_{t+1}l_{jt} + \left[1-\xi^H\right]\varepsilon_{t+1}[\gamma + p^H_{t+1}(1-\gamma)]h_{jt} + \xi^F\tilde{\eta}_{jt+1}\varepsilon_{t+1}l_{jt} + \xi^H\tilde{\eta}_{jt+1}\varepsilon_{t+1}[\gamma + p^H_{t+1}(1-\gamma)]h_{jt} = \psi d_{jt} \tag{75}$$

$$\Leftrightarrow \tilde{\eta}_{jt+1} = \frac{\psi d_{jt} - \left[1-\xi^F\right]\varepsilon_{t+1}l_{jt} - \left[1-\xi^H\right]\varepsilon_{t+1}[\gamma + p^H_{t+1}(1-\gamma)]h_{jt}}{\xi^F\varepsilon_{t+1}l_{jt} + \xi^H\varepsilon_{t+1}[\gamma + p^H_{t+1}(1-\gamma)]h_{jt}} \tag{76}$$

B.5. Proof of Proposition 2

Through the production function (6), tomorrow's output Y_{t+1} is fully determined by today's labor input N_t. This is fully characterized by households' first order condition with respect to labor supply (3):

$$N^\theta_t = w_t C_t^{-\sigma} \tag{77}$$

Because C_t is predermined ($C_t = Y_t = N_{t-1}$), labor supply is affected if and only if today's wage rate w_t changes. By firms' first order condition (11), the equilibrium wage rate w_t is tightly linked to the price of bank loans to firms p^F_t:

$$p^F_t = w_t\,\mathbb{E}_t\left[1-\Phi^F_{t+1}\right] \tag{78}$$

It follows for equilibrium labor supply:

$$N^\theta_t = \frac{p^F_t}{\mathbb{E}_t\left[1-\Phi^F_{t+1}\right]}N^{-\sigma}_{t-1} \tag{79}$$

The price of firm loans p^F_t is given by equation (30). Combining this with the condition for equilibrium labor supply yields:

$$N^\theta_t = \frac{N^{-\sigma}_{t-1}}{\mathbb{E}_t\left[1-\Phi^F_{t+1}\right]}\mathbb{E}_t\Lambda_{t,t+1}\left[\int_{\tilde{\eta}_{jt+1}}^{\infty}(1-\tilde{\Phi}^F_{jt+1})d\varphi(\eta) + \frac{\partial d_{jt}}{\partial l_{jt}}\psi\int_{-\infty}^{\tilde{\eta}_{jt+1}}d\varphi(\eta)\right] \tag{80}$$

Using (5) and $C_t = Y_t = N_{t-1}$, this can be re-written as:

$$N^\theta_t = \frac{N^{-\sigma}_{t-1}}{\mathbb{E}_t\left[1-\Phi^F_{t+1}\right]}\mathbb{E}_t\beta\frac{N^{-\sigma}_t}{N^{-\sigma}_{t-1}}\left[\int_{\tilde{\eta}_{jt+1}}^{\infty}(1-\tilde{\Phi}^F_{jt+1})d\varphi(\eta) + \frac{\partial d_{jt}}{\partial l_{jt}}\psi\int_{-\infty}^{\tilde{\eta}_{jt+1}}d\varphi(\eta)\right] \tag{81}$$

This is equal to:

$$N^\theta_t = \frac{\beta N^{-\sigma}_t}{\mathbb{E}_t\left[1-\Phi^F_{t+1}\right]}\mathbb{E}_t\left[\int_{\tilde{\eta}_{jt+1}}^{\infty}(1-\tilde{\Phi}^F_{jt+1})d\varphi(\eta) + \frac{\partial d_{jt}}{\partial l_{jt}}\psi\int_{-\infty}^{\tilde{\eta}_{jt+1}}d\varphi(\eta)\right] \tag{82}$$

Special case: $\tilde{\eta}_{jt+1} = -\infty$**.** Consider the special case in which ψ and α are set in a way such that the probability that the public deposit insurance system needs to use public funds to bailout depositors is zero: $\tilde{\eta}_{jt+1} = -\infty$. In this case, (82) becomes:

$$N_t^{\theta} = \frac{\beta N_t^{-\sigma}}{\mathbb{E}_t\left[1 - \Phi_{t+1}^F\right]} \mathbb{E}_t \int_{-\infty}^{\infty} (1 - \tilde{\Phi}_{jt+1}^F) d\varphi(\eta) \tag{83}$$

Because $1 - \mathbb{E}_t \Phi_{t+1}^F = \mathbb{E}_t \int_{-\infty}^{\infty} [1 - \tilde{\Phi}_{jt+1}^F] d\varphi(\eta)$, it follows:

$$N_t^{\theta} = \beta N_t^{-\sigma} \quad \Leftrightarrow \quad N_t = \beta^{\frac{1}{\theta+\sigma}} \tag{84}$$

It is straightforward to show that $N_t = \beta^{\frac{1}{\theta+\sigma}}$ is the Pareto efficient first best level of labor supply in this economy. Without public bailouts, the market equilibrium implements the first best allocation. Fluctuations in ε_t have no macroeconomic effects on labor or output in this case.

General case: The condition for equilibrium labor supply (82) can be written as:

$$N_t^{\theta+\sigma} = \frac{\beta}{\mathbb{E}_t\left[1 - \Phi_{t+1}^F\right]} \mathbb{E}_t \left[\int_{\tilde{\eta}_{jt+1}}^{\infty} (1 - \tilde{\Phi}_{jt+1}^F) d\varphi(\eta) + \frac{\partial d_{jt}}{\partial l_{jt}} \psi \int_{-\infty}^{\tilde{\eta}_{jt+1}} d\varphi(\eta) \right] \tag{85}$$

Or:

$$N_t^{\theta+\sigma} = \frac{\beta}{\mathbb{E}_t\left[1 - \Phi_{t+1}^F\right]} \mathbb{E}_t \left[1 - \Phi_{t+1}^F - \int_{-\infty}^{\tilde{\eta}_{jt+1}} \left[(1 - \tilde{\Phi}_{jt+1}^F) - \frac{\partial d_{jt}}{\partial l_{jt}} \psi \right] d\varphi(\eta) \right] \tag{86}$$

This is equal to:

$$N_t^{\theta+\sigma} = \beta \mathbb{E}_t \left[1 - \frac{\int_{-\infty}^{\tilde{\eta}_{jt+1}} \left[(1 - \tilde{\Phi}_{jt+1}^F) - \frac{\partial d_{jt}}{\partial l_{jt}} \psi \right] d\varphi(\eta)}{\mathbb{E}_t\left[1 - \Phi_{t+1}^F\right]} \right] \tag{87}$$

Or:

$$N_t^{\theta+\sigma} = \beta \mathbb{E}_t \left[1 - \frac{\int_{-\infty}^{\tilde{\eta}_{jt+1}} \left[(1 - \tilde{\Phi}_{jt+1}^F) - \frac{\partial d_{jt}}{\partial l_{jt}} \psi \right] d\varphi(\eta)}{\int_{-\infty}^{\infty} (1 - \tilde{\Phi}_{jt+1}^F) d\varphi(\eta)} \right] \tag{88}$$

Equivalently:

$$N_t^{\theta+\sigma} = \beta \mathbb{E}_t \left[1 - \frac{\int_{-\infty}^{\tilde{\eta}_{jt+1}} \left[(1 - \tilde{\Phi}_{jt+1}^F) - (1-\alpha) \hat{\mathbb{E}}_t (1 - \tilde{\Phi}_{jt+1}^F) \psi \right] d\varphi(\eta)}{\int_{-\infty}^{\infty} (1 - \tilde{\Phi}_{jt+1}^F) d\varphi(\eta)} \right] \tag{89}$$

The expectation $\hat{\mathbb{E}}_t(1 - \tilde{\Phi}_{jt+1}^F)$ (both in the case of *dynamic* and *static* accounting) typically is larger than the integral over $(1 - \tilde{\Phi}_{jt+1}^F)$ conditional on $\eta_{jt+1} < \tilde{\eta}_{jt+1}$. This means that N_t and Y_{t+1} can be higher than in the first best allocation. This happens if

the repayment rate on firm loans $(1-\tilde{\Phi}^F_{jt+1})$ in bailout states is significantly lower than on average. This is the case if $(1-\tilde{\Phi}^F_{jt+1})$ is highly volatile, i.e., if ξ^F is high, and if $(1-\alpha)\psi$ is high, i.e., bank leverage and the fraction of insured deposits are both high as well. On the other hand, N_t and Y_{t+1} are smaller than in the first best allocation if the repayment rate on firm loans in bailout states is similar to its average. This is the case if $(1-\tilde{\Phi}^F_{jt+1})$ has low volatility, i.e., if ξ^F is low.

The condition for equilibrium labor supply can be written as:

$$N_t^{\theta+\sigma} = \beta \mathbb{E}_t \left[1 - \frac{\int_{-\infty}^{\tilde{\eta}_{jt+1}} \left[[1-\xi^F(1-\eta_{jt+1})]\varepsilon_{t+1} - (1-\alpha)\hat{\mathbb{E}}_t[1-\xi^F(1-\eta_{jt+1})]\varepsilon_{t+1}\psi \right] d\varphi(\eta)}{\int_{-\infty}^{\infty}[1-\xi^F(1-\eta_{jt+1})]\varepsilon_{t+1} d\varphi(\eta)} \right] \tag{90}$$

From (76) we know $\tilde{\eta}_{jt+1}$:

$$\tilde{\eta}_{jt+1} = \frac{\psi d_{jt} - \left[1-\xi^F\right]\varepsilon_{t+1} l_{jt} - \left[1-\xi^H\right]\varepsilon_{t+1}[\gamma + p^H_{t+1}(1-\gamma)]h_{jt}}{\xi^F \varepsilon_{t+1} l_{jt} + \xi^H \varepsilon_{t+1}[\gamma + p^H_{t+1}(1-\gamma)]h_{jt}} \tag{91}$$

Deposits are equal to:

$$d_{jt} = (1-\alpha)\left[\hat{\mathbb{E}}_t[1-\xi^F(1-\eta_{jt+1})]\varepsilon_{t+1} l_{jt} + \hat{\mathbb{E}}_t[1-\xi^H(1-\eta_{jt+1})]\varepsilon_{t+1}\left[\gamma + (1-\gamma)p^H_{t+1}\right] h_{jt} \right] \tag{92}$$

Now we distinguish the cases of *static* and *dynamic* accounting standards.

- **Dynamic accounting:** Deposits are equal to:

$$d_{jt} = (1-\alpha)\left[[1-\xi^F(1-\mathbb{E}_t\eta_{jt+1})]\varepsilon_{t+1} l_{jt} + [1-\xi^H(1-\mathbb{E}_t\eta_{jt+1})]\varepsilon_{t+1}\left[\gamma + (1-\gamma)\mathbb{E}_t p^H_{t+1}\right] h_{jt} \right] \tag{93}$$

The threshold value $\tilde{\eta}_{jt+1}$ becomes:

$$\begin{aligned} \tilde{\eta}_{jt+1} = & \frac{\psi(1-\alpha)\left[[1-\xi^F(1-\mathbb{E}_t\eta_{jt+1})]\varepsilon_{t+1} l_{jt} + [1-\xi^H(1-\mathbb{E}_t\eta_{jt+1})]\varepsilon_{t+1}\left[\gamma + (1-\gamma)\mathbb{E}_t p^H_{t+1}\right] h_{jt} \right.}{\xi^F \varepsilon_{t+1} l_{jt} + \xi^H \varepsilon_{t+1}[\gamma + p^H_{t+1}(1-\gamma)]h_{jt}} \\ & - \frac{\left[1-\xi^F\right]\varepsilon_{t+1} l_{jt} + \left[1-\xi^H\right]\varepsilon_{t+1}[\gamma + p^H_{t+1}(1-\gamma)]h_{jt}}{\xi^F \varepsilon_{t+1} l_{jt} + \xi^H \varepsilon_{t+1}[\gamma + p^H_{t+1}(1-\gamma)]h_{jt}} \end{aligned} \tag{94}$$

The aggregate state ε_{t+1} cancels out:

$$\begin{aligned} \tilde{\eta}_{jt+1} = & \frac{\psi(1-\alpha)\left[[1-\xi^F(1-\mathbb{E}_t\eta_{jt+1})] l_{jt} + [1-\xi^H(1-\mathbb{E}_t\eta_{jt+1})]\left[\gamma + (1-\gamma)\mathbb{E}_t p^H_{t+1}\right] h_{jt} \right]}{\xi^F l_{jt} + \xi^H[\gamma + p^H_{t+1}(1-\gamma)]h_{jt}} \\ & - \frac{\left[1-\xi^F\right] l_{jt} + \left[1-\xi^H\right][\gamma + p^H_{t+1}(1-\gamma)]h_{jt}}{\xi^F l_{jt} + \xi^H[\gamma + p^H_{t+1}(1-\gamma)]h_{jt}} \end{aligned} \tag{95}$$

This means that, as long as l_{ht}, h_{ht}, and p^H_{t+1} do not move, $\tilde{\eta}_{jt+1}$ does not respond to the news about ε_{t+1}. But if ε_{t+1} does not respond to news about ε_{t+1}, the equilibrium condition (90) does not respond either because ε_{t+1} cancels out.

- **Static accounting:** With *static* accounting, the book values of l_{ht} and h_{ht} do not respond to the news about ε_{t+1}. This implies that the threshold value $\tilde{\eta}_{jt+1}$ increases if ε_{t+1} falls. The direct impact of a fall in ε_{t+1} on the equilibrium condition (90) is that N_t increases because the bailout subsidy increases on expectation. The indirect impact of the increase in $\tilde{\eta}_{jt+1}$ is ambiguous: It further increases N_t if deposit insurance leads to over-production and it further decreases N_t if deposit insurance leads to under-production.

C. Appendix - Quantitative analysis

C.1. Solution algorithm

We use the following algorithm to solve the model numerically.[12]

1. Guess a value of N_t. Market clearing implies that $N_t^d = N_t$.
2. The firm's cash flow constraint (10) together with the equilibrium price of firm loans (11) implies that $L_t = N_t \cdot \mathbb{E}_t \left[1 - \Phi_{t+1}^F\right]$.
3. From the capital requirement (22) the equilibrium level of deposits D_t is pinned down.
4. Compute the bailout threshold $\tilde{\eta}_{t+1}$, defined in (23).
5. Compute the price of firm loans (30). .
6. Compute (3), the household's optimal labor supply.
7. Compare the result of step 6 to the initial guess of N_t formed in step 1.
8. If the difference is above a threshold, update the guess and return to step 1.
9. Once convergence is achieved, the remaining equilibrium variables can be computed.

For the model with aggregate fluctuations, we discretize the exogenous shock and solve the above algorithm for every grid point. In addition, whether static or dynamic accounting rules are chosen influences steps 3 and 5, *cf.* Section 2.5.

[12]Here we present the algorithm for the case where $\gamma = 1$.