Insuring Bank Loans: Capital Relief, Money Creation and Redistribution*

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Abstract

Banks can buy insurance against losses on loans they keep on their balance sheets, and regulation then frees the capital those loans required. We study the effects of this insurance on credit, prices and distribution in a general-equilibrium model in which bank lending creates deposits, a capital requirement binds, and an outside fund sells protection, calibrated to the euro area. Protection is priced at its expected loss plus the fund's required return, so banks buy it for the capital it frees. The lending it frees creates deposits that raise the price level, a levy on holders of transaction money. A crisis hits the owners of banks and of the fund, and workers through prices and the taxes behind deposit insurance.

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1 Introduction

Bank capital regulation makes a bank hold equity against every loan it keeps. Over the last decade banks have built an instrument that relaxes this requirement without selling the loan or raising equity. In a synthetic risk transfer, a bank pays an outside investor to absorb the first losses on a pool of loans that stays on its balance sheet. The covered pool then carries a much lower risk weight, and the capital it required is freed. Annual issuance in Europe has grown from under €5 billion in 2016 to €21 billion in 2024. Protection now covers about €800 billion of loans. Close to four fifths of the pools transferred in 2024 are corporate and small-business credit, the loan classes with fairly high capital charges (Babu et al., 2026). The loans transferred are those whose risk weight is high relative to their risk, and banks redeploy the freed capital into new lending (Osberghaus and Schepens, 2026). The investors who sell protection are often borrowers of the banking system: on average a quarter of the funding of an investment comes from bank credit, and a bank is more likely to sell protection to an investor it already lends to (Osberghaus and Schepens, 2026). At this scale, the market changes how much credit a given stock of bank equity can support. The natural question is what this does to the economy as a whole. When bank lending creates the deposits that firms spend, does a market that frees bank capital change the quantity of money and the price level? And who holds the loss when the insured loans go bad?

This paper builds a general-equilibrium model of a monetary economy in which regulated banks can insure the credit risk of loans they keep. It uses the model to ask what this insurance does to credit, to the price level and to the distribution of wealth between the two classes of households: workers, who hold the deposits and currency that pay for production, and capitalists, who own the banks, the firms and the fund that sells protection. The model is solved exactly in its analytical form and calibrated to the euro area in its quantitative form. It makes three contributions. First, it is a general-equilibrium model of loan insurance under a binding risk-weighted capital requirement in which the protection seller is a fund with its own capital. The fund posts collateral at the banks it insures and, in the quantitative version, borrows from them. The price of protection, the volume covered, the cost of credit and bank capital are determined together. The closest models of credit-risk transfer have an anonymous secondary market for loans (Faia, 2018), a hold-or-sell margin estimated in partial equilibrium (Buchak et al., 2024), or a true sale to a shadow bank (Meeks et al., 2017; Ferrante, 2018); none has a seller whose capital is partly a claim of the banking system on itself. Second, it derives the monetary consequence of capital relief. Because lending creates deposits, a market that lets banks lend more against the same equity raises the price level. The rise is a one-off levy on the balances that workers carry. No model of securitisation has this consequence, because none has bank lending create money. Third, it measures who bears a credit expansion and a banking crisis when one class owns the intermediaries and the other holds the money that pays for production, with the public backstop of deposits financed by taxes on both. The literature on the redistributive effects of inflation measures this incidence for inflation of other origins; here it is a result of the market itself.

The economy has two classes of households. Workers supply labour and are paid in advance. They hold the deposits and currency they need for transactions. Capitalists own the firms, the

banks and the fund. They hold currency as a store of liquidity beside wholesale deposits. Firms differ in risk and borrow from banks to pay their inputs before production, so bank lending creates the deposits used in production, and the deposits die when the loans are repaid. The central bank fixes the growth of currency and lends to banks at a rate indexed to the wholesale deposit market. Banks price loans under a risk-sensitive capital requirement that binds, with switching frictions in lending and in retail deposits. A fund of outside capital lends to the riskiest firms directly and sells protection on bank loan pools, posting cash collateral at the bank. One price, the fund's excess return on its capital, clears the fund's capacity between the two uses. The quantitative version adds the frictions that make capital costly and slow to replace. Banks and the fund rebuild capital from earnings and raise equity at a cost. The sector as a whole can issue only a small fraction of its equity in a quarter. Banks fail under limited liability and are replaced, and deposit insurance pays the depositors of failed banks out of taxes. The protection contract has a finite maturity, the regulatory weights of the internal-ratings and securitisation frameworks, and a tranche that absorbs losses up to a fixed share of the pool.

The analytical model delivers three results. Protection is priced at the expected loss it transfers plus the return the fund requires on its capital. A bank that is neutral to risk therefore buys it for the capital it frees, not for the risk it sheds. Protection is bought on the borrowers of intermediate risk, for whom the capital charge is high relative to the collateral the fund must post; the safest borrowers stay uncovered and the riskiest borrow from the fund. For the covered borrowers the cost of credit falls permanently. When the market expands credit, the deposits that the new lending creates must be held, and the price level rises until the fixed stock of currency is willingly held. The rise is a levy on the balances workers carry. In a crisis, protection is dearest when banks need it most: the fund's capital is depleted and its collateral locked. The order in which tranches are exhausted depends on how they are sized relative to the pools' risk.

The quantitative results are of two kinds. In normal times, at the observed scale of the market, insurance is almost invisible in credit and prices and visible in bank capital. Opening the market changes credit and the price level by less than a hundredth of a per cent. It lowers bank equity by about six per cent and raises the probability of bank failure, because the capital that protection releases exceeds the risk it sheds. A tightening of the capital requirement by four percentage points leaks largely into the market: the covered share of bank credit rises from 6 to 44 per cent, and bank equity falls rather than rises. In a crisis of the 2008–09 size, with the sector able to raise only 1.5 per cent of its equity in a quarter, credit falls by 1.4 per cent, four times the fall when banks can issue freely. The fee for protection rises by 60 per cent, because the fund's capacity is fixed within the quarter and banks value relief most when capital is scarce. The loss falls on capitalists through the capital of banks and of the fund, and on workers through the wage bill that the smaller loan book finances: workers bear 13 per cent of the lost consumption, against 3 per cent without the cap. Bank failures stay negligible, and insurance makes the crisis slightly deeper rather than shallower. Beyond a loss of about eight per cent of output, and at the 2020 size, the sector has no private equilibrium: the model has no public recapitalisation, and that is where it would enter. The taxes that fund deposit insurance fall on workers only when failures are material, which within

the model's range they are not. The model also says what it does not deliver. A crisis lasts one quarter, because borrowers' demand for credit is almost insensitive to its price: a bank short of capital charges more and refills its capital from one quarter's earnings.

Related literature. The paper relates to three literatures. The first studies securitisation and credit-risk transfer. The theory of loan sales explains when a bank lays off risk and through which instrument (Gorton and Pennacchi, 1995; Duffee and Zhou, 2001; Parlour and Plantin, 2008; Parlour and Winton, 2013). The security-design tradition explains pooling and tranching under private information (DeMarzo, 2005). The macroeconomic treatments place a secondary market for loans or a shadow bank in a general-equilibrium model (Faia, 2018; Meeks et al., 2017; Ferrante, 2018), and Buchak et al. (2024) estimate a structural model of the hold-or-sell margin without general-equilibrium effects. In Faia (2018) credit-risk transfer weakens monitoring; it stabilises the response of output to standard shocks and amplifies financial shocks, in a real model. The empirical literature on securitisation and the bank lending channel finds that a deep market for loans loosens the link between a bank's balance sheet and its lending (Estrella, 2002; Loutskina and Strahan, 2009; Altunbas et al., 2009), and Henricot and Sette (2026) find that euro-area banks that use synthetic transfers cut credit by more after a monetary tightening. The evidence on the transfers themselves documents the selection of pools, the redeployment of capital, the funding of investors by banks and the concentration of the investor base (Osberghaus and Schepens, 2026; Babu et al., 2026; Cortes et al., 2025; European Systemic Risk Board, 2025; Basel Committee on Banking Supervision, 2026). We differ from this literature in the object and in the question. The loan stays with the bank and only its first losses move; the motive is the capital the transfer frees; and the consequences we trace run through money and the price level. Acharya et al. (2013) show that the pre-crisis conduits were securitisation without risk transfer: guarantees designed to reduce capital requirements kept the risk with the banks. In our model the contract transfers the losses it promises, and part of the risk returns to the banks through the collateral deposited with them and the credit they extend to the seller. The bank–non-bank interconnection that Acharya et al. (2024) and Glasserman and Young (2016) measure or model as cross-holdings is here a priced contract, whose funding and collateral legs are equilibrium outcomes.

The second literature models bank lending as the creation of deposits. McLeay et al. (2014) state the accounting. Jakab and Kumhof (2019) and Kumhof and Wang (2021) build it into New Keynesian models with payment in advance and a price level set by an interest-rate rule. Bianchi and Bigio (2022) and Bigio and Sannikov (2021) add reserves, interbank settlement and the policy instruments that act on them. Brunnermeier and Sannikov (2016) have inside money created by intermediaries against fixed outside money, so that losses shrink inside money and raise the value of outside money. Faure and Gersbach (2021, 2022) show in two-period models with a capital requirement when money creation and loanable funds are equivalent. Behind them stand the cash-in-advance economies with wages borrowed in advance (Lucas and Stokey, 1987; Fuerst, 1992; Christiano and Eichenbaum, 1992). Our price level is pinned by a currency stock that the central bank lets grow at a fixed rate, with no interest-rate rule and no reserves market. The shock we study is to regulation, not to money: a market that relaxes the capital requirement changes the

quantity of deposits that lending creates, and the price level moves to keep the currency willingly held.

The third literature evaluates capital requirements in general equilibrium and measures who pays for inflation. Van den Heuvel (2008), Begenau (2020), Begenau and Landvoigt (2022), Mendicino et al. (2018), Corbae and D'Erasmo (2021) and Elenev et al. (2021) take the level of the requirement as the policy object. They quantify its cost through the liquidity it crowds out, the migration of credit to unregulated lenders, or the default of borrowers and banks. We take the requirement as given and let banks relax it at a price, so that the effective requirement, the leakage of a tightening into the insurance market, and the capital the sector holds are outcomes. Empirically, Gropp et al. (2019) find that banks meet higher ratios by cutting risk-weighted assets and lending, with real effects on firms; Hirtle (2009) links credit-derivative use to loan terms. On incidence, Doepke and Schneider (2006) and Adam and Zhu (2016) measure the redistribution of nominal wealth that an inflation episode causes in the United States and in the euro area. Erosa and Ventura (2002) and Albanesi (2007) study anticipated inflation as a regressive tax. Auclert (2019) and Kaplan et al. (2018) trace monetary shocks across households through their balance sheets, and Mendicino et al. (2021) ask who bears bank losses and bailouts in a heterogeneous-agent economy. In these papers the inflation measured is exogenous, chosen by the central bank, or the response to a monetary shock. Ours has a regulatory origin: the price level moves because a market changed how much banks lend against a given stock of equity. Two of the parties that bear it are new to the question: the holders of the money that pays for production, and the seller of protection itself, through the collateral it posts.

Outline. The rest of the paper is organised as follows. Section 2 describes the contract, the regulatory treatment and the evidence that disciplines the model. Section 3 presents the mechanism model, its equilibrium and its results. Section 4 presents the quantitative model, its calibration and its results in normal times and in a crisis. Section 5 concludes. Every derivation is in the appendix.

2 Synthetic risk transfers

We describe the contract and its regulatory treatment, and then state four facts about the market. Each fact is stated with the numbers its source reports.

2.1 How a synthetic risk transfer works

A bank holds a portfolio of loans and buys protection against the credit losses on part of it. The protection seller is a non-bank investor, typically a credit fund, a pension fund or a multi-strategy asset manager. The loans stay on the bank's balance sheet, and the bank continues to service them and to collect the repayments. What moves is not the loan itself but a tranche of its credit losses.

In most transactions the investor pays cash in advance, and the proceeds are typically held by the bank itself or by a third-party custodian (Babu et al., 2026). Unfunded protection, in which the seller gives only a promise, is a minority of the market (Babu et al., 2026).

Capital requirements make a bank hold equity in proportion to its risk-weighted assets, where the weight attached to an exposure is meant to reflect its riskiness. When the transfer is recognised for regulatory purposes, the risk-weighted exposure of the protected tranche falls sharply. A stylised

transaction reported by Babu et al. (2026) takes a €1 billion portfolio with an average risk weight of 65 per cent and, through a three-tranche structure, reduces the effective weight to 26.3 per cent, which cuts risk-weighted assets from €650 million to €263 million. The leverage ratio requirement, which is not risk-weighted, gives no relief, because the loans remain on the balance sheet.

The underlying loan portfolio is unchanged, but its regulatory capital charge falls. At the same time, the bank may acquire a claim on the protection seller when the investor borrows to fund the collateral it posts. This second movement is less visible in the legal form of the transaction. It is central to the model: the fund that sells protection posts its collateral as a deposit at the bank it insures and, in the quantitative version, borrows from banks, so part of the capital that bears the transferred risk is a claim of the banking system on itself.

Real transactions are tranched, so the protection seller absorbs the losses between an attachment and a detachment point rather than all losses up to the collateral it has posted. The model keeps the first-loss form and gives every covered pool a tranche of the same thickness, absorbed over the life of the contract; it does not model the mezzanine and senior pieces of real transactions, so it loses the option-like payoff of a mezzanine position. What it keeps is what the transaction does to regulatory capital and to the balance-sheet link between the bank and the seller, which are the margins the paper studies.

2.2 Four facts

Fact 1. SRTs provide regulatory capital relief and concentrate where capital is expensive relative to risk. SRTs provide regulatory capital relief without removing the underlying loans from the bank's balance sheet. Their primary balance-sheet effect is to reduce risk-weighted assets, not to raise funding. Osberghaus and Schepens (2026) show that banks disproportionately transfer loans with high regulatory risk weights relative to their economic riskiness. They exploit the discontinuity in the SME supporting factor at €50 million of borrower revenue, where the regulatory risk weight rises by about 15 percentage points. At the threshold a loan is about 10 per cent more likely to be transferred on average, and up to 57 to 70 per cent more likely for a hypothetical €1 million exposure. Other loan characteristics are smooth around the threshold. Corporate and SME loans account for close to four-fifths of SRT issuance in 2024, and they carry fairly high capital charges (Babu et al., 2026). At the current size of the market the relief is meaningful but modest relative to bank capital. It averages about 43 basis points of CET1 across 44 issuing banks (Babu et al., 2026), and Osberghaus and Schepens (2026) estimate that euro-area SRTs had released between €11 billion and €24 billion of Tier 1 capital by the third quarter of 2024.

Fact 2. Freed capital is redeployed into lending, and lending shifts toward riskier borrowers. Whether capital relief matters for the economy depends on whether banks redeploy it into lending. Osberghaus and Schepens (2026) document that issuing banks redeploy the freed capital into new lending and, in doing so, become riskier relative to their capitalisation. They also find that monitoring falls after a transfer. The frequency of borrower risk assessments drops by 12 to 25 per cent relative to other banks lending to the same firm, and by as much as 70 per cent when a bank transfers its entire exposure to a borrower. In the model the selection and the redeployment

are results, not targets: protection is bought on the pools whose capital charge is high relative to the collateral the fund must post, and the capital it frees lowers the cost of credit for those borrowers permanently. The re-lending the evidence measures at the bank level has no counterpart in a symmetric sector, and we say so where the result is stated. Monitoring is not modelled, so the fall in monitoring after a transfer is a channel the model leaves out; adding it would add a cost of insurance beside the ones the model has.

Fact 3. SRT investments are partly financed with bank credit. Osberghaus and Schepens (2026) estimate that, on average, 26 per cent of the funding for euro-area SRT investments comes from bank credit. The figure attributes the whole increase in an investor's debt before the investment to the transaction. They also find that banks are 57 to 66 per cent more likely to sell protection to investors with whom they already have a lending relationship. The European Systemic Risk Board calls the resulting configuration a circle of risk (European Systemic Risk Board, 2025). Babu et al. (2026) note that European and Japanese banks transfer credit risk to funds based in the United States, and that banks also provide financing to some of those entities. The banks that finance the investors are generally not the banks that issue the transactions (Babu et al., 2026, p. 41). The investor base is concentrated: a small number of credit funds and pension funds have historically accounted for around three-quarters of investment.

The leverage of investors and the financing of SRT positions are distinct margins. Osberghaus and Schepens (2026) report that SRT investors are only modestly levered overall, as Babu et al. (2026) also assess. Bank borrowing by investors nonetheless rises in the months before an SRT investment. The rise is largest for funded transactions, and within them for transactions with a junior tranche larger than €50 million (Osberghaus and Schepens, 2026). The model takes the balance-sheet link rather than the investors' average leverage: the fund's collateral is a deposit at the bank, and in the quantitative version the fund borrows from banks up to a cap set by the data on credit funds' leverage, so the bank loan rate is part of the cost of supplying protection.

Fact 4. Bank credit to non-banks is large and can displace lending to firms. Bank credit to non-bank financial institutions extends well beyond SRTs. Li et al. (2026) report that euro-area bank lending to these institutions exceeds €3.1 trillion, equivalent to 63 per cent of lending to non-financial firms. Between 2019 and 2024 it grew by nearly 60 per cent, against about 20 per cent for lending to firms. At the bank level, a 1 per cent increase in lending to non-banks is associated with a 0.55 per cent decline in lending to firms, and the contraction is concentrated among smaller and riskier borrowers.

Much of the aggregate growth reflects reverse repos to securities-investing non-banks. The bank-level evidence makes a narrower point: bank claims on non-banks absorb balance-sheet capacity and can displace corporate lending. In the model the bank's loan to the fund enters its capital requirement with its own risk weight, so the relief a transfer gives is net of the capital the funding leg absorbs. Fact 3 gives the evidence specific to synthetic transfers for this link; Fact 4 says the link is part of a larger one.

What the facts leave open. Taken together, the facts establish that banks use SRTs to obtain regulatory capital relief, redeploy that relief into lending, and finance part of investors' SRT col-

lateral with bank credit. They also show that bank credit to non-banks is large and growing fast. What the evidence cannot establish is the aggregate consequence. Whether bank-level lending responses translate into higher aggregate credit, whether credit risk stays outside the banking sector once banks' financing of protection sellers is taken into account, and how these changes affect prices and the real value of nominal claims are equilibrium questions. Answering them requires a model in which the price and volume of protection, bank lending, borrower risk and the price level are determined together. That is the model of the next two sections.

3 The mechanism model

This section states the smallest model in which loan insurance has a price, a buyer, a seller, and consequences for credit, bank capital and the price level. Six frictions do the work: payment in advance, so that bank lending creates the deposits used in production; default under limited liability; a risk-sensitive capital requirement; switching frictions in lending and in retail deposits; a stock of non-bank capital that regulation does not reach; and a currency stock whose growth the central bank fixes, held by workers for transactions and by capitalists as a store of liquidity beside wholesale deposits. Firms differ in risk. Because the bank's capital charge rises with risk and the fund's does not, the riskiest firms borrow from the fund, the safest stay uncovered at banks, and a band in between is insured; one price, the fund's excess return on its capital, clears the fund's capacity between lending and collateral. We present the environment first, then the solution, then the results; every derivation is in Appendix A.

3.1 Environment

Time is discrete and infinite. The economy has workers (mass one), capitalists, a continuum of one-period firms indexed by their ex-ante risk σ, N symmetric banks, one credit fund, and a government that consolidates the central bank and the treasury. Capitalists own the banks, the fund, the firms and the capital stock. There is one good, with price P_t; $\Pi_{t+1} \equiv P_{t+1}/P_t$ is gross inflation.

A bank can buy first-loss protection on a pool of its loans to firms of one risk type: the seller bears the realised losses on the pool up to a tranche τ per covered euro, posts cash collateral of that amount at the bank, and receives a fee; the bank keeps the loans and bears the losses above the tranche. A pool so protected is *covered*, and regulation assigns it the retained-senior weight $v(\sigma) \leq w(\sigma)$ in place of the pool weight; a pool without protection is *uncovered*. The contract and its market are in Section 3.1.

A quantity carries the date of the period in which it is chosen. A rate or price paid at settlement carries the date of the settlement period, so a rate written I_{t+1} is set at t and paid at $t+1$. Every rate is a gross nominal rate: I is the rate on the central bank's facility, the economy's riskless nominal rate; I^W and I^K the rates on retail and wholesale deposits; $I^L(\sigma)$ the loan rate of type σ. The net rate is $I-1$ and the real return I_{t+1}/Π_{t+1}, written out where needed. A bar marks a steady state. Capital letters denote quantities and nominal stocks; a quantity of one firm carries the risk type as an argument, $L_t(\sigma)$, and the same letter without it is the aggregate. Lower-case letters are rates, costs and ratios per euro, and the two real money balances $m = M/P$ and $d = D/P$.

Frictions. Six frictions carry every result, and each is stated where its object first appears. *Payment in advance:* firms pay wages and the rental of capital before output exists, out of a one-period loan, so bank lending creates the deposits that households carry into the next period (Section 3.1). *Limited liability and default:* each project is hit by an idiosyncratic shock after borrowing and defaults when revenue falls short of the debt; the lender recovers the revenue (Section 3.1). *Risk-sensitive capital regulation:* a bank must hold equity of at least κ_r times its risk-weighted loans, the weight rises with the borrower's risk, and an insured pool carries a lower weight (Section 3.1). *Switching frictions:* borrowers find banks imperfect substitutes for one another, and so do retail depositors; wholesale deposits and the two lenders, bank sector and fund, are perfect substitutes for a given holder or firm (Sections 3.1 and 3.1). *Trapped non-bank capital:* the fund's capital is a fixed stock that regulation does not reach and that its owners cannot withdraw at will (Section 3.1). *A fixed currency stock:* the central bank sets the growth rate of currency and lets its lending facility follow the wholesale deposit market; workers hold currency for transactions and capitalists hold it as a store of liquidity beside deposits, so the price level is the currency stock divided by the two households' real demand for it (Section 3.1). Everything else is standard.

Timing. Within period t: (1) *settlement*: the positions contracted at $t-1$ are settled and the goods market opens, simultaneously. Output is produced and sold at P_t; loans are repaid or defaulted on; insurance contracts settle; the facility and deposits pay interest; intermediaries pay out or raise equity, firms pay dividends, and the government pays its transfer; households consume, workers out of the balances they carried and capitalists out of their balances, dividends and transfer, and capitalists buy investment goods. (2) *contracting*: banks post loan margins and deposit rates, the fund posts its lending terms, firms choose a lender and their inputs, insurance contracts are written and collateral is posted. (3) *payment*: wages and rentals are paid into deposits, households choose how much of them to hold as currency and where to place the rest, and the banks' net positions settle at the central bank.

Workers. Workers supply labour, are paid in advance, and spend their wage one period later. Their preferences are

$$\mathbb{E}_0 \sum_{t\geq 0} \beta^t \Big[\log C_t^W - \frac{H_t^{1+1/\psi}}{1+1/\psi} + \lambda_W \frac{(m_t^W)^{1-\vartheta_W}}{1-\vartheta_W} \Big], \qquad \psi > 0,\ \lambda_W > 0,\ \vartheta_W > 1, \tag{3.1}$$

with ψ the Frisch elasticity of labour supply and $m_t^W = M_t^W/P_t$ the real currency they carry. The last term is the service of cash in the transactions that must be paid in cash; deposits are the means of payment for everything else and give no such service. The curvature ϑ_W is the one parameter of this demand: real transaction cash rises with real spending with elasticity $1/\vartheta_W$. Household-level estimates of that elasticity run from 0.1 to 0.5 and cluster at 0.3–0.5, lower where cards are widely accepted (Attanasio et al., 2002; Lippi and Secchi, 2009; Huynh et al., 2015; Briglevics and Schuh, 2013), so ϑ_W is between 2 and 7; Section 4.2 takes $\vartheta_W = 4$, an elasticity of 0.25, in the lower part of the range. The specification is chosen so that one parameter carries that fact and nothing else.

The wage $P_t W_t H_t$ is paid at the payment stage of t and is spendable from the settlement stage of $t+1$. The worker splits it between currency and deposits, places the deposits across the N

banks, and consumes next period out of the balances with their interest:

$$M_t^W + D_t^W = P_t W_t H_t, \qquad P_{t+1} C_{t+1}^W \leq M_t^W + I_{t+1}^W D_t^W. \tag{3.2}$$

Firms finance their wage bill before receipts arrive, which is the working-capital channel (Christiano et al., 2005; Barth and Ramey, 2001), and wage income is spent with a lag out of a transaction account, the cash-in-advance timing of Lucas and Stokey (1987). The spending constraint binds whenever the real return on deposits is below the worker's impatience, which holds throughout (Appendix A.1): workers are hand to mouth, as a large share of households are, holding little liquid wealth beyond a transaction balance (Kaplan et al., 2014).

Banks are imperfect substitutes for a depositor: a balance is more convenient when spread across banks than when concentrated at one, and the worker weighs that against the rate each bank pays. A balance D_t^W placed as $\{D_{i,t}\}$ across the N banks must satisfy the placement constraint

$$\Big[\sum_{i=1}^{N} N^{1/\eta_D} D_{i,t}^{\frac{\eta_D+1}{\eta_D}}\Big]^{\frac{\eta_D}{\eta_D+1}} \leq D_t^W, \qquad \eta_D > 0, \tag{3.3}$$

which the equal split satisfies with equality and any concentration violates at the same balance. Taking the posted rates $\{I_{i,t+1}^W\}$ as given, the worker chooses the allocation to maximise interest income.

Capitalists. Capitalists own the banks, the fund, the firms and the capital stock, and consume the residual. Their preferences are linear in consumption with a liquidity term,

$$\mathbb{E}_0 \sum_{t\geq 0} \beta^t \Big[C_t^K + \lambda_K \frac{\Lambda_t^{1-\vartheta_K}}{1-\vartheta_K}\Big], \qquad \Lambda_t = \Big[a^{1/\eta_M} (m_t^K)^{\frac{\eta_M-1}{\eta_M}} + (1-a)^{1/\eta_M} (d_t^K)^{\frac{\eta_M-1}{\eta_M}}\Big]^{\frac{\eta_M}{\eta_M-1}}, \tag{3.4}$$

with $m_t^K = M_t^K/P_t$ their real currency, $d_t^K = D_t^K/P_t$ their real wholesale deposits, $\eta_M > 1$ the elasticity of substitution between the two, $\vartheta_K > 0$ the curvature of liquidity services, and $\eta_M \vartheta_K > 1$. The aggregate is the one of Belongia and Ireland (2014). Linear utility makes the marginal utility of consumption one in every state, so that intermediary payoffs are valued at their expected discounted value and the money conditions below are level conditions in which neither consumption nor wealth appears. Two features of the liquidity term carry the mechanism, and neither can be dropped. Deposits must enter the aggregate beside currency: if currency alone gave liquidity services, the deposits that lending creates would enter no margin of the capitalist's problem, the currency condition would not move when credit expands, and the price level would not respond to credit at all; it is the substitution of created deposits for currency inside Λ that makes a credit expansion inflationary (Section 3.3). And consumption must stay out of the money conditions: with a concave utility of consumption the steady-state riskless rate would be pinned at the owners' impatience, which removes the price of regulatory capital (Proposition 1), and payouts would enter the price level through consumption; linear utility is what keeps the price level a function of the loans made and of nothing else the intermediaries do. The store-of-value demand that Λ describes is in the data: roughly half of euro banknotes held inside the euro area are a store of value rather than transaction balances, concentrated in the upper tail of the income distribution (Zamora-Pérez, 2021; Lalouette et al., 2021; Deutsche Bundesbank, 2020).

Capitalists hold the capital stock K_t and rent it to firms at the real rental rate r_t; it depreciates at rate δ and is augmented by investment X_t in goods:

$$K_{t+1} = (1-\delta)K_t + X_t. \tag{3.5}$$

The rental $P_t r_t K_t$ is paid at the payment stage of t out of the firm's loan, like the wage bill, and is spendable by the capitalist from $t+1$. The rental is therefore the part of the deposits that lending creates which the capitalist carries for a period, and it is a fixed share of every loan (Section 3.1); its role in the price level is in Section 3.3. At $\delta = 1$ the capital is an operating input bought each period.

At the settlement stage of t the capitalist receives the balances carried from $t-1$ with their interest, the dividends and payouts of the intermediaries and firms, and the government's transfer, and pays for consumption, investment and the balances carried into $t+1$:

$$P_t C_t^K + P_t X_t + M_t^K + D_t^K = M_{t-1}^K + I_t^K D_{t-1}^K + P_t r_t K_t + P_t Y_t^K, \qquad Y_t^K \equiv d_t^B - i_t^B + d_t^F - i_t^F + \mathrm{Div}_t + \mathrm{Tr}_t, \tag{3.6}$$

with d_t^B, i_t^B the banks' dividend and equity issuance, d_t^F, i_t^F the fund's payout and injection, Div_t the dividends of firms, and Tr_t the transfer. The rental is received as money and cannot be consumed before $t+1$:

$$M_t^K + D_t^K \geq P_t r_t K_t, \tag{3.7}$$

while dividends and the transfer, received at settlement, are consumed at once. Capitalists inject no equity into firms.

Firms and credit demand. A firm of type σ hires labour $H_t(\sigma)$ at the wage W_t and rents capital $K_t(\sigma)$ at the rate r_t, both paid in advance out of a one-period loan $L_t(\sigma) = W_t H_t(\sigma) + r_t K_t(\sigma)$ (in goods of t), and produces at $t+1$

$$Y_{t+1}(\sigma) = z_{t+1}\,\omega\, H_t(\sigma)^{\alpha_H} K_t(\sigma)^{\alpha_K}, \qquad \alpha \equiv \alpha_H + \alpha_K < 1, \qquad \log\omega \sim N(-\sigma^2/2, \sigma^2), \quad \mathbb{E}\omega = 1. \tag{3.8}$$

z_{t+1} is aggregate productivity, constant except in the stress experiment; ω is idiosyncratic and realised after borrowing. Firms are distributed over $\sigma \in [\sigma_L, \sigma_H]$ with density g, each type of unit mass per unit of density; projects last one period and are replaced. Write $F(\bar\omega;\sigma)$ for the distribution function of ω and $G(\bar\omega;\sigma) = \int_0^{\bar\omega} \omega\,\mathrm{d}F$ for its partial expectation; with $u = (\log\bar\omega + \sigma^2/2)/\sigma$, $F = \Phi(u)$ and $G = \Phi(u-\sigma)$. This is the default environment of Bernanke et al. (1999) without the monitoring cost: the least structure under which a loan has a default rate and a loss rate that depend on the borrower's risk, which is what a risk-sensitive capital rule prices and what insurance transfers.

The firm borrows at the gross nominal rate $I_{t+1}^L(\sigma)$ from one lender. Under limited liability it defaults if and only if revenue falls short of the debt, $\omega < \bar\omega_{t+1}(\sigma)$, with

$$\bar\omega_{t+1}(\sigma) = \frac{I_{t+1}^L(\sigma)}{\Pi_{t+1}} \frac{L_t(\sigma)}{z_{t+1} H_t(\sigma)^{\alpha_H} K_t(\sigma)^{\alpha_K}}; \tag{3.9}$$

in default the lender takes the revenue and nothing is destroyed (a resolution loss belongs to the quantitative layer, Section 4). Taking the loan rate, the wage and the rental as given, the owners

choose H and K to maximise the expected discounted equity payoff $\beta\,\mathbb{E}_t[(\omega-\bar{\omega}_{t+1})^+]\,z_{t+1}H^{\alpha_H}K^{\alpha_K}$.

Lenders and the choice of lender. A firm can borrow from the bank sector or from the fund. For a given firm the two are perfect substitutes: the firm takes the lower real gross rate, and since its loss factor is the same whoever lends, the lower net cost of credit. Within the bank sector banks are imperfect substitutes. The bank part of a type's borrowing, L^B, is raised from bank-specific facilities L_i through the constant-elasticity aggregate

$$L_t^B(\sigma) = \Big[\sum_{i=1}^{N}\Big(\frac{1}{N}\Big)^{1/\eta} L_{i,t}(\sigma)^{\frac{\eta-1}{\eta}}\Big]^{\frac{\eta}{\eta-1}}, \qquad \eta>1, \tag{3.10}$$

with η the switching elasticity across banks and the $1/N$ weights chosen so that at equal quantities the aggregate equals the sum of its parts: no love of variety, N matters only through conduct. Bank i posts a net rate $x_{i,t}$, its gross rate being $1+x_{i,t}$; only the interest bill varies with the allocation across banks, since the principal and the deposits it creates depend on the total.

Banks. The N banks are symmetric; the sector is described per bank times N, and since every constraint is homogeneous of degree one, sector-level notation is exact (Appendix A.7). The bank sector's balance sheet at the end of the contracting stage is

$$\sum_{\sigma} L_t^B(\sigma) + Z_t + A_t = D_t^W + D_t^K + T_t + e_t, \tag{3.11}$$

where $L_t^B(\sigma)$ are loans to the bank-served types, Z_t a loan to the fund (zero unless the switch of Section B.9 is on), A_t the banks' net balance at the central bank's facility, of either sign, D_t^W and D_t^K retail and wholesale deposits, T_t the insurance collateral held, and e_t equity. The facility balance is the residual.

$$\text{(RW)} \qquad e_t \geq \kappa_r\Big[\sum_{\sigma\in\mathcal{U}} w(\sigma)L_t^B(\sigma) + \sum_{\sigma\in\mathcal{C}} v(\sigma)L_t^B(\sigma) + w_Z Z_t\Big], \qquad (\mu_t) \tag{3.12}$$

$$\text{(LEV)} \qquad e_t \geq \kappa_\ell\Big[\sum_{\sigma} L_t^B(\sigma) + Z_t + (A_t)^+\Big], \qquad (\phi_t) \tag{3.13}$$

with $\mathcal{U}$ the bank-served types whose pools are uncovered, $\mathcal{C}$ those whose pools are covered by the instrument of Section 3.1, and μ_t, ϕ_t the multipliers. The risk weight $w(\sigma)$ rises with the type's risk, from a floor w_0, and is bounded; the covered weight $v(\sigma) \leq w(\sigma)$ is defined with the contract in Section 3.1. The two weights are those of the Basel framework: the internal-ratings approach makes the weight a function of the borrower's default probability, and the securitisation framework gives a retained senior tranche a lower weight once the junior tranche has been transferred (Basel Committee on Banking Supervision, 2017; BCBS CRE41; CRR, 2026; European Banking Authority, 2020b). The leverage rule is slack in the region of interest and is verified, not assumed; it is optional (Section B.9) and is kept because it makes the risk-weighted rule part of a framework rather than a stand-alone cap, and because insurance relaxes the first and not the second.

Bank i sets its rate on type σ taking rivals' rates, the fund's price, the insurance spread and factor prices as given, and internalising two things: the response of its share of the type's borrowing to its own rate, and the effect of its own rate, through the index, on the type's default threshold.

The bank maximises shareholder value. At the contracting stage it chooses, besides rates and coverage, the equity e_{t+1} it will carry into the next period; at settlement it pays out the surplus of post-settlement equity over the target or raises the shortfall. In the baseline both are costless and immediate, the *frictionless reset*; the quantitative layer changes this rule and nothing else in the bank's problem. Post-settlement equity is

$$e_{t+1}^{\text{post}} = \sum_{\sigma} \Big[\frac{(1 + x_t(\sigma)) L_t^B(\sigma)}{\Pi_{t+1}} - \text{loss}_{t+1}^B(\sigma) L_t^B(\sigma) - \mathbf{1}_{\sigma \in \mathcal{C}}\, \tau(\sigma) q_t(\sigma) L_t^B(\sigma) \Big] + \frac{I_{t+1}^Z Z_t + I_{t+1} A_t - I_{t+1}^W D_t^W - I_{t+1}^K D_t^K - I_{t+1} T_t}{\Pi_{t+1}}, \tag{3.14}$$

where loss^B is the loss the bank bears: the whole loss on uncovered types, the excess over the tranche on covered ones.

The fund and the insurance market. The fund is a competitive, price-taking sector with a fixed real capital W^F. It lends to firms and sells insurance against cash collateral; optionally it borrows from banks up to a cap (Section B.9). Its resources are allocated between loans and collateral:

$$\sum_{\sigma \in \mathcal{N}} L_t^F(\sigma) + T_t = W^F + Z_t, \qquad T_t = \sum_{\sigma \in \mathcal{C}} \tau(\sigma) L_t^B(\sigma), \tag{3.15}$$

with $\mathcal{N}$ the fund-served types and T_t the collateral posted. The fixed stock is the limiting form of the capital of the sellers of loan protection: credit funds and pension funds, which have bought most of the protection sold, and insurers; many of the funds are closed-end, so that their investors cannot withdraw capital on demand, and none of these sellers is subject to the bank capital rules (Cortes et al., 2025; Babu et al., 2026; Osberghaus and Schepens, 2026); in the European Union the closed-ended form is the legal default for alternative investment funds that originate loans, an open-ended one being allowed only under a liquidity-management derogation (AIFMD II, 2024). The private-credit sector that lends to the firms banks do not serve is funded the same way. Entry and exit belong to the quantitative layer.

Taking every price as given, the fund chooses its loans and the collateral it posts to maximise the discounted value of its resources at $t + 1$.

On a pool of its loans to type σ, the bank buys first-loss protection: the fund bears realised losses on the pool up to $\tau(\sigma)$ per covered euro and the bank bears the excess. The fund posts cash collateral $\tau(\sigma)$ per covered euro in a segregated account at the bank, which earns the facility rate, so that a euro of collateral raises the bank's facility balance by one and its net cost of custody is zero; the bank pays the fee $q_t(\sigma)$ per unit of collateral at settlement, in full whether or not the tranche is exhausted. Protection lasts one period. Why this contract: synthetic risk transfers are first-loss or junior tranches on performing loan pools, protected by cash collateral or funded notes, with the bank retaining the senior piece; the tranche is sized above expected loss, as the first-loss test for significant risk transfer requires (European Banking Authority, 2020b; Osberghaus and Schepens, 2026; CRR, 2026; European Banking Authority, 2020a). The collateral ratio is sized to

the pool's risk,

$$\tau(\sigma) = n\,\ell(\sigma)\,\frac{I^L_{t+1}(\sigma)}{\Pi_{t+1}}, \qquad n > 1, \tag{3.16}$$

n times the pool's expected loss per euro.

Regulation replaces $w(\sigma)$ on the covered pool by the retained-senior weight $v(\sigma)$, which is bounded below by the floor w_0 and rises toward the pool weight as the pool's risk rises relative to the tranche: when the slice the bank sells is thin relative to the pool's own capital charge, the senior piece the bank keeps is no safer than the pool and carries its full weight on the part retained, $(1-\tau)w$ per euro of pool, the slice sold carrying no capital. We use the one-parameter form

$$v(\sigma) = w(\sigma) - \big(w(\sigma) - w_0\big)\min\Big\{1,\ \frac{\tau(\sigma)}{b\,\kappa_r\,w(\sigma)}\Big\}, \qquad b > 0, \tag{3.17}$$

full relief down to the floor while the tranche covers at least b times the pool's capital charge, relief shrinking to zero as it does not; the securitisation formula of the regulation has this shape and replaces it in the quantitative layer. Relief per covered euro is

$$\varrho(\sigma) \equiv \kappa_r\big(w(\sigma) - v(\sigma)\big) = \kappa_r\big(w(\sigma) - w_0\big)\min\Big\{1, \frac{\tau(\sigma)}{b\kappa_r w(\sigma)}\Big\}, \tag{3.18}$$

zero at the floor, rising with the weight in the middle, and bounded by τ/b at the top, where the pool's capital charge outgrows the tranche: per euro of collateral, relief stops growing while the expected loss, and with it the collateral, keeps rising. The stand-in lets v approach w, which overstates the capital on a covered pool by at most $\kappa_r\tau w$; the quantitative layer uses the statutory form. That relief falls short of the collateral's cost at high risk is what keeps the riskiest firms at the fund (Proposition 2).

The government and the price level. The government runs the central bank's facility, issues currency, and balances its budget with a lump-sum transfer to capitalists. Three conventions describe it.

The currency stock grows at a fixed gross rate,

$$M_{t+1} = \theta M_t, \qquad \theta \geq 1, \tag{3.19}$$

and is held by the two households, $M_t = M^W_t + M^K_t$. This is the policy instrument. It is a nominal anchor that does not pin the riskless rate, which the mechanism needs (the result on a fixed-rate instrument, Appendix A.21), and it makes the price level move with the public's demand for currency, which is what a credit expansion in this model changes. Institutionally it describes a central bank that accommodates bank liquidity at whatever rate the deposits lending has created are willingly held, and leans against credit in doing so.

The facility pays I_{t+1} on the banks' net balance A_t of either sign and is *indexed* to the wholesale deposit market: $I_{t+1} = I^K_{t+1}$, so that banks are indifferent at the margin between a wholesale deposit and a euro at the facility. There is no bond and no instrument at a fixed rate. Why: a fixed-rate instrument that banks can arbitrage against the facility pins the riskless rate to it by competition, the wholesale deposit market can no longer clear by price, and the sign of the mechanism is lost:

A fixed-rate instrument would flatten the deposit market (Appendix A.21): If banks have access to any instrument at a fixed nominal rate, competition for wholesale deposits pins I^K to it; the

capitalists' deposit condition (3.24) then holds with $\upsilon_t > 0$ (they are rationed) or with money carried beyond the receipts (a voluntary excess). In the voluntary case currency does not respond to lending at all; in the rationed case the split between currency and deposits is pinned by the fixed rate, so currency demand rises in proportion to the rental bill and lending is deflationary.

3.2 Solution

The first-order conditions and the equilibrium objects follow, agent by agent, in the order of Section 3.1.

Workers. The solution (Appendix A.2) is a share system,

$$\frac{D_{i,t}}{D_t^W} = \frac{1}{N}\Big(\frac{I_{i,t+1}^W - 1}{I_{t+1}^W - 1}\Big)^{\eta_D}, \qquad I_{t+1}^W - 1 = \Big[\frac{1}{N}\sum_i (I_{i,t+1}^W - 1)^{1+\eta_D}\Big]^{\frac{1}{1+\eta_D}}, \tag{3.20}$$

with shares rising in a bank's net rate relative to the index with elasticity η_D, an equal split at equal rates, and interest income equal to the index rate times the balance. In the symmetric equilibrium every bank holds $1/N$ of every worker's deposits. The friction stands for the stickiness of retail deposit rates: they respond to market rates by a fraction, the deposit beta, which is lower where banks are more concentrated (Hannan and Berger, 1991; Drechsler et al., 2017), and in the euro area the long-run beta on household sight deposits is about 0.25, down to about 0.1 in the 2022–24 cycle (Albertazzi et al., 2026; European Central Bank, 2023). The constant-elasticity placement technology delivers a markdown proportional to the riskless rate (Section 3.1), which is what those betas measure.

Taking the wage, the deposit rates and prices as given, the worker chooses hours, the split of the wage between currency and deposits, and the placement. The first-order conditions (Appendix A.1) are

$$H_t^{1/\psi} = \beta\,\mathbb{E}_t\Big[\frac{I_{t+1}^W W_t}{\Pi_{t+1} C_{t+1}^W}\Big], \qquad \lambda_W (m_t^W)^{-\vartheta_W} = \beta\,\mathbb{E}_t\Big[\frac{I_{t+1}^W - 1}{\Pi_{t+1} C_{t+1}^W}\Big]. \tag{3.21}$$

Labour supply is forward looking in next period's price because the wage is spent one period later: anticipated inflation taxes hours. The cash condition says that the marginal service of a euro of cash equals the deposit interest it forgoes, valued at next period's marginal utility of consumption. Both choices are interior: the marginal service of cash is unbounded at zero, so workers hold currency at any positive deposit rate, and $C_{t+1}^W = (M_t^W + I_{t+1}^W D_t^W)/P_{t+1}$ is what they consume. Under certainty the cash condition solves as

$$m_t^W = \Big[\frac{\lambda_W\,\Pi_{t+1} C_{t+1}^W}{\beta\,(I_{t+1}^W - 1)}\Big]^{1/\vartheta_W}, \tag{3.22}$$

rising with spending with elasticity $1/\vartheta_W$ and falling with the deposit rate with the same elasticity.

Capitalists. Taking rates, prices and the rental as given, the capitalist chooses consumption, investment, and the currency and deposits to carry. The first-order conditions (Appendix A.3) are

$$\lambda_K \Lambda_t^{-\vartheta_K}\Big(\frac{a\Lambda_t}{m_t^K}\Big)^{1/\eta_M} = 1 - \upsilon_t - \beta\,\mathbb{E}_t\Big[\frac{1}{\Pi_{t+1}}\Big], \tag{3.23}$$

$$\lambda_K \Lambda_t^{-\vartheta_K}\Big(\frac{(1-a)\Lambda_t}{d_t^K}\Big)^{1/\eta_M} = 1 - \upsilon_t - \beta\,\mathbb{E}_t\Big[\frac{I_{t+1}^K}{\Pi_{t+1}}\Big], \tag{3.24}$$

$$1 = \beta\,\mathbb{E}_t\big[(1-\upsilon_{t+1})\,r_{t+1} + 1 - \delta\big], \tag{3.25}$$

with $\upsilon_t \geq 0$ the multiplier on (3.7) in euros of t. The left side of the two money conditions is the liquidity service of a euro of currency and of deposits. The right side is what carrying the euro costs: one unit of consumption today, less its discounted real return, less the relief it gives to the receipts constraint. A unit of capital costs one good and returns its rental, valued at $1-\upsilon$ per euro because the rental arrives as money that must be held, plus the undepreciated remainder. Section 3.1 selects the configuration in which the receipts constraint holds with equality at $\upsilon_t = 0$; there the rental rate is $r = 1/\beta - 1 + \delta$ in every period, capital is supplied at that rate in whatever quantity firms demand, and the two money conditions determine the capitalists' currency demand and the wholesale deposit rate.

Firms and credit demand. The two first-order conditions (Appendix A.4) give a fixed input mix and a condition on the threshold alone:

$$\frac{W_t H_t(\sigma)}{L_t(\sigma)} = \frac{\alpha_H}{\alpha}, \qquad \frac{r_t K_t(\sigma)}{L_t(\sigma)} = \frac{\alpha_K}{\alpha}, \qquad \alpha\big(1 - G(\bar\omega;\sigma)\big) = \bar\omega\big(1 - F(\bar\omega;\sigma)\big). \tag{3.26}$$

The loan finances the wage bill and the rental bill in the fixed proportions α_H/α and α_K/α. With no equity stake the project is entirely debt financed, so a change in the cost of credit changes its scale and not its leverage: the default threshold, and with it the default probability $F(\bar\omega(\sigma);\sigma)$, is a function of (α,σ) only. The low root of the threshold equation is the relevant one, and $\bar\omega(\sigma)$ rises with σ: riskier types default more. Given the threshold, the scale of the loan follows from (3.9):

$$L_t(\sigma) = \left[\frac{\bar\omega(\sigma)\,z_{t+1}\,\Psi_t}{I^L_{t+1}(\sigma)/\Pi_{t+1}}\right]^{\frac{1}{1-\alpha}}, \qquad \Psi_t \equiv \left(\frac{\alpha_H}{\alpha W_t}\right)^{\alpha_H}\left(\frac{\alpha_K}{\alpha r_t}\right)^{\alpha_K}, \qquad -\frac{\partial \log L_t(\sigma)}{\partial \log I^L_{t+1}(\sigma)} = \frac{1}{1-\alpha}. \tag{3.27}$$

Credit demand of every type has the same constant elasticity with respect to the real gross loan rate, the no-default benchmark exactly; it falls with the wage with elasticity $\alpha_H/(1-\alpha)$ and with the rental with elasticity $\alpha_K/(1-\alpha)$.

The lender's expected loss per euro lent is (Appendix A.4)

$$\ell(\sigma)\,\frac{I^L_{t+1}(\sigma)}{\Pi_{t+1}}, \qquad \ell(\sigma) \equiv F(\bar\omega(\sigma);\sigma) - \frac{G(\bar\omega(\sigma);\sigma)}{\bar\omega(\sigma)} \in (0,1), \tag{3.28}$$

a type-specific loss factor times the real gross rate: a dearer loan is a riskier loan in proportion, because the threshold is fixed and the promise is what is lost in default states. ℓ rises with σ. The lender's expected real receipts net of losses per euro, $(1-\ell(\sigma))\,I^L_{t+1}(\sigma)/\Pi_{t+1}$, are the object lenders price and compete on, the *net cost of credit* of the type.

Lenders and the choice of lender. Taking the posted rates as given, the firm chooses $\{L_i\}$ to minimise $\sum_i x_{i,t}L_{i,t}$ subject to (3.10) delivering the facility it wants (Appendix A.5):

$$\frac{L_{i,t}(\sigma)}{L^B_t(\sigma)} = \frac{1}{N}\left(\frac{x_{i,t}}{x_t}\right)^{-\eta}, \qquad x_t = \left[\frac{1}{N}\sum_i x_{i,t}^{1-\eta}\right]^{\frac{1}{1-\eta}}, \qquad \sum_i x_{i,t}L_{i,t} = x_t L^B_t, \tag{3.29}$$

with x the rate index the firm faces and the interest bill equal to the index times the facility. The aggregator stands for the fact that borrowers do not move freely between banks, because of relationships, information and distance, so that the terms a firm gets depend on the bank it is tied to (Petersen and Rajan, 1994; Degryse and Ongena, 2005; Ioannidou and Ongena, 2010); it gives

each bank a downward-sloping demand with a constant switching elasticity, the mirror image of the depositor's placement problem.

Let $a_t^B(\sigma)$ be the bank's all-in marginal cost of serving type σ per euro, net of the expected loss (defined in Section 3.1), and ρ_t^F the fund's required net return per euro lent, which is its return on capital (Section 3.1). The firm's net cost of credit is the lower of the bank sector's price and the fund's,

$$\big(1-\ell(\sigma)\big)\frac{I_{t+1}^L(\sigma)}{\Pi_{t+1}} = \min\Big\{\big(1-\ell(\sigma)\big)\frac{1+x_t(\sigma)}{\Pi_{t+1}},\ \rho_t^F\Big\}, \tag{3.30}$$

and the lender is the bank sector if and only if $a_t^B(\sigma) \le \rho_t^F$. Three regions on the risk line follow (Appendix A.6). Where the bank's markup price is below the fund's, banks price at their markup. Where the bank's cost is below the fund's price but its markup price is above, banks *limit-price*: they post the fund's price and keep the firm. Where the bank's cost is above the fund's price, the firm borrows from the fund. Because a^B rises with σ (Section 3.1) there is a single *migration cutoff* σ_t^* with $a_t^B(\sigma_t^*) = \rho_t^F$: banks serve $\sigma \le \sigma^*$, the fund serves $\sigma > \sigma^*$. The bank funds a loan with deposits at a marked-down rate and the fund funds it with capital that must earn ρ^F, so on funding the bank is always cheaper. What the bank pays and the fund does not is the capital charge, and the charge rises with the borrower's risk; the two cost curves cross, and above the crossing regulation prices the bank out. No firm is rationed and no elasticity between lenders is assumed: the fund's clientele is the set of firms for which the regulatory cost of a bank loan exceeds the fund's scarcity rent on capital. That non-bank lenders serve the riskier firms is what the direct-lending evidence shows (Chernenko et al., 2022); here it is a result.

Banks. A loan of one euro creates α_H/α euros of wage deposits and α_K/α euros of rental deposits at the lending bank. The worker allocates the first by (3.20); the capitalist, who earns the same wholesale rate at every bank, is indifferent and in the symmetric equilibrium holds $1/N$ at each. So the lending bank keeps $1/N$ of the deposits it created and the rest flows to rivals, settled through the facility. The lending bank's marginal funding cost of a loan euro, in real terms at settlement, is

$$c_{t+1}^B = \frac{1}{\Pi_{t+1}}\Big[I_{t+1} - \frac{\alpha_H}{\alpha N}\big(I_{t+1} - I_{t+1}^W\big)\Big], \tag{3.31}$$

the facility rate on every euro except the retail share it keeps, on which it pays the marked-down rate; wholesale deposits cost the facility rate and leave no franchise. The deposits that arrive from rivals' lending earn the bank $(I_{t+1} - I_{t+1}^W)/\Pi_{t+1}$ on the retail part and enter no marginal condition: they are the *deposit franchise*, a profit line separate from lending. Loans are priced off the riskless rate up to the small retained retail share.

Each bank posts a retail rate $I_{i,t+1}^W$ facing the share system (3.20), valuing a deposit euro at the facility rate. Profit maximisation gives (Appendix A.8)

$$I_{t+1}^W - 1 = \frac{\eta_D(1-1/N)}{1+\eta_D(1-1/N)}\big(I_{t+1}-1\big), \tag{3.32}$$

a markdown on the net riskless rate that shrinks with the switching elasticity and with the number of banks; $\eta_D \to \infty$ gives the riskless rate and $\eta_D \to 0$ a zero rate. Wholesale deposits are homogeneous: a bank posting above the facility rate loses money on every euro it attracts and a bank posting

below attracts none and loses nothing, so the bank side of that market is flat and the rate is pinned on the depositors' side (Section 3.1); in the baseline $I^K_{t+1} = I_{t+1}$, and a proportional markdown below the facility rate, set by the wholesale depositors' switching elasticity (Section 4), is a switch of the quantitative layer. Banks do price deposits by holder class, and the retail rate is the sticky one. In the euro area the official statistics report households and firms separately and the gap is systematic, in December 2025 0.25% against 0.52% on overnight deposits (European Central Bank, 2026d); price sensitivity differs sharply between households and firms, firms the more sensitive (Albertazzi et al., 2026); and within households the gradient runs by sophistication: banks serving high-income or educated depositors raised rates more in 2022–23, and the less sophisticated hold all their liquid wealth in deposits (Narayanan and Ratnadiwakara, 2024; Cirelli, 2023). Banks that lose retail deposits replace them only in part with wholesale funding, which costs more at the margin (Drechsler et al., 2017). The two tiers are the limiting form of this pattern.

Its perceived demand elasticity is (Appendix A.9)

$$\varepsilon^B(\sigma) = \eta\Big(1 - \frac{1}{N}\Big) + \frac{1}{N}\,\frac{1}{1-\alpha}\,\frac{x(\sigma)}{1+x(\sigma)}, \tag{3.33}$$

the switching term plus the small response of the type's total borrowing to the index rate. Define the bank's *all-in marginal cost* of a euro of type σ, net of the expected loss, as the funding cost plus the capital charge, and, on a covered type, plus the cost of the collateral that insurance requires:

$$a^B_t(\sigma) = c^B_{t+1} + \frac{\phi_t \kappa_\ell}{\beta \nu_{t+1}} + \begin{cases} \dfrac{\mu_t \kappa_r w(\sigma)}{\beta \nu_{t+1}} & \sigma \in \mathcal{U}, \\[2ex] \tau(\sigma)\, s_t + \dfrac{\mu_t \kappa_r v(\sigma)}{\beta \nu_{t+1}} & \sigma \in \mathcal{C}, \end{cases} \tag{3.34}$$

where $\tau(\sigma)$ is the collateral per covered euro and s_t the fund's excess return, both from Section 3.1, and ν the marginal value of bank equity (one in the baseline). The lending first-order condition is, in the markup region,

$$\frac{(1+x(\sigma))\big(1-\ell(\sigma)\big)}{\Pi_{t+1}} - \frac{1}{\varepsilon^B(\sigma)}\,\frac{x(\sigma)}{\Pi_{t+1}}\Big(1 - \frac{\ell(\sigma)}{N}\Big) = a^B_t(\sigma)\,: \tag{3.35}$$

net receipts per euro minus the market-power wedge equal the all-in cost. The term ℓ/N in the wedge is the bank's own effect on the type's default threshold, kept because the condition is exact. The condition is linear in x and solves in closed form; in the limit-pricing region it is replaced by the fund's price, and in the competitive limit $\eta \to \infty$ the wedge vanishes and the bank prices at cost.

The marginal value of equity satisfies the envelope condition (Appendix A.10)

$$\nu_t = \beta\, \mathbb{E}_t\Big[\nu_{t+1}\frac{I_{t+1}}{\Pi_{t+1}}\Big] + \mu_t + \phi_t\,: \tag{3.36}$$

a marginal euro of equity sits at the facility and relaxes both constraints. With the frictionless reset $\nu \equiv 1$.

Proposition 1 (The steady-state price of regulatory capital)**.** *In a steady state with the leverage rule slack and* $\bar{\nu} = 1$*,*

$$\bar{\mu} = 1 - \beta\,\frac{\bar{I}}{\bar{\Pi}}, \tag{3.37}$$

the owners' impatience minus the real return on the bank's idle euro. The risk-weighted requirement binds if and only if $\bar{I}/\bar{\Pi} < 1/\beta$.

This is where the nominal block enters the mechanism: regulatory capital has a steady-state price only if the riskless real return is below the owners' impatience. Section 3.1 shows that the gap is the liquidity premium on wholesale deposits, so that $\bar{\mu}$ is pinned by the capitalists' money demand. In steady state a unit of risk-weighted capacity is worth $\bar{\mu}$ per period; on impact, with equity predetermined and the requirement binding, μ_t is read off the pricing conditions at the constrained book, and a capital shortfall forces rates up along an inelastic demand (Appendix A.11). With the frictionless reset, equity above the requirement is paid out, because a euro inside earns $\beta\bar{I}/\bar{\Pi} < 1$ of its payout value once the requirement no longer needs it: across steady states the freed capital leaves the bank.

The fund and the insurance market. Attach $\beta\rho_t^F$ to (3.15): ρ_t^F is the shadow value, in goods of $t+1$, of a euro of fund resources at t. The first-order conditions (Appendix A.12) are

$$\text{loans to type } \sigma: \qquad \big(1-\ell(\sigma)\big)\frac{I^L_{t+1}(\sigma)}{\Pi_{t+1}} = \rho_t^F \quad \text{for every } \sigma \in \mathcal{N}, \tag{3.38}$$

$$\text{collateral on type } \sigma: \qquad \frac{I_{t+1}}{\Pi_{t+1}} + q_t(\sigma) - \frac{\mathbb{E}_t \min\{\text{loss}_{t+1}(\sigma), \tau(\sigma)\}}{\tau(\sigma)} = \rho_t^F, \tag{3.39}$$

with $q_t(\sigma)$ the fee per unit of collateral: every use of a euro of fund capital earns the same marginal return. The fund charges every firm it serves the same net cost of credit ρ^F, and the real gross rate it posts to type σ is $\rho^F/(1-\ell(\sigma))$. The excess return of fund capital over the riskless rate,

$$s_t \equiv \rho_t^F - \frac{I_{t+1}}{\Pi_{t+1}} > 0, \tag{3.40}$$

is the price of a euro of fund capital over what a euro earns at the facility, and the single price through which the fund's capacity is rationed between its two uses. It is positive whenever fund capital is scarce relative to the demand for it, which is checked, not assumed. The fund pays out its net income each period; in the baseline a shortfall after losses is made up at once at no cost, as for the bank. Without an insurance market the fund lends to the types above the migration cutoff at the net cost ρ^F that clears its capacity against their demand; the insurance market is a second use of the same capital.

Covering a euro of type σ changes the bank's costs in three ways: it pays the fee τq; it no longer bears the loss up to the tranche; and its capital charge on the euro falls from $\kappa_r w$ to $\kappa_r v$. The fund's condition (3.39) gives the fee,

$$q_t(\sigma) = \frac{\mathbb{E}_t \min\{\text{loss}_{t+1}(\sigma), \tau(\sigma)\}}{\tau(\sigma)} + s_t, \tag{3.41}$$

the expected transferred loss plus the fund's excess return: a deal-specific expected-loss component and a common capital price. Outside stress the tranche is not exhausted and the first term is $1/n$. The expected transferred loss cancels between the two sides, so the fee net of it is the collateral's cost τs per covered euro, the covered all-in cost is the second line of (3.34), and the bank covers type σ if and only if

$$\frac{\mu_t\, \varrho(\sigma)}{\beta \nu_{t+1}} \;\geq\; \tau(\sigma)\, s_t, \tag{3.42}$$

the value of the capital released per covered euro against the cost of the collateral that releases it. The decision is all or nothing per type. Dividing by the expected loss: the bank covers the types with the most relief *per euro of expected loss*, which under a risk-sensitive weight are not the riskiest. Collecting the lender rule and the cover rule, the risk line splits into four sets,

$$\mathcal{U}_0 = \{\sigma : w(\sigma) = w_0\}, \quad \mathcal{C} = \{\sigma \le \sigma^* : (3.42) \text{ holds}\}, \quad \mathcal{U}_1 = \{\sigma \le \sigma^*\}\backslash(\mathcal{U}_0 \cup \mathcal{C}), \quad \mathcal{N} = \{\sigma > \sigma^*\} : \tag{3.43}$$

the lightest-weighted loans uncovered at banks; a covered band; loans the bank keeps uncovered because relief has fallen below the collateral's cost but the bank is still cheaper than the fund; and the riskiest tail at the fund. The boundaries are closed-form given (μ_t, s_t), and banks limit-price in the neighbourhood below σ^* (Appendix A.13).

The quantity of protection and its price are pinned together with the fund's lending by one price, s_t, through the capacity identity (3.15): a higher s raises the migration cutoff, so fewer firms borrow from the fund, and narrows the covered band, so less collateral is posted; both demands for fund capital fall, supply is fixed, and s clears uniquely (Appendix A.13). No bargaining rule, no convex cost and no market-power factor is needed: price taking on both sides gives an interior allocation because the demand for protection slopes down through the relief schedule.

Proposition 2 (Coexistence of the fund's two lines)**.** *If the cover condition fails at the top of the risk line, the value of the relief there being below the collateral's cost, and the bank's uncovered cost exceeds the fund's price there, then in every equilibrium with an insurance market the fund keeps a lending book: $\sigma^* < \sigma_H$. If instead the covered weight stayed at the floor for every type, insurance would dominate fund lending for every firm whenever $c^B \le I/\Pi$ and $\tau < 1$, and the fund's book would disappear. (Appendix A.14.)*

The second statement is why the covered weight must rise toward the pool weight: a euro of fund capital covers $1/\tau$ euros as collateral and one euro as a loan, so with full relief everywhere the bank would always prefer to insure. In the regulation relief shrinks to the charge on the slice sold when a thin tranche attaches below the pool's capital charge; in the data the riskiest credit is at non-banks and insured pools are performing portfolios.

Proposition 3 (Two results of the market without market power)**.** *(i)* Regulatory origin. *If $\mu_t = 0$, no type is covered: with $\varrho\mu = 0$ the condition (3.42) fails for every σ since $s > 0$. (ii)* Strict bank gain. *Every type strictly inside the covered band earns the bank a surplus of $\mu\varrho(\sigma)/(\beta\nu) - \tau(\sigma)s$ per covered euro, under price taking on both sides. (Appendix A.13.)*

The government and the price level. Given the loans made, the deposits forced on capitalists are a quantity, the rental bill. The bank side of the wholesale market is flat (Section 3.1), so the rate must be pinned on the depositors' side. The wholesale rate is the rate at which capitalists hold the rental at an interior optimum:

$$\upsilon_t = 0, \qquad M_t^K + D_t^K = P_t r_t K_t, \tag{3.44}$$

with (3.23)–(3.24) at $\upsilon_t = 0$. The rental is the inelastic supply, the two money conditions the demand, and I^K clears. This is the Walrasian equilibrium of a market with inelastic supply, stated

as a condition because it is a selection: with the bank side flat, the capitalists' conditions with υ_t free admit a continuum of rationed configurations, in which the rental rate carries a compensating wedge $1/(1-\upsilon)$ above its resource cost, and of voluntary-excess ones. Institutionally the convention reads, together with the indexed facility, as a central bank that accommodates at the rate at which the created deposits are willingly held. On the clearing branch the rental rate is $r = 1/\beta - 1 + \delta$ and capital is priced at its resource cost (Appendix A.3).

Every loan euro cancels against the deposit it created, and what remains at the facility is the economy's unborrowed wealth, bank equity and fund capital, less the currency the public holds in place of deposits (Appendix A.15):

$$A_t = e_t + W^F - \frac{M_t}{P_t}. \tag{3.45}$$

The identity determines the facility balance, a quantity. The government's budget, in goods of t, is

$$\mathrm{Tr}_t = -\frac{(I_t - 1)A_{t-1}}{\Pi_t} + \left(A_t - \frac{A_{t-1}}{\Pi_t}\right) + \frac{M_t - M_{t-1}}{P_t}, \tag{3.46}$$

the facility interest and the change in the government's liabilities to banks, plus the seigniorage on new currency, paid out to or collected from the capitalists as a lump sum; under linear utility it is neutral, and the inflation tax on currency falls on the two households in proportion to their holdings.

Combining the currency identity with the two households' demands,

$$P_t = \frac{M_t}{m_t^K + m_t^W}, \tag{3.47}$$

where m_t^K solves (3.23) given the real rental bill $r_t K_t$ and Π_{t+1}, and m_t^W is (3.22). The first of these is the channel: the rental bill enters (3.23) only through the aggregate Λ, in which deposits substitute for currency, so the price level responds to lending because, and only because, created deposits are liquidity to the capitalist (Section 3.1). In steady state inflation equals currency growth, $\bar{\Pi} = \theta$, and the price level is the currency stock over a constant real demand. Two facts of this block deserve stating now. The capitalists' deposit condition on the clearing branch reads $\bar{\mu} = \lambda_K \bar{\Lambda}^{-\vartheta_K}((1-a)\bar{\Lambda}/\bar{d}^K)^{1/\eta_M}$: the steady-state price of regulatory capital of Proposition 1 is the marginal liquidity service of a euro of wholesale deposits, and it is positive because that service is. And the real rental bill is a fixed share of credit, $r_t K_t = (\alpha_K/\alpha)\sum_\sigma L_t(\sigma) g(\sigma)$, so the balance forced on capitalists moves one for one with the loans made.

Equilibrium and steady state.

Definition 1 (Equilibrium). *Given the productivity sequence $\{z_t\}$, the currency rule (3.19) with M_0, the fund's capital W^F, the regulatory parameters $(\kappa_r, \kappa_\ell, w(\cdot), w_0, b)$, and initial balances and equity, an equilibrium is a sequence of prices $\{P_t, W_t, r_t\}$, deposit and facility rates $\{I_{t+1}, I^W_{t+1}, I^K_{t+1}\}$, loan rates, fees and the fund's return $\{I^L_{t+1}(\sigma)\}$, $\{q_t(\sigma)\}$, ρ^F_t, allocations $\{H_t(\sigma), K_t(\sigma), L_t(\sigma)\}$, $\{H_t, K_t, X_t\}$, consumption $\{C^W_t, C^K_t\}$ and balances $\{m^W_t, m^K_t, d^W_t, d^K_t\}$, lender assignments $(\mathcal{U}_0, \mathcal{C}, \mathcal{U}_1, \mathcal{N})_t$, balance-sheet positions $\{L^B_t(\sigma), L^F_t(\sigma), T_t, A_t, e_t\}$, payouts, the transfer, and multipliers $\{\mu_t, \phi_t, \nu_t\}$ such that:*

1. *workers optimise: (3.2) with the spending constraint binding, (3.20) and (3.21);*

2. *capitalists optimise:* (3.6), (3.5), (3.23)–(3.25), *with the clearing selection* (3.44);

3. *each type solves* (3.26)–(3.27) *at the rate of its lender, and the lender rule* (3.30) *holds;*

4. *banks' rates satisfy* (3.35) *or the limit-pricing constraint, their retail rate* (3.32), *their equity the capital rule with* (3.36), *their coverage decisions* (3.42), *with* (3.12)–(3.13) *and complementary slackness;*

5. *the fund satisfies* (3.15)–(3.39);

6. *the facility is indexed,* $I_{t+1} = I^K_{t+1}$, *the flow of funds* (3.45) *and the budget* (3.46) *hold;*

7. *markets clear: labour,* $\int H_t(\sigma)g(\sigma)\,\mathrm{d}\sigma = H_t$; *capital,* $\int K_t(\sigma)g(\sigma)\,\mathrm{d}\sigma = K_t$; *currency,* $M_t = P_t(m^W_t + m^K_t)$; *and goods,* $Y_t = C^W_t + C^K_t + X_t$, *which is implied by the budgets (Walras's law, Appendix A.16).*

A steady state is an equilibrium with z constant in which every real quantity and every rate is constant and nominal quantities grow at θ, so that $\bar{\Pi} = \theta$.

The steady state reduces to two scalar roots, one inside the other (Appendix A.17). *Given a trial value of the real riskless return $\bar{I}/\theta$:* the price of regulatory capital $\bar{\mu} = 1 - \beta\bar{I}/\theta$, the retail rate (3.32), the funding cost (3.31), the rental $r = 1/\beta - 1 + \delta$, hours $\bar{H}$ from (3.21), and the thresholds and loss factors, type by type, are pinned analytically. *Given further a trial value of $\bar{\rho}^F$:* each type's uncovered and covered costs (3.34), its cover decision (3.42), its rate from (3.35) or from the fund, and so $I^L(\sigma)$, none of which depend on the wage; the wage from labour clearing in closed form; and with it every loan. The inner root is the fund's capacity identity (3.15), one equation in $\bar{\rho}^F$ whose left side is decreasing, so the root is unique. The outer root is the capitalists' deposit condition (3.24) at $\upsilon = 0$: with the loans known, the real rental bill $(\alpha_K/\alpha)\bar{L}$ is known, the cash condition (3.23) at $\bar{\Pi} = \theta$ gives $\bar{m}^K$ and so $\bar{d}^K$, and the deposit condition returns a value of $\bar{I}/\theta$ that must equal the trial value. The price level then follows from (3.47), equity from the binding requirement, the facility balance from (3.45), and the checks are: the leverage rule slack, $\bar{s} > 0$, the markup existence condition, the low root of the threshold equation, goods clearing and the budget. The real block depends on the nominal block through one number, $\bar{I}/\theta$; the nominal block depends on the real block through one number, total credit.

3.3 Results

Propositions 2 and 3 and the risk line (3.43) describe the market: insurance exists because regulation binds; it is bought on the types with the most relief per euro of expected loss; the fund lends where regulation prices banks out; banks earn a strict surplus on inframarginal covered types without any buying power.

Adoption: credit. On impact, the market changes little (Appendix A.18): Open the insurance market in an economy at its no-insurance steady state, with bank equity e_0 predetermined for one period. (i) The shadow price of the requirement does not rise on impact: $\mu_0 \leq \bar{\mu}$, with equality only if no cover is written and the fund lends no more than before. (ii) Cover written at date 0 is bounded: it is bought only while the requirement binds, so the risk-weighted capacity it releases,

net of the fund loans withdrawn to post its collateral, must be refilled by bank lending at lower rates, and the capacity that lending can absorb is at most the response of credit demand to the removal of the whole capital charge, $\Delta_{\max}$, which is small because that demand is inelastic in rate space. The covered band of the insurance steady state is written from date 1, once equity has been reset. (iii) If the fund holds capacity at date 0 that was not lent in the no-insurance steady state, it is lent to the risky tail at the excess return that places it, and the marginal types move from banks to the fund; when the bank book so displaced exceeds $\Delta_{\max}$, the requirement is slack, $\mu_0 = 0$, and no cover is written at date 0. (iv) Total credit rises on impact by the fund's additional lending net of the types it takes from banks, plus the banks' re-lending at rates lower by the charge; the expansion lasts one period. At the next settlement equity is reset to the insurance steady state's target, the band is covered, and the capital the cover releases is paid out, not re-lent.

The re-lending the evidence measures, freed capital returning to lending, is in the model the permanent fall in the covered types' cost of credit of the result on adoption across steady states (Appendix A.19), not a refill on impact: the capital that cover releases leaves as a payout at the first settlement. At the calibration of the quantitative layer the fund has no lending book in the no-insurance steady state, so an opening with the fund's capital in place is case (iii): the computed path has $\mu_0 = 0$, no cover at date 0, the fund's capital lent to the riskiest types for one period, and the band covered from date 1.

Across steady states (Appendix A.19): Across the no-insurance and insurance steady states, holding the real riskless return fixed: (i) for every type strictly inside the covered band the net cost of credit falls by $\bar{\mu}\varrho(\sigma)/\beta - \tau(\sigma)\bar{s} > 0$, times the markup factor in the markup region, and its borrowing rises by $1/(1-\alpha)$ times the proportional fall in its real gross rate; (ii) the fund's excess return rises, so the migration cutoff rises and the types that move from the fund to uncovered bank lending pay more and borrow less; (iii) the equity stock falls by the relief on the covered book net of the capital absorbed by the extra lending, and the freed capital is paid out.

The sign of the total credit response is not established analytically: The sum of (i) and (ii) over types is positive: a euro of fund capital lowers the cost of credit by more as collateral than as a loan, so the reallocation of the fund's fixed capital from lending to collateral raises total credit. The sign is not established analytically for general distributions and is left for computation.

Coverage is by type and the marginal loan of a covered type is covered, so relief is marginal for the band and the long-run effect on its cost of credit is first order. It comes from relief being marginal, not from any payout rule; the frictionless reset pays the freed capital out, and a retention rule would change the speed at which it leaves, not the level.

Adoption: the price level and incidence. The nominal block adds two objects to the comparison across steady states: the price level and the wholesale rate. Write $\varsigma \equiv \bar{m}^K/(\bar{m}^K + \bar{m}^W)$ for the capitalists' share of the currency stock, and $\Gamma_M \equiv \eta_M \vartheta_K - 1 > 0$.

Proposition 4 (Credit and the price level)**.** *Across steady states of the nominal block, with the currency stock given at a date and inflation at θ: (i) the capitalists' real currency demand falls*

when the real rental bill rises, with elasticity

$$e_K \equiv -\frac{\mathrm{d}\log \bar{m}^K}{\mathrm{d}\log(rK)} = \frac{\Gamma_M\, s_d}{\omega_d + \Gamma_M\,(s_m - \omega_m)} > 0, \tag{3.48}$$

where ω_m, ω_d are the shares of currency and deposits in the rental bill and s_m, s_d their shares in the liquidity aggregate, and the denominator is positive because currency carries the higher opportunity cost; (ii) the wholesale rate rises and the price of regulatory capital $\bar{\mu}$ falls; (iii) the price level responds to total credit $\bar{L}$, of which the rental bill is the fixed share α_K/α, with elasticity

$$e_P \equiv \frac{\mathrm{d}\log \bar{P}}{\mathrm{d}\log \bar{L}} = \varsigma\, e_K - \frac{1-\varsigma}{\vartheta_W}\Big[\frac{\mathrm{d}\log \bar{C}^W}{\mathrm{d}\log \bar{L}} - \frac{\mathrm{d}\log(\bar{I}-1)}{\mathrm{d}\log \bar{L}}\Big], \tag{3.49}$$

the capitalists' satiation against the workers' transaction demand net of the rate's effect on it; (iv) $e_P > 0$ whenever ςe_K exceeds $(1-\varsigma)/\vartheta_W$ by a margin of the order of the net retail deposit rate, since the workers' consumption rises one for one with credit up to a term of that order and the rate term is positive. (Appendix A.20.)

The mechanism is in (i): the deposits that lending creates do part of currency's job, so the marginal liquidity service of a euro of cash falls, capitalists want less of it, and with the stock fixed the price level rises until the real stock equals the new desired holding. The deposit condition then raises the wholesale rate until capitalists hold the created deposits, which lowers the gap between impatience and the riskless return and with it the value of regulatory capital, a general-equilibrium damping of the insurance band. The workers' demand works the other way: their cash rises with spending, by less than proportionally, and falls with the rate. In particular, under the condition of Proposition 4(iv), the opening of the insurance market raises the price level if and only if it raises total credit, by e_P times the proportional credit expansion; a tightening of the capital requirement that contracts credit lowers it by the same elasticity. On the sign, the data do the work: the hoarded share of domestic currency, which is the model's ς, is about 0.56–0.71 in the euro area, and the elasticity of transaction cash to spending, $1/\vartheta_W$, is at most 0.5 (Zamora-Pérez, 2021; Lalouette et al., 2021; Huynh et al., 2015; Lippi and Secchi, 2009), so $(1-\varsigma)/\vartheta_W$ is at most about 0.22 while ςe_K is above one at the liquidity parameters of the money-demand literature; the sign holds with a wide margin and the quantitative layer gives the number.

Proposition 5 (Incidence)**.** *(i) On impact, the price level jumps to its new path within the period in which the real block adjusts; the balances carried into that date lose e_P times the proportional credit expansion of their real value, a one-off levy on money holders. Workers hold the share $1-\varsigma$ of currency and all retail deposits, so most of the levy falls on them. (ii) Across steady states, the inflation rate is unchanged at θ; workers' real consumption changes with the real wage bill, which rises with credit, and with the retail rate, which rises with the wholesale rate. (iii) Dividends and payouts do not enter the price level: they are consumed at settlement and are not part of the forced balances, so the intermediaries' capital rules have no price effect. (Appendix A.20.)*

The redistribution is a levy on the transaction money of the economy, paid once, and borne by the household that holds it; against it stand a higher real wage bill and a higher deposit rate in the long run. Which dominates is a quantitative question.

Tightening the capital requirement. A higher requirement (Appendix A.22): Raise κ_r, holding the real riskless return fixed. (i) At the fund's old price, every bank-served type's all-in cost rises, its rate rises and its borrowing falls; the migration cutoff falls and the types that migrate pay the fund's price, above their old bank price; the fund-served types are unchanged. Total credit falls. (ii) Relief per covered euro rises in proportion to κ_r, so at the old excess return the covered band's lower boundary falls: more types are insured. (iii) In general equilibrium the fund's excess return rises if the migration of borrowers raises the demand for fund capital by more than the shrinking of covered books lowers the demand for collateral; then every type's cost of credit rises, total credit falls unambiguously, and by Proposition 4 the price level falls; the feedback through $\bar{\mu}$, which rises as credit contracts, reinforces it.

Insurance changes what a tightening does: without it a higher requirement pushes credit to the fund; with it part of the tightening is absorbed by more coverage, and the fund's capital is pulled from lending to collateral. The quantitative layer is where the two are weighed.

Stress. The stress experiment is an unanticipated fall in z at a settlement date.

A fall in productivity exhausts tranches in an order set by how they are sized (Appendix A.23): A fall in realised productivity from z to $z' < z$ raises every type's threshold to $\bar{\omega}z/z'$ and its realised loss factor from $\ell(\bar{\omega})$ to $\ell(\bar{\omega}z/z')$. The tranche of a covered pool is exhausted when the realised loss per covered euro exceeds it, $\ell(\bar{\omega}z/z')R > \tau$. (i) Under the contract (3.16), which sizes every tranche at n times the pool's expected loss, exhaustion occurs when the ratio of realised to expected loss exceeds n; since $\mathrm{d}\log\ell/\,\mathrm{d}\log\bar{\omega} = G/(\bar{\omega}F - G)$ falls with σ, that ratio is larger for safer pools, and for a common shock exhaustion begins at the safe end of the covered band and spreads toward the risky end. (ii) Under a tranche of the same thickness on every pool, a fixed share τ of the covered euros, which is the convention of the quantitative layer, the condition is on the level of the realised loss; the multiple $n(\sigma) = \tau/(\ell R)$ then falls with risk, and since the realised loss rises with σ along the band at the calibration, exhaustion begins at the risky end. In both cases effective protection falls when losses are common; where it falls first is set by how the tranche is sized relative to the pool's risk, and under (i) it falls first where the bank expected it least.

What the mechanism model does not deliver in stress: With the frictionless reset both intermediaries' owners refill capital at settlement at no cost. Losses never constrain lending, the shadow value of capital stays at (3.37), and fund capital is intact. The price level is unchanged too: the currency condition is forward looking in the loans contracted, which a one-period shock does not change, so the fall in output is absorbed by capitalists' consumption through the losses they bear as owners (Appendix A.20). The statements "protection is dearer when banks need it" and "a crisis is inflationary or deflationary" require capital to be costly or slow to replace, which is the quantitative layer; a persistent fall in productivity contracts credit and lowers the price level through Proposition 4.

4 The quantitative model

The mechanism model says what loan insurance does and why; it cannot say how much a crisis costs or how long it lasts, because its intermediaries replace capital at no cost. This section adds

the frictions that make capital costly and slow to replace, calibrates the resulting economy to the euro area, and reports what it delivers in normal times and in a crisis. Every addition is a switch with a neutral value at which the economy is the mechanism model equation by equation, and none reverses a sign of its results.

4.1 From the mechanism model to the quantitative economy

The mechanism model (Section 3) is the smallest economy in which insurance on loans a bank keeps has a price, a buyer, a seller, and consequences for credit, bank capital and the price level. It is exactly solved within its own frictions and it carries the paper's analytical results. It cannot be taken to the data, and it cannot say that relaxing regulation is ever bad: with a frictionless reset of equity, losses never constrain lending, no intermediary fails, and no one but the owners bears the consequences of risk. The quantitative layer adds what is needed for both, under one rule: every addition is a switch with a neutral value at which the model is the mechanism model equation by equation, and no addition may reverse a sign of its results.

The quantitative model is stated in full in Appendix B, which opens with the list of the additions. The paragraphs below give each addition with its central equations; the blocks not repeated here are in that appendix, in their original order.

Project continuation and the resolution loss. Two things are new. First, a project that does not default survives to the next contracting stage with probability γ, where it borrows again; one that defaults, or fails to survive, is replaced by a new project of the same type, so the mass of each type is constant. The expected duration of a project is $1/(1-\gamma)$, calibrated to loan maturities, while every loan is one-period and rolled over. Second, in default the lender recovers only the fraction $1-\zeta$ of revenue; the rest is a resolution cost, lost to the economy.

The project's value and choice. Let $V_t(\sigma)$ be the value to its owners of an operating project at the contracting stage. With limited liability and the owners' discount β,

$$V_t(\sigma) = \max_{H,K\geq 0} \; \beta\,\mathbb{E}_t\Big[\big(1-\Gamma(\bar\omega_{t+1})\big)Y_{t+1} + \gamma\big(1-F(\bar\omega_{t+1})\big)V_{t+1}(\sigma)\Big], \qquad \Gamma \equiv G + \bar\omega(1-F), \quad (4.1)$$

where $\bar\omega_{t+1} = (I^L_{t+1}/\Pi_{t+1})L_t/Y_{t+1}$ is the default threshold, as in the mechanism model. Taking the loan rate, the wage, the rental and the continuation value as given, the owners choose the two inputs. The first-order conditions (Appendix C.2) give the input proportions of the mechanism model and a threshold condition with one new term:

$$\frac{W_tH_t(\sigma)}{L_t(\sigma)} = \frac{\alpha_H}{\alpha}, \qquad \frac{r_tK_t(\sigma)}{L_t(\sigma)} = \frac{\alpha_K}{\alpha}, \qquad \alpha\big(1-G(\bar\omega)\big) = \bar\omega\big(1-F(\bar\omega)\big) + (1-\alpha)\,\gamma\,\bar\omega f(\bar\omega)\,\frac{V_{t+1}(\sigma)}{Y_{t+1}(\sigma)}. \quad (4.2)$$

The new term is the survival cost of scale: expanding raises the threshold and with it the probability of losing the continuation value. At $\gamma = 0$ the threshold is pinned by (α, σ) alone, the mechanism model's result; with $\gamma > 0$ it depends also on the value of continuing relative to output. In steady state that ratio is a function of the threshold alone, $\bar V/\bar Y = \beta(1-\Gamma)/(1-\beta\gamma(1-F))$, so the steady-state threshold is still pinned type by type, by $(\alpha, \sigma, \gamma, \beta)$, and it is lower than at $\gamma = 0$: surviving projects lever less.

Two deposit rates and the riskless rate. Servicing accounts and loans uses resources: a bank bears an operating cost c_D per euro of retail deposits, c_L per euro of loans and a fixed cost c_0 per period, all paid in goods at settlement, while wholesale balances cost nothing to service. Each bank posts a retail and a wholesale rate facing the two share systems, valuing a retail deposit euro at the facility rate net of c_D and a wholesale euro at the facility rate. Profit maximisation gives (Appendix C.1)

$$I^W_{t+1} - 1 = \frac{\varepsilon_D}{1+\varepsilon_D}\big(I_{t+1} - 1 - \Pi_{t+1} c_D\big), \qquad I^K_{t+1} - 1 = \frac{\varepsilon_K}{1+\varepsilon_K}\big(I_{t+1} - 1\big), \tag{4.3}$$

with $\varepsilon_D \equiv \eta_D(1 - 1/N)$ and $\varepsilon_K \equiv \eta_K(1 - 1/N)$: two markdowns on the net riskless rate, the wholesale one the smaller. This is where the quantitative layer has to be explicit about what determines the riskless rate, because the chain of the mechanism model gains a link. The capitalists' deposit condition (B.5) pins the wholesale rate I^K_{t+1} at which they willingly hold the rental; the wholesale markdown (4.3) then pins the riskless rate as that rate grossed up by the markdown,

$$I_{t+1} - 1 = \frac{1+\varepsilon_K}{\varepsilon_K}\big(I^K_{t+1} - 1\big); \tag{4.4}$$

and the central bank's facility is indexed to it, I_{t+1} being the rate it pays on banks' balances of either sign. So the riskless rate is still determined by the capitalists' willingness to hold the deposits lending has created, the central bank still accommodates, and the market still clears by price; the bank side of the wholesale market is no longer flat but a posted markdown, and nothing in the selection argument of the mechanism model, which is on the depositors' side, changes. There is still no instrument at a fixed rate, so the flattening lemma of the mechanism model is not triggered.

Regulation.

$$\text{(RW)} \qquad e_t \geq \kappa_r \Big[\sum_\sigma \big(L^B_t(\sigma) - S_t(\sigma)\big) w(\sigma) + \sum_\sigma S_t(\sigma)\, v(\sigma) + w_Z Z_t \Big], \qquad (\mu_t) \tag{4.5}$$

$$\text{(LEV)} \qquad e_t \geq \kappa_\ell \Big[\sum_\sigma L^B_t(\sigma) + Z_t + (A_t)^+ \Big], \qquad (\phi_t) \tag{4.6}$$

where $S_t(\sigma) \leq L^B_t(\sigma)$ is the stock of protection on the type's book, its covered part; it is a state because coverage of past vintages survives (Section B.6). The weights are the regulation's own. The pool weight is the internal-ratings function of the type's default probability and loss given default,

$$w(\sigma) = w^{\text{IRB}}\big(F(\bar\omega(\sigma);\sigma),\ \ell(\sigma)/F(\bar\omega(\sigma);\sigma)\big), \tag{4.7}$$

and the covered weight is the securitisation formula applied to the senior tranche the bank retains, which attaches at the collateral ratio $\tau(\sigma)$ and detaches at one, capped at the weight of the retained part, since the slice sold carries no capital:

$$v(\sigma) = \min\Big\{\big(1-\tau(\sigma)\big) w(\sigma),\ v^{\text{SEC}}\big(\tau(\sigma),\, 0.08\, w(\sigma)\big)\Big\}. \tag{4.8}$$

Both functions are written out in Appendix C.3 (Basel Committee on Banking Supervision, 2017; BCBS CRE31; BCBS CRE41; CRR, 2026). They have the properties the mechanism model assumed: w rises with the type's risk; v is bounded below by the regulatory floor and rises to the weight of the retained part as the tranche thins relative to the pool's capital, so relief per covered euro, $\varrho(\sigma) \equiv \kappa_r(w(\sigma) - v(\sigma))$, falls at the top of the risk line to the charge on the slice sold, $\kappa_r \tau w$,

below the collateral's cost there, and the coexistence result of the mechanism model holds with the calibrated formulas as with the stand-ins. The securitisation floor v_0 replaces the pool-weight floor w_0 of the mechanism model's stand-in.

Bank-level risk: the loss draw. At settlement, bank i's realised losses on every pool scale with one draw,

$$\text{loss}_{t+1}(\sigma;\xi) = \xi\,\ell(\sigma)\frac{I^L_{t+1}(\sigma)}{\Pi_{t+1}}, \qquad \log\xi \sim N\big(-\sigma_b^2/2,\ \sigma_b^2\big), \quad \mathbb{E}\xi = 1, \tag{4.9}$$

independent across banks and periods: a bank's book loads on the conditions of its own clientele, its sectors and regions, which no diversification within the bank removes. The draw is a reduced form of the location structure of Araujo et al. (2026), in which a bank lends to the firms of its own location and bears a risk it cannot diversify. Two consequences carry the block. Because the fund lends to and insures every bank's clientele, every expectation the fund prices is a mean over the draw: the fund is the diversified party and its block involves means only. And because the tranche's per-period share exceeds the expected loss, $(1-\gamma_X)\tau(\sigma) = n\,\ell(\sigma)I^L_{t+1}(\sigma)/\Pi_{t+1}$ with $n > 1$ (the collateral multiple of the mechanism model, now implied by the tranche and the contract's life), a covered pool loses nothing to the bank unless the draw exceeds n: the bank bears $(\xi-n)^+\ell I^L/\Pi$ per covered euro. With contract survival the per-period share of the tranche is $(1-\gamma_X)\tau$, so the multiple is $n(\sigma) = (1-\gamma_X)\tau/(\ell R)$, which at $\gamma_X = 0$ is the convention of part (ii) of the result on tranche exhaustion (Appendix A.23). Post-settlement equity is therefore piecewise linear in the draw: around its mean $\bar{e}^{\text{post}}_{t+1}$ it falls with $\xi - 1$ times the expected loss on the uncovered book and, once the draw exceeds n, with $\xi - n$ times the expected loss on the covered book (Appendix C.4, eq. C.3). The lognormal structure gives every probability and partial expectation the block needs in closed form, through the standard normal distribution function Φ and $\bar{\Phi} \equiv 1-\Phi$ (Appendix C.4). With $\sigma_b \to 0$ the draw degenerates and every object of this section is the mechanism model's.

Lending: the pricing condition. Bank i sets its rate on type σ as in the mechanism model, internalising its share of the type's borrowing and its own effect on the type's threshold, with perceived elasticity

$$\varepsilon^B(\sigma) = \eta\Big(1-\frac{1}{N}\Big) + \frac{\varepsilon(\sigma)}{N}\,\frac{x(\sigma)}{1+x(\sigma)}, \tag{4.10}$$

$\varepsilon(\sigma)$ from (B.6). Two terms are added to the condition. The operating cost c_L per euro of loan enters the all-in cost. And the bank values a draw-scaled loss at more than its mean: a settlement flow $-\mathfrak{b}\xi$ is worth $-\mathfrak{b}[\nu + \chi\,\text{Cov}(\mathbf{1}_{\text{iss}},\xi)]$ to the owners, since it is larger exactly in the states in which equity is replaced at the cost χ (Section 4.1). Write

$$\kappa_\xi \equiv \frac{\chi\,\text{Cov}_\xi(\mathbf{1}_{\text{iss}},\xi)}{\nu} \ \geq 0 \tag{4.11}$$

for the risk charge, the covariance per unit of the marginal value of equity. The all-in cost and the pricing condition are

$$a^B_t(\sigma) = c^B_{t+1} + c_L + \frac{\phi_t\kappa_\ell}{\beta\nu_{t+1}} + \begin{cases} \dfrac{\mu_t\kappa_r w(\sigma)}{\beta\nu_{t+1}} & \text{uncovered,} \\[2ex] \tau(\sigma)\,s_t + \dfrac{\mu_t\kappa_r v(\sigma)}{\beta\nu_{t+1}} - \text{RT}_t(\sigma) & \text{covered,} \end{cases} \tag{4.12}$$

$$\frac{(1+x)\big(1-(1+\kappa_\xi)\ell\big)}{\Pi_{t+1}} - \frac{1}{\varepsilon^B}\,\frac{x}{\Pi_{t+1}}\Big(1-\frac{(1+\kappa_\xi)\ell}{N}\Big) = a_t^B(\sigma), \tag{4.13}$$

where $\mathrm{RT}_t(\sigma) \geq 0$ is the risk-transfer value of coverage defined in Section B.6: on a covered type the bank bears only the loss above the tranche, so its loss term in (4.13) is the expected residual loss with its covariance premium, which the appendix writes out; (4.13) is displayed for the uncovered case and the covered case replaces $(1+\kappa_\xi)\ell$ by the residual-loss expression. At $\sigma_b = 0$, $\kappa_\xi = \mathrm{RT} = 0$ and at $c_L = 0$ the condition is the mechanism model's. Limit pricing against the fund and the migration cutoff are unchanged.

Three rules replace the frictionless reset of the mechanism model.

The target and the common component. At the contracting stage the bank sector carries equity e_t against its book; the requirement (4.5) binds in every equilibrium of interest (the result on the steady-state price of regulatory capital, Appendix C.5), so the sector's target for next period is the capital its chosen book requires, $e_{t+1} = \kappa_r \mathrm{RWA}_{t+1}$. Whether the sector can reach the target depends on its *common* post-settlement equity $\bar{e}^{\,\mathrm{post}}_{t+1}$, the mean over the draw. If $\bar{e}^{\,\mathrm{post}}_{t+1} \geq e_{t+1}$ the surplus is paid out. If it falls short, the sector does not issue equity to make up the common shortfall unless capital inside is worth the issuance cost, $\nu_{t+1} \geq 1+\chi$; otherwise it pays nothing out, its book is the one its capital supports, and capital is rebuilt from retained earnings until the target is regained. This is the retention rule: payouts above target only, and a sector-wide loss rebuilt from earnings, which is what gives stress persistence.

The reset of the idiosyncratic component. Bank i's own post-settlement equity is $e^{\mathrm{post}}_{t+1}(\xi)$, which differs from the sector's by its draw. The difference is reset at once: a bank with a better draw than the sector pays out the excess, a bank with a worse draw raises the shortfall at the proportional cost χ, so that every bank enters the next contracting stage with the sector's equity. Issuance by bank i therefore occurs when its draw exceeds the threshold ξ^*_t defined by $e^{\mathrm{post}}_{t+1}(\xi^*_t) = e_{t+1}$ in the common case $\bar{e}^{\mathrm{post}} \geq e_{t+1}$ (and by $e^{\mathrm{post}}_{t+1}(\xi^*_t) = \bar{e}^{\mathrm{post}}_{t+1}$ in a common shortfall), so that

$$\pi_{t+1} = \Pr[\xi > \xi^*_t], \qquad \nu_{t+1} = 1 + \chi\,\pi_{t+1}, \qquad \mathrm{Cov}_\xi(\mathbf{1}_{\mathrm{iss}}, \xi) > 0, \tag{4.14}$$

the issuance probability of a bank, the marginal value of its equity and the covariance between issuing and the draw, all in closed form (Appendix C.4). ν is the ex-ante marginal value of a euro of bank equity: one, plus the issuance cost weighted by the probability of having to raise it. Resetting idiosyncratic shortfalls while retaining common ones keeps the cross-section of banks degenerate under bank-level risk. The rule reflects the asymmetry of equity markets in a crisis: a single bank can raise equity against a shortfall of its own, while the sector cannot when losses are common.

The envelope and the price of capital. A marginal euro of equity sits at the facility and relaxes both requirements:

$$\nu_t = \beta\,\mathbb{E}_t\Big[\nu_{t+1}\frac{I_{t+1}}{\Pi_{t+1}}\Big] + \mu_t + \phi_t, \qquad \nu \in [1, 1+\chi]. \tag{4.15}$$

The steady-state price of regulatory capital is the mechanism model's, scaled by the marginal value of equity (Appendix C.5): In a steady state with the leverage rule slack and an interior

issuance probability $\bar{\pi}$,

$$\bar{\nu} = 1 + \chi\bar{\pi}, \qquad \bar{\mu} = \bar{\nu}\Big(1 - \beta\frac{\bar{I}}{\theta}\Big), \qquad \bar{I} - 1 = \frac{1+\varepsilon_K}{\varepsilon_K}\big(\bar{I}^K - 1\big), \tag{4.16}$$

with $\bar{I}^K$ the wholesale rate at which capitalists hold the rental (eq. B.5): the gap between the owners' impatience and the real riskless return, scaled by the recapitalisation risk the draw creates. The requirement binds whenever the gap is positive.

Relative to the mechanism model the price of capital is higher by the factor $\bar{\nu} \geq 1$, and the gap itself is larger by the wholesale markdown, since the riskless rate now sits above the rate capitalists require. Off steady state ν_t rises toward $1 + \chi$ as a common shortfall raises the issuance threshold's bite, which is the term structure of relief's value: on impact relief is worth the rents on the constrained book, in a common shortfall it is worth the equity it replaces, in steady state the carry cost of capital.

Failure, deposit insurance and re-entry. Limited liability gives the owners a second option at settlement: not to refill. Let V^B_{t+1} be the value to the owners of a bank that enters the next contracting stage with the sector's equity e_{t+1}, the capitalised stream of its rents under the rules above. A bank with post-settlement equity $e^{\text{post}}_{t+1}(\xi)$ below the target is refilled if what the owners keep is worth more than what they put in, $V^B_{t+1} \geq (1+\chi)(e_{t+1} - e^{\text{post}}_{t+1}(\xi))$, and abandoned otherwise. The abandonment threshold on equity and the corresponding draw are

$$e^*_{t+1} \equiv e_{t+1} - \frac{V^B_{t+1}}{1+\chi}, \qquad e^{\text{post}}_{t+1}(\xi^f_t) = e^*_{t+1}, \qquad \varpi_{t+1} = \bar{\Phi}\Big(\frac{\log \xi^f_t + \sigma_b^2/2}{\sigma_b}\Big), \tag{4.17}$$

ϖ being the failure probability of a bank, the mass of banks that fail each period. Parameters are restricted so that the franchise covers the cost of a new bank, $V^B_{t+1} \geq (1+\chi)e_{t+1}$, a condition verified at every solution; then $e^* \leq 0$, only insolvent banks are abandoned, and a failed bank is replaced at the next contracting stage by a new one, endowed with the sector's equity by the capitalists at the issuance cost, which is profitable by the same condition. The sector therefore stays symmetric: the mass ϖ is replaced, and $1 - \varpi$ is refilled or pays out. The value function satisfies (Appendix C.6)

$$V^B_t = \beta\,\mathbb{E}_t\Big[\Big(e^{\text{post}}_{t+1}(\xi) - e_{t+1} - \chi\big(e_{t+1} - e^{\text{post}}_{t+1}(\xi)\big)^+ + V^B_{t+1}\Big)\mathbf{1}\{\xi \leq \xi^f_t\}\Big], \tag{4.18}$$

the discounted payout net of issuance cost plus continuation, in the states in which the owners keep the bank, and zero in the others.

Who bears a failed bank's shortfall. The failed bank's assets are settled; its facility position, if a debt, is senior and repaid in full; the collateral it holds is segregated and returned to the fund; its depositors, retail and wholesale, are owed $D^W + D^K$ with interest and the estate falls short by $-e^{\text{post}}(\xi) > 0$. The deposit-insurance scheme pays the shortfall, so no depositor loses and the created deposits stay in the system. The scheme's outlay per period is the sector's expected shortfall on failed banks,

$$J_{t+1} = \mathbb{E}_\xi\Big[-e^{\text{post}}_{t+1}(\xi)\,\mathbf{1}\{\xi > \xi^f_t\}\Big] \geq 0, \tag{4.19}$$

in closed form by the lognormal partial expectations (Appendix C.4); it is financed through the budget (Section B.7). The facility ranks ahead of depositors, as central bank lending does in

practice: it is secured, sits outside the depositor ranking and is protected in resolution, and no documented case has left a central bank with a final loss on a failed bank, though in several the repayment came from the sovereign or the insurer (European Parliament and Council, 2014b; Bindseil et al., 2017; European Central Bank, 2024). The ranking rarely matters here: the banks' facility balance is unborrowed wealth less currency, positive in normal times, so the central bank is a debtor of the banking sector, not a creditor.

The fund's capital cycle. At settlement the fund's capital becomes W_{t+1}^{post}, its resources after loan losses, tranche payments and the carry on borrowing, all at the realised aggregate state and at the mean over the banks' draws. Above the target the surplus is paid out; below it nothing is paid and capital is rebuilt from earnings; an injection is made only if the marginal value of fund capital, ν^F, reaches $1+\chi^F$. The marginal value follows $\nu_t^F = \beta\rho_t^F\nu_{t+1}^F$ below the target and $\nu_t^F = \beta\rho_t^F$ at it, where capital is paid out at the margin; in steady state $\bar{\nu}^F = \beta\bar{\rho}^F$, below one at the calibration, which is why the capital must be trapped to stay in: the owners would withdraw it if they could. The fund's capital is an outcome: in steady state it is the level at which the fund's excess return equals the return its investors require, s^*; along a path it is rebuilt from earnings, new capital committed when the fund's marginal value of capital exceeds its issuance threshold arrives one quarter later at the issuance cost, and a fund enters when protection is first demanded or when a failed fund is replaced.

The contract with finite maturity. A contract written at t on the bank's loans to type σ covers $S_t(\sigma) - \gamma_X S_{t-1}(\sigma) \geq 0$ new euros, at the fee $q_t(\sigma)$ per unit of collateral and with collateral $\tau(\sigma)$ per covered euro, and survives to the next period with probability γ_X at the fee it locked in. Geometric survival makes two totals per type sufficient for the whole history of vintages: the stock of protection,

$$S_t(\sigma) = \gamma_X S_{t-1}(\sigma) + \big[S_t(\sigma) - \gamma_X S_{t-1}(\sigma)\big], \qquad S_t(\sigma) \leq L_t^B(\sigma), \tag{4.20}$$

and the fees locked in on the surviving contracts, which Appendix C.8 carries as a second state; surviving coverage in excess of the book lapses. At settlement the fund bears, per covered euro of the active coverage, the bank's realised loss up to the tranche's per-period share, $\min\{\xi\ell I^L/\Pi, (1-\gamma_X)\tau\}$, and receives the locked-in fees; the bank bears the excess; the collateral on the active coverage earns the facility rate and is returned as contracts lapse. At $\gamma_X = 0$ every contract is one-period and S_t is the covered book of the mechanism model.

Demand, supply and the covered band. Covering a euro of type σ for the life of a contract changes the bank's position in four ways: it releases capital, $\kappa_r(w-v) = \varrho$ per euro each period while alive, valued at the shadow price of the requirement; it removes the loss up to the tranche, a draw-scaled flow that the bank values at its mean plus the covariance premium,

$$\text{RT}_t(\sigma) \equiv \frac{\chi}{\nu_{t+1}} \text{Cov}_\xi\Big(\mathbf{1}_{\text{iss}},\ \min\{\xi\,\ell(\sigma) I_{t+1}^L(\sigma)/\Pi_{t+1},\ (1-\gamma_X)\tau(\sigma)\}\Big)\ \geq 0, \tag{4.21}$$

the risk-transfer value: protection pays exactly in the states in which the bank replaces equity at a cost; it commits the fee for the contract's life; and it costs the fund the collateral's carry, s_t per unit of collateral each period while alive. With the co-states of inherited coverage and of the inherited

fee bill, which Appendix C.8 derives as perpetuities with decay, the bank's demand fee and the fund's supply fee for new coverage are

$$q_t^D(\sigma) = \frac{\mathcal{V}_t^B(\sigma)}{\mathcal{B}_t^B}, \qquad q_t^S(\sigma) = \frac{\mathcal{V}_t^F(\sigma)}{\mathcal{B}_t^F}, \tag{4.22}$$

the annuitised value of a unit of coverage over the annuitised cost of promising a unit of fee, on each side, and the market for new coverage on a type clears at $q_t(\sigma) = q_t^D(\sigma) = q_t^S(\sigma)$ under price taking. At $\gamma_X = 0$ the co-states vanish and (4.22) reduces to the mechanism model's supply fee and cover condition with the risk-transfer term added:

$$q_t(\sigma) = \frac{\mathbb{E}_\xi \min\{\xi \ell I^L/\Pi, \tau\}}{\tau} + s_t, \qquad \text{cover iff} \quad \frac{\mu_t \varrho(\sigma)}{\beta \nu_{t+1}} + \mathrm{RT}_t(\sigma) \;\geq\; \tau(\sigma)\, s_t. \tag{4.23}$$

The expected transferred loss cancels between the two sides as in the mechanism model; what remains is the value of the capital released plus the value of removing losses from the issuance states, against the cost of the collateral. The second term is the non-regulatory motive: with $\sigma_b > 0$ and $\chi > 0$ a bank would buy some protection even at $\mu = 0$, which the mechanism model's regulatory-origin result excluded; its size at the calibration is small, because the covariance is of second order in σ_b (Appendix C.4).

Deposit insurance and its financing. The scheme pays the depositors of failed banks their shortfall, J_t of (4.19), as a grant. It is financed in the period in which it is paid by lump-sum taxes on the two households in proportion to their steady-state shares of income, the labour share $\bar{W}\bar{H}/\bar{Y}$ on workers and the remainder on capitalists:

$$\mathrm{Tr}_t^W = -\frac{\bar{W}\bar{H}}{\bar{Y}}\, J_t, \qquad \mathrm{Tr}_t^K = \Big[-\frac{(I_t - 1)A_{t-1}}{\Pi_t} + \Big(A_t - \frac{A_{t-1}}{\Pi_t}\Big) + \frac{M_t - M_{t-1}}{P_t}\Big] - \Big(1 - \frac{\bar{W}\bar{H}}{\bar{Y}}\Big) J_t. \tag{4.24}$$

The bracket is the ordinary budget residual of the mechanism model, the facility interest and the change in the government's liabilities to banks plus seigniorage, which goes to capitalists as before and is neutral under linear utility. The outlay is extraordinary and is split by income as a lump sum; Elenev et al. (2021) instead finance it with government debt repaid over time through taxes on labour income. The lump sum keeps it from entering the hours and capital margins, where a tax of several per cent of a quarter's income would itself make the recession. The split is one parameter, the workers' share of the outlay; zero is the rule of the 3D model, the whole burden on the owners (Clerc et al., 2015), and the population share the per-head rule of Mendicino et al. (2018); both are comparison values for the stress experiment. The scheme is public and unfunded: in practice the first loss falls on banks through pre-funded schemes with statutory targets and the public purse steps in beyond them (European Parliament and Council, 2014a); that first layer is an extension, and its absence here makes the public outlay an upper bound on what the budget would bear.

What the layer keeps.

Proposition 6 (Neutrality and sign preservation)**.** *At $\eta_K \to \infty$, $\gamma = 0$, $\zeta = 0$, $c_L = c_D = c_0 = 0$, $\sigma_b = 0$, $\chi = \chi^F = 0$ with full payout, $\kappa_Z = 0$, $\gamma_X = 0$, and the weights w, v of the mechanism model in place of (4.7)–(4.8), every condition of Sections B.2–B.7 is the corresponding condition of the mechanism model, equation by equation, and the steady state is the mechanism model's.*

(Appendix C.10.) Moreover, at the calibrated values of the switches: (i) The operating costs are additive marginal costs: they raise rates and enter goods clearing, and move no elasticity of the nominal block. (ii) The wholesale markdown shifts the level of the riskless rate above the rate capitalists require and raises $\bar{\mu}$; it leaves the clearing step and the price-level mechanism unchanged. (iii) The continuation value changes the size of the perceived credit elasticity, not its sign, and leaves the steady-state elasticity at the benchmark. (iv) The resolution loss raises every loss factor and lowers every covered band's relief per euro of expected loss proportionally; it cannot make coverage negative. (v) The draw adds the nonnegative terms κ_ξ and RT *and the factor $\bar{\nu} \geq 1$; it widens the covered band and raises the price of capital, and vanishes with σ_b. (vi) The capital cycle changes persistence, not the steady-state levels, which are those of the frictionless reset at the same $\bar{\nu}$. (vii) Rollover changes the speed of repricing, not the one-period limit. (viii) Deposit insurance and the taxes enter households' consumption and the budget, not the forced balances, so the price level remains the function of the loans made that the mechanism model derived. (Appendix C.10.)*

The results of the mechanism model therefore stand in this layer: the shape of the market, adoption on impact and across steady states, credit and the price level, the incidence of adoption on workers' balances, the tightening of the requirement, the order of tranche exhaustion. What follows is what the mechanism model could not say.

4.2 Calibration

The model period is a quarter and the economy is the euro area. Levels are measured in units of the currency stock, which grows at the rate the central bank fixes; rates are gross and per quarter unless a yearly figure is stated. We proceed in three steps. A first set of parameters is assigned from outside the model, each with the source it comes from (Table 1). Seven parameters are then set so that the steady state reproduces seven moments, one each (Table 2). The remaining moments the model produces are not targeted and are read against the data as a validation (Table 3).

Assigned parameters. Table 1 lists them by block. Three choices deserve a word. The discount factor $\beta = 0.98$ is common to both households; it puts the real return capitalists require at about 8 per cent a year, which is also the floor under the banks' return on equity, and it is what makes the fund's capital worth trapping: at the fund's measured real return the owners' impatience exceeds the return, so capital that could leave would. Returns to scale in the firm's technology are $\alpha = 0.85$, the span-of-control value of Atkeson and Kehoe (2005), with the labour elasticity α_H set by the labour share below and the capital elasticity as the remainder. The dispersion of the bank-level loss draw, $\sigma_b = 0.72$, is the dispersion of a bank's net charge-off rate around the banking system's, for United States banks with more than $10 billion of assets (FDIC BankFind, 2026), read as a log-standard deviation; it governs how often an individual bank falls short of its capital target, not how often the sector does, and it is a dispersion parameter rather than a failure-rate target.

Which moment pins which parameter. The seven calibrated parameters and their targets are in Table 2; every target is hit to machine precision in every run that is calibrated. The logic of each pair is as follows. The labour share pins the labour elasticity α_H, since with a Cobb–Douglas technology the two are the same number up to the markup. The two money-demand scales are

Table 1: Assigned parameters (per quarter unless stated)

Symbol	Meaning	Value	Source
Preferences and technology			
β	discount factor, both households	0.98	impatient households of Clerc et al., 2015, Table 1, p. 41; fund's return Cliffwater, 2026 (see text)
ψ	Frisch elasticity of workers' labour supply	0.82	micro, aggregate hours: Chetty et al., 2011, Table 1
α	returns to scale, $\alpha_H + \alpha_K$	0.85	span of control: Atkeson and Kehoe, 2005, Table 1, p. 1045
δ	depreciation of rented capital	0.025	Gertler and Karadi, 2011, Table 1, p. 26; Clerc et al., 2015, Table 1, p. 41
θ	gross growth of currency	1.00496	2 per cent target, ECB, 2021; HICP 1999–2025, ECB ICP, 2026
ϑ_W	curvature of workers' cash demand	4	cash elasticity 0.25, lower part of the 0.1–0.5 range: Attanasio et al., 2002; Lippi and Secchi, 2009; Huynh et al., 2015; Briglevics and Schuh, 2013
η_M, ϑ_K	capitalists' liquidity aggregate	1.5, 2	Belongia and Ireland, 2014, p. 10; Lucas, 2000, p. 250
Market structure			
N	number of symmetric banks	12	asset-weighted national 1/HHI, ECB SSI, 2026
η_D	retail depositors' switching elasticity	0.364	retail pass-through 0.25: Albertazzi et al., 2026, p. 10
η_K	wholesale depositors' switching elasticity	32	wholesale pass-through 0.967: ECB MIR, 2026
Regulation			
κ_r	risk-weighted requirement	0.105	8 per cent, BCBS RBC20, RBC20.1, CRR, 2026, Article 92(1); conservation buffer 2.5 per cent, BCBS RBC30, RBC30.2
IRB inputs	PD floor; LGD input λ_{reg}; maturity	0.05%; 0.344; 2.5 yr	CRR, 2026, Articles 160(1), 162(1); LGD: EBA Risk Dashboard, 2026
SEC-SA	supervisory parameter; weight floor	$p = 0.5$; 10%	CRR, 2026, Article 262; BCBS CRE41, CRE41.21–41.22
w_0	lowest corporate IRB weight	0.1485	CRR, 2026, Article 153(1) at the PD floor
Bank-level risk, capital and costs			
σ_b	dispersion of the bank-level loss draw	0.72	net charge-off rates, US banks above $10bn, FDIC BankFind, 2026
χ, χ^F	cost of new equity, bank and fund	0.053, 0.01	Hennessy and Whited, 2007, Table III, p. 1728; assumed
c_0, c_L, c_D	operating costs: fixed, per loan, per retail deposit	0.21%, 0.143%, 0.162%	total: ECB SUP, 2026; split: Corbae and D'Erasmo, 2021, Table III, Benston et al., 1982, fn. 11, p. 441
Firms			
γ	survival of a project	0.9554	SRT pool maturity 5.6 years, Osberghaus and Schepens, 2026, fn. 18, p. 13
ζ	share of defaulted output lost in resolution	0.33	value lost in debt enforcement, Djankov et al., 2006, Tables 2–3
PD grid	30 types on the distribution of annual PDs	median 1.26%	Koufopoulos et al., 2026, Table 2, p. 29
The contract and the fund			
τ	first-loss tranche, share of the pool	0.08	European Systemic Risk Board, 2025, p. 29; Basel Committee on Banking Supervision, 2026, p. 14
γ_X	survival of a protection contract	0.9167	contract life three years: European Systemic Risk Board, 2025, p. 6; Basel Committee on Banking Supervision, 2026, p. 14
κ_Z, w_Z	fund's borrowing cap; weight on loans to the fund	0.25, 0.29	Matvos et al., 2026, Table 1, p. 9; Osberghaus and Schepens, 2026, fn. 46, p. 47
The backstop			
s_L	workers' share of the deposit-insurance outlay	0.631	labour share, AMECO, 2026 (comparisons 0, 0.90)

pinned by the two ratios of currency to what it serves: workers' transaction cash to their quarterly consumption, and capitalists' currency to their wholesale deposits. The real riskless return, one per cent a year, the mean of the pre-2008 period at which the deposit market cleared without a floor, pins the scale a of the capitalists' liquidity aggregate: it is the return at which capitalists are willing to hold the wholesale deposits that lending creates. The lending spread over the riskless rate, 1.6 percentage points a year, pins the borrowers' switching elasticity η, which sets the markup; the spread also carries the funding, operating, capital and expected-loss terms, so the markup is what is left, about a quarter of the spread. The share of bank credit covered by protection, 6 per cent, pins the fund's required excess return s^*: the covered band is the set of types for which relief per euro of collateral exceeds s^*, and the share rises as s^* falls. The credit-weighted annual default rate, one per cent, pins the weight κ_g that tilts the type distribution toward safer types at a given PD grid.

Table 2: Targets and the parameters they pin

Moment	Data	Source	Parameter	Value
Labour share of income	0.631	adjusted wage share, 1999–2025, AMECO, 2026	α_H	0.661
Workers' cash over quarterly consumption	0.170	transaction share Zamora-Pérez, 2021, Section 5; ECB BKN, 2026; ECB MNA, 2026	λ_W	7.35×10^{-7}
Capitalists' currency over wholesale deposits	0.137	ECB QSA, 2026; ECB BSI, 2026	λ_K	1.10×10^{-3}
Real riskless return (per year)	+1.00%	EONIA, ECB FM, 2026, less HICP inflation, ECB ICP, 2026, 1999–2007	a	0.184
Lending spread over the riskless rate (per year)	1.60 pp	ECB MIR, 2026 less ECB FM, 2026; ECB EST, 2026	η	12.16
Covered share of bank credit	0.060	Osberghaus and Schepens, 2026, pp. 4, 13 over ECB BSI, 2026	s^*	0.01313
Credit-weighted annual default rate	1.00%	default rates, five largest countries, EBA Risk Dashboard, 2026	κ_g	0.289

The firm distribution. Firms come in thirty types on a grid of annual default probabilities that spans the supervisory distribution of corporate exposures, from 0.07 to 19.5 per cent; each type's dispersion σ is the value at which a project priced by a bank defaults with that probability, re-solved under project continuation. The tilt κ_g gives the grid a credit-weighted default rate of one per cent. Riskier types lever less per firm, so credit is concentrated in the safer half of the grid.

Untargeted moments. Table 3 reads the model against moments it was not asked to match. Four are close: the credit-weighted loss given default is 0.356 against 0.34, operating costs are 1.83 per cent of loans a year against 2.09, the fund's return on its capital is 6.4 per cent a year (7.8 with its borrowing) against 7.1, and the share of currency that capitalists hoard rather than use in transactions comes out at 0.17 where the data put it near 0.6, a miss we return to. Three are structural misses that the model's design explains. The return on bank equity is 20 per cent a year against 3.9 in the data: in the model equity is 5 per cent of loans and earns the capital charge's floor of about 8 per cent a year plus the retail deposit franchise and the markup, with no management buffer above the requirement. The steady-state failure rate is of the order of 10^{-12} a year against 0.5 per cent: the loss draw scales one quarter's expected loss, equity is about fifty-seven quarters of

it, and the lognormal tail cannot place a failure of that size at any dispersion, the attainable rate being capped near 0.3 per cent a year. Failures in this model are a stress phenomenon, and we treat them as such in the crisis experiments. The return on posted collateral exceeds the riskless rate by 3.6 percentage points a quarter against 1.7 in the data: the fee carries the per-period expected loss on the covered pool per unit of collateral, which the resolution loss makes about twenty times what it is in the mechanism model; at $\zeta = 0$ the spread returns to 2.2. Finally, the pass-through of the requirement to the loan rate, 2.7 basis points a year per percentage point of κ_r, is at the low end of the 2.3 to 13 that the studies reviewed by Birn et al. (2020, Table 1) find, for the reason the mechanism model already has: credit is the firms' input bill, hours barely move, and the capital charge is a small share of the loan rate.

Table 3: Untargeted moments at the calibration

Moment	Model	Data	Source	Reason for the gap
Credit-weighted loss given default	0.356	0.34	EBA Risk Dashboard, 2026	continuation lowers recovery at a given PD
Operating costs, share of loans (per year)	1.83%	2.09%	ECB SUP, 2026	retail deposits are 0.65 of loans in the model, 0.95 in the data
Fund's return on capital (per year)	6.4% (7.8% levered)	7.1%	Cliffwater, 2026, deflated by ECB ICP, 2026	borrowing at the cap lifts the levered return
Hoarded share of currency	0.17	0.635	Zamora-Pérez, 2021, Sections 2, 3, 5; Lalouette et al., 2021, p. 2	one quarter's rental bill is the only use (Section 4.3)
Fund's share of corporate credit	0	0.044	Cera et al., 2026 over ECB BSI, 2026	the fund's price exceeds every bank type's cost
Real return on bank equity (per year)	20.2%	3.85%	ECB SUP, 2026, deflated by ECB ICP, 2026	equity 5% of loans; charge floor $1/\beta - 1$; franchise and markup
Bank failure rate (per year)	2×10^{-12}	0.54%	SRB, 2026 over ECB, 2026, supervised entities	one quarter's loss base against equity; lognormal bound 0.3%
Return on posted collateral over the riskless rate (per quarter)	3.55 pp	1.70 pp	Osberghaus and Schepens, 2026, pp. 14–15; Cortes et al., 2025, Table 1, p. 16	per-period expected loss per unit of collateral, raised by ζ
Pass-through of κ_r to loan rates (bp per year per pp)	2.65	2.3–13	Birn et al., 2020, Table 1, p. 4	inelastic credit; charge a small share of the rate

4.3 The steady state

Before the crisis experiments it is useful to state what the quantitative economy looks like in normal times, what the additions change relative to the mechanism model, and what they leave in place.

What the layer keeps. The neutrality result of Section 4.1 holds in the code as it does on paper: with every switch at its neutral value the quantitative solver reproduces the mechanism model's calibrated steady state with every gap equal to zero. At the calibration the additions move the levels but not the signs. Credit is 14 per cent lower and the price level 16 per cent higher than in the mechanism model at the same targets, because projects that may continue lever less at a given default probability; the borrowers' switching elasticity rises from 3.7 to 12.2, because operating costs and a loss given default of 0.36 rather than 0.02 absorb most of the 1.6 percentage points of spread; and the elasticity of the price level to credit rises from 1.14 to 1.49, entirely through the workers' deposit rate, which with a cost per euro of retail deposits responds to credit 1.3 times as

much as the riskless rate does. Table 4 decomposes the lending spread: operating costs and the markup account for over half of it, the capital charge for a quarter, the expected loss for the rest, and the collateral cost of the covered types for almost nothing. Every comparative static of the mechanism model keeps its sign: adoption raises credit and the price level, a higher requirement lowers both, and the covered band is the same three types.

Table 4: The lending spread at the calibration (percentage points per quarter, credit-weighted over bank-served types)

Funding cost net of the riskless rate	−0.039
Operating cost per loan	0.144
Capital charge	0.094
Collateral cost net of the risk-transfer value	0.006
Expected loss	0.092
Markup	0.103
Lending spread (target)	0.400

The insurance market in normal times. Protection is bought on three of the thirty types, those with annual default probabilities between 1.2 and 1.5 per cent, the safest of them covered in part; together they are 6 per cent of bank credit by construction. These are not the riskiest borrowers: relief per euro of collateral is largest where the risk weight is high but the expected loss, which sizes the collateral the fund must post, is still moderate. The bank pays a fee of 2.6 to 3.0 per cent a quarter per unit of collateral, of which about 1.2 to 1.5 points is the expected loss transferred and the rest the fund's required excess return of 1.3 per cent a quarter; the per-period share of the tranche stands at five to seven times each covered pool's expected loss per quarter. The fund's capital is 0.4 per cent of total credit and it borrows a quarter of that from the banks at the cap; all of its capacity is posted as collateral and none is lent, because at the excess return the covered share requires the fund's loan rate exceeds the all-in cost at every bank. The second motive for protection that the layer adds, the removal of losses from the states in which a bank must replace equity at a cost, is present but small: it is worth about 0.3 per cent of the relief, and when the requirement is removed altogether no protection is bought. Insurance here has a regulatory origin, as the mechanism model says.

Adoption across steady states. Comparing the economy with the market to the same economy without it at the calibration, total credit and the price level are unchanged to the sixth decimal: at a covered share of 6 per cent the fund's required return sits at the marginal type's threshold, so the band gains almost nothing in cost of credit, and the expansion the mechanism model predicts is of second order. What changes is the banks' balance sheet. Equity falls by 6.4 per cent, the capital that cover releases being paid out, and the failure threshold falls with it: insurance raises the steady-state probability of failure, from 1.8 to 2.3 in 10^{12} a year, because the capital released exceeds the risk shed. The sign is the one the quantitative model leaves to computation, and it is the first of the paper's results on fragility: at the observed scale of the market, insurance is almost invisible in credit and prices and visible only in the capital that leaves the banks.

Tightening the requirement. Raising κ_r from 0.105 to 0.145 lowers credit by 0.03 per cent and the price level by 0.05 per cent, a pass-through of 2.7 basis points a year to loan rates per percentage point of the requirement. The market absorbs most of the tightening: the covered share rises from 6 to 44 per cent of bank credit as relief becomes worth more on types that were uncovered, the fund's capital rises sevenfold, and bank equity falls by 15 per cent rather than rising. The failure probability rises. The fixed-book statement that a higher requirement lowers failure, is not contradicted, because the book is not fixed: in general equilibrium the tightening is met by buying more protection and holding less capital. This is the second result on fragility, and the one a supervisor would want to know: the leakage of a tightening into the insurance market is large, and it works through the sector's capital.

Failure in normal times. The sector's common equity sits at its target, individual banks fall short of theirs in 1.2 per cent of bank-quarters and refill at the issuance cost, and the probability that a bank's loss exceeds its equity and its franchise is negligible, as the validation above explains. Deposit insurance therefore pays out nothing in normal times, and the split of its outlay between the two households, which the crisis experiments make matter, is a steady-state non-event.

Sensitivities. Table 7 recalibrates the model at other values of the four parameters that the data pin least well, each run hitting the seven targets again. The loss dispersion moves the premium on capital and the failure probability but nothing else; only a dispersion of 1.07 brings the failure rate to a visible order, 8×10^{-7} a year. The issuance cost moves the failure threshold through the franchise value. Removing contract survival changes little. The resolution loss is the parameter that matters: at $\zeta = 0$ the loss given default returns to 0.04, the switching elasticity to 6.7 and the collateral spread to its data range, which confirms that the fee's miss in Table 3 is the resolution loss. The elasticity of the price level to credit is 1.486 in every run. Table 7 is in Appendix D.

The opening of the market. Before the crisis, one path that is not a steady state: the market opens in the economy without it, with bank equity inherited from the no-insurance steady state. On the first date there is no fund yet, so nothing is covered; the requirement binds, with a shadow price just below its long-run level, and credit rises by three thousandths of a per cent. The fund enters on the second date with its long-run capital and the whole band is covered at once; the capital this releases, about six per cent of bank equity, is paid out, and from the third date the economy is at the insurance steady state. The price level moves by less than a thousandth of a per cent. Adoption, in this model, is an event for bank capital and not for credit or prices; the re-lending the evidence measures is the permanent fall in the covered borrowers' cost of credit, not a refill on impact. One detail is reported for completeness: the first-date loan book sits exactly where one borrower type is indifferent to buying protection, and the requirement at that date is met to within one hundredth of a per cent of equity rather than exactly.

Two limitations to carry forward. Two features of the steady state qualify what the crisis experiments can show, and we state them here rather than discover them there. First, hours are pinned: with log utility in consumption and workers who spend the wage bill they carry, the wage drops out of the hours condition, so aggregate credit, which is the firms' input bill, moves only

with the wage, and the response of credit to any change in its cost is small in general equilibrium. This is why the pass-through is low, why adoption is a non-event in volumes, and, in the crisis experiments, why a bank short of capital refills it quickly: it charges more, and borrowing barely falls. Second, the hoarded share of currency is 0.17 against 0.6 in the data, because the only use of capitalists' currency in the model is one quarter's rental bill; the price elasticity of currency demand, which the price-level result turns on, is calibrated separately and is not affected, but the level of hoarding is understated.

What the layer delivers. The model implies, first, that protection is dearer when banks need it (Appendix C.11): Let an unanticipated common loss at settlement t leave the sector's common post-settlement equity below its target and the fund's capital below its target. Under the retention rule, with issuance for the common shortfall only at $\nu = 1 + \chi$: (i) the sector's book is limited by its capital, the shadow price μ_t rises above its steady-state value and ν_t rises toward $1 + \chi$; (ii) the fund's capacity falls while the collateral on inherited coverage stays posted, so s_t and every fee rise and the fund lends less to the tail; (iii) relief is worth more to banks and costs more at once, and whether contracted new coverage rises or falls is quantitative, while the fee rises unambiguously; (iv) both capitals are rebuilt from earnings, so fees and the shadow price return to their steady-state values gradually, at a speed set by the retained earnings and by χ. The steady state is unchanged.

This is the insurance-cycle mechanism of the reinsurance literature, capacity depleted by claims and prices high until capital returns, and it is what the stress experiment measures. Debt deflation amplifies it: the price level falls with credit (Proposition 4), the real burden of the nominal loans priced before the shock rises, defaults and losses rise beyond what the productivity fall alone implies, and the sector's common shortfall is larger.

second, a failure probability and a deposit-insurance outlay in closed form (Appendix C.6): (i) In steady state a mass $\bar{\varpi} > 0$ of banks fails each period whenever $\sigma_b > 0$ and the franchise is finite, and the scheme's outlay $\bar{J} > 0$ is paid by the two households in proportion to their income; neither enters any first-order condition of the bank, which maximises the value of the states in which it survives. (ii) A higher requirement κ_r raises the sector's target equity against a given loss base, raises the failure threshold ξ^f, and lowers $\bar{\varpi}$ and $\bar{J}$; it also raises the all-in cost of every bank-served type and lowers credit, as in the mechanism model. (iii) Insurance lowers the retained loss base on the covered types, so for a given equity it lowers $\bar{\varpi}$ and $\bar{J}$; the capital it releases is paid out, which raises them back; the net effect on the failure probability is the sign of the change in the retained loss base per euro of equity, a quantitative object.

Part (iii) is the welfare question of the paper in one line: insurance replaces regulated capital with the fund's; whether the banks that buy it fail less or more often depends on whether the risk they shed exceeds the capital they release, and the deposit-insurance outlay, which the owners do not pay, is what makes the answer matter to someone other than them.

third, who pays for a crisis (Appendix C.11): In the period of a crisis with bank failures, workers' consumption changes by three terms: the fall in the real wage bill as credit contracts; the *gain* on the real value of the balances they carried, since the price level falls with credit; and the loss of their share of the deposit-insurance outlay, $(\bar{W}\bar{H}/\bar{Y})J_t$, paid out of the same balances. Capitalists

bear the losses of the intermediaries and firms they own, the rest of the outlay, and the fall in the real value of their balances' counterpart, the nominal loans. Across steady states nothing changes.

The monetary channel of the mechanism model and the fiscal channel of this layer pull in opposite directions for workers in a crisis: deflation favours the holders of transaction money, the backstop taxes them. Which dominates is the number the stress experiment produces, and the comparison values of the tax split show how much of it is the financing rule.

4.4 A crisis with and without insurance

The experiment. At the settlement of a quarter, productivity turns out lower than the value at which the quarter's loans were priced; it returns to normal the next quarter, and from then on the economy is solved under perfect foresight. Three sizes are used: one standard deviation of quarterly output growth (−0.60 per cent), the 2008–09 fall (−5.73 per cent), and the 2020 fall (−13.96 per cent). Each is run in the economy with the market and in the same economy without it, so that the difference is the effect of insurance. The sector as a whole can issue at most 1.5 per cent of its equity in a quarter, the value the euro-area data give for the worst quarters of 2008–09 and 2011–12, and new capital for the fund arrives one quarter after it is committed. Both are taken from the data, not derived; Section 4.2 gives their sources, and the sensitivities below move them.

The 2008–09 shock. Table 5 reports the quarter of the shock and the next. The loss leaves the banks short of capital: to keep their book at the rate of return their owners require they would have to raise five per cent of their equity, and the cap lets them raise 1.5. The rest of the gap is closed by shrinking the book. The shadow price of capital rises to fourteen times its normal level, the marginal value of a euro of bank equity rises a fifth above the cost of issuing it, and credit falls by 1.35 per cent. Had the cap not bound, as it does not at a cap of six per cent, credit would have fallen by 0.33 per cent: the cap deepens the contraction fourfold. The price level falls by four hundredths of a per cent, because currency demand is forward looking and the loans that carry the rental bill were contracted before the shock. The fund's capital falls by 4.5 per cent, its collateral stays posted, and investors commit new capital at once; it arrives the next quarter. In the quarter of the shock the price of protection is set by the banks' demand for relief at a shadow price of 0.24, not by the fund's loss: the fee on the covered band rises by 60 per cent (by 14 per cent without the cap), and new coverage halves. Refilling the fund in the same quarter, as the sensitivity with no lag does, lowers the fee's rise little, because the demand for relief is what moves it.

Who pays. Capitalists lose first and most: the firms' dividends fall with output in the quarter of the shock, the banks' payout turns into a retention, and the fund's capital is eaten. Workers lose in the next quarter, when the wage bill that the shrunken loan book finances is paid, and their loss is proportional to the fall in credit: 1.4 per cent of their consumption, against 0.3 per cent when the cap does not bind. In present value workers bear 13 per cent of the lost consumption with the cap and 3 per cent without it. The two monetary terms are small at this size: the fall in the price level gives workers a gain on the balances they carry worth three hundredths of a per cent of their consumption, reversed the next quarter, and the deposit-insurance outlay is three ten-millionths of output, so the rule that splits it between the two classes changes nothing visible. Insurance makes

Table 5: The 2008–09 shock: the quarter of the shock (date 0) and the next

	Insured	Uninsured	Insured, cap slack
Issue needed; allowed (per cent of equity)	5.07; 1.50	4.78; 1.50	4.96; 6.00
Shadow price of capital μ_0 (steady state 0.0176)	0.241	0.238	0.071
Marginal value of equity ν_0 $(1+\chi = 1.053)$	1.223	1.220	1.053
Credit, date 0 (per cent)	−1.35	−1.33	−0.33
Price level, date 0 (per cent)	−0.043	−0.042	−0.010
Bank equity, date 0 (per cent)	−4.46	−4.40	−0.89
Fee on the covered band (per cent change)	+60	—	+14
Fund's capital, date 0 (per cent); new capital arrives	−4.5; date 1	—	−4.5; date 1
Banks failing, date 0 (share per quarter)	3.9×10^{-6}	3.4×10^{-6}	5.8×10^{-6}
Target regained	date 1	date 1	date 1
Workers' consumption, date 1 (per cent)	−1.40	−1.38	−0.34
Capitalists' consumption, date 0 (per cent)	−23.2	−23.2	−23.1
Workers' share of the present-value loss	13.0%	12.8%	3.2%

the crisis slightly worse rather than better: credit falls two hundredths of a percentage point more, failures are 16 per cent more frequent, and workers' share rises from 12.8 to 13.0 per cent, because the insured sector holds less capital and the residual losses above the exhausted tranches stay with it.

The capital cycle lasts one quarter. At every shock that solves, only the quarter of the shock is capped, and equity is back at its target in the next: the book priced at a shadow price of 0.24 earns margins worth 31 per cent of equity in one quarter, six times the normal payout. The cap therefore changes how deep the contraction is, not how long it lasts. The reason is the one stated in Section 4.3: borrowers' demand for credit barely responds to its price, so a bank short of capital charges more and refills. A gradual rebuild, as the insurance-cycle literature describes for reinsurers, would need the margins to be competed away.

Debt deflation. Settling every nominal position at the price level expected when the loans were priced, instead of the realised one, the banks' shortfall in the quarter of the shock is 2.6 per cent smaller: the unexpected fall in prices raises the real value of the loans the banks hold (a gain of 0.04 per cent of loans) and of the deposits, facility balance, collateral and fund borrowing they owe (a loss of 0.05 per cent), and the second exceeds the first by about the banks' equity. Revaluing the loans alone would give the opposite sign. The effect is small because the price level falls by four hundredths of a per cent; it raises the realised default rate by 1.5 per cent and the number of failures by 8 per cent.

The size of the shock. Table 6 runs the one-period shock from one to eight per cent of output. Below about 4.9 per cent the banks' retained earnings and ordinary issuance absorb the loss and the cap does not bind; above it the cap binds in the quarter of the shock, and credit, the price level, the shadow price of capital and the price of protection rise steeply with the size of the loss. At eight per cent, credit falls by 7.7 per cent and the shadow price of capital reaches 1.5. Beyond eight per cent the model has no equilibrium under the cap. From twelve per cent the sector's equity after losses is negative and the cap cannot cover it; between 8.5 and 10 per cent its equity is still

positive, but no loan book satisfies the requirement at any price of protection within the range the solver admits, and at eight per cent the required prices are already extreme. The 2020-size shock has no private equilibrium in either economy. In the data the sector was recapitalised by the state, by about six per cent of its end-2008 Tier 1 capital in 2008, after the euro-area governments' rescue commitments of October 2008 (EC State Aid Scoreboard, 2018; ECB CBD2, 2026; ECB FSR, 2008); the model has no public recapitalisation, by design, and this is where it would enter. Within the range where equilibria exist, bank failures never become material: the largest failure rate is one hundredth of a per cent of banks per quarter, at eight per cent.

Table 6: One-period shocks of increasing size, with insurance (the quarter of the shock)

Fall in productivity (per cent)	1	2	3	4	5	6	8
Cap binds	no	no	no	no	yes	yes	yes
Shadow price of capital μ_0	0.019	0.021	0.027	0.035	0.090	0.314	1.508
Credit (per cent)	−0.01	−0.02	−0.06	−0.11	−0.45	−1.77	−7.71
Price level (per cent)	−0.000	−0.001	−0.002	−0.003	−0.014	−0.056	−0.273
Fund's excess return s_0 (normal 0.013)	0.014	0.016	0.020	0.026	0.067	0.234	1.115
Banks failing (share per quarter)	10^{-11}	10^{-10}	10^{-9}	10^{-7}	10^{-6}	6×10^{-6}	1×10^{-4}
Target regained	date 0	date 0	date 0	date 0	date 1	date 1	date 1

A persistent shock. If productivity falls by 5.73 per cent and recovers by a tenth of the remaining gap each quarter, the cap binds in the first quarter with a shadow price of 0.44, credit falls by 7.4 per cent and the price level by 1.7 per cent; equity is back at its target the next quarter, and credit recovers over eighteen quarters at the pace of productivity. Here the monetary channel acts: the fall in prices raises the real burden of the nominal loans priced before the shock, and workers, who lose through the wage bill and gain on their balances, bear 65 per cent of the present-value loss.

Sensitivities. A cap of 0.8 per cent of equity a quarter deepens the contraction to 1.57 per cent and raises workers' loss by 16 per cent; a cap of six per cent does not bind and returns the economy without the cap. A lag of zero lowers the fee's rise little, as said; lags of two and six quarters leave the quarter of the shock unchanged and delay the fund's return to its target, which with a lag of six happens from earnings before the committed capital arrives. A dispersion of bank-level losses of 1.07 instead of 0.72 raises the failure rate in the quarter of the shock to five hundredths of a per cent of banks and leaves everything else within a per cent; insurance raises failures by 10 per cent at that dispersion. The split of the deposit-insurance outlay between the classes has no visible effect at any shock that solves, because the outlay is negligible there.

What the model does not deliver. Three things, stated once. The crisis does not last: at every size that solves, equity is back at its target in one quarter, for the reason given above. The price of protection in the quarter of the shock is not a market price: the fund's excess return of 18 per cent a quarter says that within a quarter the supply of protection is fixed and the demand for relief is urgent, and the fee's rise, not the return, is the number to read. And beyond a loss of about eight per cent of output the model has no private equilibrium, because it has no public recapitalisation: the entry we assumed for the fund and the cap we assumed for the banks are

the two frictions that make a crisis cost something, and both are taken from the data rather than derived.

5 Conclusions

Banks can now buy insurance against the losses on loans they keep, and regulation frees the capital behind the insured loans. We have asked what this does to credit, to prices and to the distribution of wealth in an economy where bank lending creates the deposits that firms spend. The answer comes from a model in which a risk-sensitive capital requirement binds, a fund of outside capital sells protection at the price that clears its capacity, and two classes of households hold, respectively, the money that pays for production and the claims on the intermediaries.

Four results stand. Protection is priced at the loss it transfers plus the return the fund requires on its capital, so banks buy it for the capital it frees, on borrowers of intermediate risk; for them the cost of credit falls for good. When the market expands credit, the deposits it creates raise the price level until the fixed stock of currency is willingly held, and the rise is a levy on the balances workers carry. At the scale the market has reached, insurance is almost invisible in credit and prices and visible in bank capital: it lowers the sector's equity by six per cent and raises, slightly, the probability that a bank fails, and a tightening of the requirement leaks largely into the market rather than into capital. In a crisis of the 2008–09 size, with the sector able to raise only a small fraction of its equity, credit falls by 1.4 per cent, the fee for protection rises by 60 per cent, the loss falls on capitalists through the capital of banks and of the fund and on workers through the wage bill, and insurance makes the crisis slightly deeper rather than shallower; beyond a loss of about eight per cent of output the sector has no private equilibrium.

The model has limits, and we have stated them where they bite. Hours barely move, so credit volumes respond little to their price: the pass-through of the requirement is low, adoption is a non-event in volumes, and a crisis lasts one quarter because a bank short of capital charges more and refills from one quarter's earnings. Deposits are one quarter's flow of payments, where the data's are a stock ten times larger, which the hoarding share and the return on bank equity pay for. The price of regulatory capital is identified with the liquidity premium on wholesale deposits, right for the first and high for the second. Coverage responds to the requirement along a knife-edge. The price of protection in the quarter of a crisis is the price of a fixed within-quarter capacity, not a market price. And the model has no public recapitalisation, so the largest crises have no equilibrium in it.

Two extensions would change the most. Preferences with a weaker income effect would let hours, and with them credit volumes, respond to the loan rate; the capital cycle could then produce persistence, the pass-through would rise, and the re-lending the evidence documents could be matched. Loans that amortise over several quarters, with firms financing most inputs from retained earnings, would give the model the stock of loans and deposits the data show, and with it a deposit market of the right depth. Both are changes to the mechanism model and are left to future work.

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A Derivations: the mechanism model

Every result of the main text is derived here, in the order in which it is cited. Perfect foresight is used except where stated; time subscripts are dropped when no confusion arises, with settlement objects understood at $t+1$. In this appendix $R(\sigma) \equiv I^L_{t+1}(\sigma)/\Pi_{t+1}$ is the real gross loan rate of a type and $R \equiv I_{t+1}/\Pi_{t+1}$ the real riskless return, as local shorthands.

A.1 Workers

Problem. Maximise (3.1) subject to the split $M^W_t + D^W_t = P_t W_t H_t + U_t$, where $U_t \geq 0$ is any balance the worker chooses not to spend at t (so that the spending constraint is $P_t C^W_t + U_t = M^W_{t-1} + I^W_t D^W_{t-1}$), and to the placement (3.3). Attach Υ_t to the split and λ_t to the spending identity, both in current value. The first-order conditions are

$$\frac{1}{C^W_t} = \lambda_t P_t, \qquad H_t^{1/\psi} = \Upsilon_t P_t W_t,$$

$$\Upsilon_t = \beta\, \mathbb{E}_t[\lambda_{t+1} I^W_{t+1}] \ \text{(deposits)}, \qquad \Upsilon_t = \frac{\lambda_W (m^W_t)^{-\vartheta_W}}{P_t} + \beta\, \mathbb{E}_t[\lambda_{t+1}] \ \text{(currency)},$$

and, for the unspent balance, $\lambda_t \geq \Upsilon_t$ with equality if $U_t > 0$. Combining, $U_t > 0$ requires $1/C^W_t = \beta \mathbb{E}_t[I^W_{t+1}/(\Pi_{t+1} C^W_{t+1})]$, which fails, with the left side larger, whenever the real deposit return is below $1/\beta$: in steady state $\bar{I}^W/\theta < 1/\beta$, which holds a fortiori when the riskless return is below impatience (Proposition 1) since $I^W \leq I$. So $U_t = 0$: workers are hand to mouth and $P_{t+1} C^W_{t+1} = M^W_t + I^W_{t+1} D^W_t$.

Hours and cash. Substituting the deposit condition into the hours condition gives the first part of (3.21). Equating the two values of a euro at the payment stage,

$$\lambda_W (m^W_t)^{-\vartheta_W} = \beta P_t\, \mathbb{E}_t[\lambda_{t+1}(I^W_{t+1} - 1)] = \beta\, \mathbb{E}_t\Big[\frac{I^W_{t+1} - 1}{\Pi_{t+1} C^W_{t+1}}\Big];$$

these are (3.21). Since the marginal service of cash is unbounded as $m^W \to 0$ and zero as $m^W \to \infty$, the cash choice is interior at any positive net deposit rate. Elasticities of (3.22): $1/\vartheta_W$ in $\Pi_{t+1} C^W_{t+1}$ and $-1/\vartheta_W$ in $I^W_{t+1} - 1$.

Steady state. With $\varphi \equiv \bar{m}^W/(\bar{W}\bar{H})$ the cash share of the wage, $\bar{C}^W = \bar{W}\bar{H}[1 + (\bar{I}^W - 1)(1 - \varphi)]/\theta$, and the hours condition gives $\bar{H}^{1+1/\psi} = \beta \bar{I}^W/[1 + (\bar{I}^W - 1)(1-\varphi)] = \beta/[1 - (1 - 1/\bar{I}^W)\varphi]$: hours depend on β, ψ, and the interest forgone on the cash share, which is of the order of the net retail rate times φ. At $\varphi = 0$, $\bar{H} = \beta^{\psi/(1+\psi)}$. Hours do not depend on inflation.

A.2 Deposits across banks

Problem. Given the balance D^W and posted net rates $\{I^W_i - 1\}$, the worker solves

$$\max_{\{D_i \geq 0\}} \sum_i (I^W_i - 1) D_i \quad \text{subject to (3.3)}.$$

Write $\mathcal{P}(\{D_i\})$ for the left side of (3.3). It is homogeneous of degree one and convex, so the constraint set is convex and the linear objective has a unique maximiser, interior when all rates are positive.

First-order conditions. With multiplier Ξ_t on the constraint, $I_i^W - 1 = \Xi_t N^{1/\eta_D} D_i^{1/\eta_D} \mathcal{P}^{-1/\eta_D}$, so $D_i = \frac{1}{N}((I_i^W - 1)/\Xi_t)^{\eta_D}\mathcal{P}$. Substituting into the constraint at equality,

$$\frac{1}{N}\sum_i \Big(\frac{I_i^W - 1}{\Xi_t}\Big)^{\eta_D+1} \mathcal{P}^{\frac{\eta_D+1}{\eta_D}} = \mathcal{P}^{\frac{\eta_D+1}{\eta_D}} \quad \Longrightarrow \quad \Xi_t = \Big[\frac{1}{N}\sum_i (I_i^W - 1)^{1+\eta_D}\Big]^{\frac{1}{1+\eta_D}} \equiv I^W - 1,$$

the index rate. Then $D_i/D^W = \frac{1}{N}((I_i^W - 1)/(I^W - 1))^{\eta_D}$ and interest income $\sum_i (I_i^W - 1)D_i = (I^W - 1)D^W$: duality. These are (3.20). At equal rates $D_i = D^W/N$ and $\mathcal{P} = D^W$: the equal split exhausts the constraint exactly; at a corner $\mathcal{P} = N^{1/(\eta_D+1)} D^W > D^W$, which is the sense in which concentration is less convenient.

$\partial \log(I^W - 1)/\partial \log(I_i^W - 1) = \frac{1}{N}((I_i^W - 1)/(I^W - 1))^{1+\eta_D} = 1/N$ at symmetry, so $\partial \log D_i/\partial \log(I_i^W - 1) = \eta_D(1 - 1/N)$, with no aggregate term because the balance is the wage net of the cash choice, which does not respond to a single bank's rate.

Alternative environments. A depositor minimising forgone interest over a concave aggregate gives shares with constant elasticity in the spread; a bank's deposit profit then has no interior optimum when the balance is inelastic. A discrete-choice environment gives an interior but additive markdown, so deposit rates would move one for one with the riskless rate. The placement technology gives an interior proportional markdown (Appendix A.8), a deposit rate that moves less than one for one with the riskless rate, which is what deposit betas below one measure, and the exact mirror of the loan bundle.

A.3 Capitalists

Problem. Maximise (3.4) subject to the budget (3.6), the law of motion (3.5) and the receipts constraint (3.7), choosing C_t^K, X_t, M_t^K, D_t^K. Attach λ_t^K to the budget and υ_t/P_t to the receipts constraint (so that υ_t is in euros of t), both in current value. The conditions are

$$1 = \lambda_t^K P_t, \qquad \lambda_t^K = \frac{\lambda_K \Lambda_t^{-\vartheta_K} \Lambda_{m,t}}{P_t} + \frac{\upsilon_t}{P_t} + \beta\, \mathbb{E}_t[\lambda_{t+1}^K], \qquad \lambda_t^K = \frac{\lambda_K \Lambda_t^{-\vartheta_K} \Lambda_{d,t}}{P_t} + \frac{\upsilon_t}{P_t} + \beta\, \mathbb{E}_t[\lambda_{t+1}^K I_{t+1}^K],$$

$$\lambda_t^K P_t = \beta\, \mathbb{E}_t\big[(\lambda_{t+1}^K - \upsilon_{t+1}/P_{t+1})P_{t+1} r_{t+1} + \lambda_{t+1}^K P_{t+1}(1 - \delta)\big],$$

where $\Lambda_m = (a\Lambda/m)^{1/\eta_M}$ and $\Lambda_d = ((1-a)\Lambda/d)^{1/\eta_M}$ are the partial derivatives of the aggregate, and the rental at $t+1$ is valued net of the receipts multiplier because it arrives as money that must be held. Multiplying the money conditions by P_t and using $\lambda^K P = 1$ gives (3.23)–(3.24); the capital condition gives (3.25). On the clearing branch $\upsilon \equiv 0$ and, under perfect foresight, $r_{t+1} = 1/\beta - 1 + \delta$ in every period: capital is supplied at that rental in whatever quantity firms demand, the stock jumping to $K_{t+1} = \int K_{t+1}(\sigma) g\, \mathrm{d}\sigma$ with investment $X_t = K_{t+1} - (1-\delta)K_t$ in goods. In a rationed configuration $\upsilon > 0$ and the rental carries the wedge $r = (1/\beta - 1 + \delta)/(1 - \upsilon)$: the input is priced above its resource cost, as in the operating-input version of the 6 October notes.

Neither C^K nor wealth appears in (3.23)–(3.24) because $\lambda^K P = 1$ in every state. Given the real rental bill $B_t \equiv r_t K_t$ and Π_{t+1}, the two conditions with $m_t^K + d_t^K = B_t$ determine (m_t^K, I_{t+1}^K): the cash condition is one equation in m_t^K (with $d_t^K = B_t - m_t^K$), and the deposit condition returns I_{t+1}^K.

A.4 Firms

At settlement the firm owes RL in goods of $t+1$ and holds revenue ωY with $Y = zH^{\alpha_H}K^{\alpha_K}$; its payoff is $(\omega-\bar\omega)^+Y$ with $\bar\omega = RL/Y$. Its expectation is $[1-G(\bar\omega)-\bar\omega(1-F(\bar\omega))]\,Y$, using $\mathbb{E}\omega = 1$.

First-order conditions. With $L = WH + rK$, $\partial\bar\omega/\partial H = (\bar\omega/H)(WH/L - \alpha_H)$ and $\partial\bar\omega/\partial K = (\bar\omega/K)(rK/L - \alpha_K)$, and $\frac{\mathrm{d}}{\mathrm{d}\bar\omega}[1-G-\bar\omega(1-F)] = -(1-F)$ (since $G' = \bar\omega f$). The condition in H is

$$\alpha_H\big[1-G-\bar\omega(1-F)\big] - (1-F)\bar\omega\Big(\frac{WH}{L} - \alpha_H\Big) = 0 \quad\Longleftrightarrow\quad \alpha_H(1-G) = \bar\omega(1-F)\frac{WH}{L},$$

and symmetrically $\alpha_K(1-G) = \bar\omega(1-F)\,rK/L$. Adding, $\alpha(1-G) = \bar\omega(1-F)$; dividing, $WH/(rK) = \alpha_H/\alpha_K$, so $WH/L = \alpha_H/\alpha$ and $rK/L = \alpha_K/\alpha$: (3.26). Neither W, r, R nor z appears in the threshold equation: with full debt finance the owners' problem is homogeneous in scale.

Roots and the relevant branch. The left side of the threshold equation falls from α at $\bar\omega = 0$ to 0; the right side rises from 0, peaks, and falls to 0. There are generically two roots or none. The second-order condition selects the low root, at which the right side crosses the left from below: there the lender's expected receipts $[G + \bar\omega(1-F)]Y$ are increasing in the promised rate and the owners' objective is concave in scale. Existence requires the peak of $\bar\omega(1-F)$ to exceed $\alpha(1-G)$ there, which holds with a wide margin at an α near 0.7 and default rates of a few per cent. At the low root $F(\bar\omega(\sigma);\sigma)$ rises with σ over the relevant range (verified numerically for the lognormal family).

With the mix fixed, $H = \alpha_H L/(\alpha W)$, $K = \alpha_K L/(\alpha r)$ and $Y = zL^{\alpha}\Psi$ with Ψ as in (3.27). Then $\bar\omega = RL/Y = RL^{1-\alpha}/(z\Psi)$, so $L = (\bar\omega z\Psi/R)^{1/(1-\alpha)}$: (3.27). The elasticities follow from $\Psi \propto W^{-\alpha_H}r^{-\alpha_K}$.

The loss rate. In default the lender receives ωY against a claim of $\bar\omega Y$. Expected shortfall per euro lent: $\mathbb{E}[(\bar\omega-\omega)\mathbf{1}\{\omega<\bar\omega\}]\,Y/L = (\bar\omega F - G)Y/L = (F - G/\bar\omega)\,\bar\omega Y/L = \ell(\sigma)R$, using $\bar\omega Y = RL$: (3.28). $\ell \in (0,1)$ since $0 < G < \bar\omega F$. Differentiating, $\mathrm{d}\ell/\,\mathrm{d}\bar\omega = f - (\bar\omega^2 f - G)/\bar\omega^2 = G/\bar\omega^2 > 0$, and $\mathrm{d}\log\ell/\,\mathrm{d}\log\bar\omega = G/(\bar\omega F - G)$, used in Appendix A.23.

A.5 The bank bundle

Given the facility L^B the firm wants and posted rates $\{x_i\}$, it solves $\min_{\{L_i\ge 0\}}\sum_i x_i L_i$ subject to (3.10) delivering at least L^B. Only the interest bill varies with the allocation. The aggregator is homogeneous of degree one and concave, so the minimiser is unique and interior.

First-order conditions. With multiplier Ξ_t, $x_i = \Xi_t(1/N)^{1/\eta}L_i^{-1/\eta}(L^B)^{1/\eta}$, so $L_i = \frac{1}{N}(x_i/\Xi_t)^{-\eta}L^B$. Substituting into the aggregator at equality, $\frac{1}{N}\sum_i(x_i/\Xi_t)^{1-\eta}(L^B)^{(\eta-1)/\eta} = (L^B)^{(\eta-1)/\eta}$, hence $\Xi_t = [\frac{1}{N}\sum_i x_i^{1-\eta}]^{1/(1-\eta)} \equiv x$, the index. Then $L_i/L^B = \frac{1}{N}(x_i/x)^{-\eta}$ and $\sum_i x_i L_i = xL^B$: duality, (3.29). At symmetric quantities $L^B = NL_i$ and at symmetric rates $x = x_i$: N matters only through conduct. Own-rate effect on the index: $\partial\log x/\partial\log x_i = \frac{1}{N}(x_i/x)^{1-\eta} = 1/N$ at symmetry.

A.6 Lender choice, limit pricing, the cutoff

A firm compares net costs of credit; its loss factor is lender-independent. The fund posts the net cost ρ^F (Appendix A.12). Banks post the markup price $r^B(\sigma) \equiv (1+x)(1-\ell)/\Pi$ from Appendix A.9

when it is below ρ^F. If $a^B(\sigma) \le \rho^F < r^B(\sigma)$, any bank posting a rate that yields a net cost just below ρ^F keeps the type and earns $\rho^F - a^B > 0$ per euro, while a bank posting its markup price loses the type to the fund: Bertrand logic across banks with the fund as the outside option pins the symmetric equilibrium at the fund's price (limit pricing). If $a^B(\sigma) > \rho^F$ no bank can serve the type without a loss and the fund serves it. Hence (3.30): bank sector if and only if $a^B \le \rho^F$. Since both branches of (3.34) rise with σ (Appendices A.9 and A.13), so does a^B, and the cutoff σ^* with $a^B(\sigma^*) = \rho^F$ is unique.

A.7 Symmetry and sector-level notation

The regulatory constraints (3.12)–(3.13), the balance sheet (3.11) and post-settlement equity (3.14) are homogeneous of degree one in a bank's positions; in the symmetric equilibrium each bank holds $1/N$ of each sector position and posts the same rates, so multipliers and marginal values coincide across banks and bank-level conditions aggregate one for one. Off-symmetric configurations are needed only for perceived derivatives.

A.8 Deposit rates and the funding cost

The retail rate. Bank i values a deposit euro at the facility rate: a euro of deposits raises its facility balance by one. Its retail deposit profit is $(I - I_i^W)D_i(I_i^W)$ with $\partial \log D_i / \partial \log(I_i^W - 1) = \eta_D(1 - 1/N) \equiv \varepsilon_D$ (Appendix A.2). The first-order condition is $-D_i + (I - I_i^W)\varepsilon_D D_i/(I_i^W - 1) = 0$, i.e. $I_i^W - 1 = (I-1)\varepsilon_D/(1+\varepsilon_D)$, which is (3.32) at symmetry. The deposit franchise on the retail deposits a bank holds is $(I - I^W)D_i/\Pi$ per period.

Wholesale deposits are homogeneous and capitalists move them at no cost. A bank posting $I_i^K > I$ attracts every wholesale euro and loses $(I_i^K - I)/\Pi$ on each; a bank posting $I_i^K < I$ attracts none and loses nothing, since it funds at the facility at I. Every $I^K \le I$ is therefore a Nash equilibrium of the banks' wholesale game and no bank gains by bidding: the bank side is flat and the rate is pinned on the depositors' side, Section 3.1. The baseline takes $I^K = I$.

The funding cost (3.31). A loan euro creates α_H/α euros of retail and α_K/α euros of wholesale deposits at the lending bank. The retail part is placed by (3.20), so $1/N$ stays and $(N-1)/N$ leaves through the facility; the wholesale part is split equally by indifference. The bank's settlement cost per loan euro is $\frac{1}{\Pi}\left[\frac{N-1}{N} I + \frac{1}{N}\left(\frac{\alpha_H}{\alpha} I^W + \frac{\alpha_K}{\alpha} I^K\right)\right]$, which at $I^K = I$ is (3.31). It lies between I^W/Π and I/Π, and equals I/Π when $\eta_D \to \infty$ or $N \to \infty$.

A.9 The pricing condition

From Appendix A.5, $\log L_i = -\log N - \eta(\log x_i - \log x) + \log L^B$, and the type's total borrowing responds to the index rate through its real gross rate: by (3.27), $\partial \log L^B / \partial \log x = -\frac{1}{1-\alpha}\frac{x}{1+x}$. With $\partial \log x / \partial \log x_i = 1/N$, $\mathrm{d}\log L_i / \mathrm{d}\log x_i = -\eta(1 - 1/N) - \frac{1}{N}\frac{1}{1-\alpha}\frac{x}{1+x} \equiv -\varepsilon^B$.

The condition (3.35). Bank i's expected profit per euro on type σ, in goods of $t+1$: receipts $(1 + x_i)/\Pi$, minus the expected loss $\ell(1+x)/\Pi$, which depends on the *index* rate because the threshold is set by the firm's total obligation, minus the funding cost c^B, minus the capital charge and, on a covered type, the collateral cost (Appendix A.13); the last three terms are a^B. Write

$\Omega^B(x_i)$ for this margin times $L_i(x_i)$. Differentiating and using $\partial x/\partial x_i = 1/N$ at symmetry,

$$\Big[\frac{1}{\Pi} - \frac{\ell}{N\Pi}\Big] L_i + \Big[\frac{(1+x)(1-\ell)}{\Pi} - a^B\Big] \frac{\partial L_i}{\partial x_i} = 0, \qquad \frac{\partial L_i}{\partial x_i} = -\frac{\varepsilon^B}{x} L_i,$$

which rearranges to (3.35). The term ℓ/N is the bank's own effect on the default threshold through the index.

Closed form. The condition is linear in x:

$$x = \frac{\Pi a^B - (1-\ell)}{(1-\ell) - (1-\ell/N)/\varepsilon^B},$$

positive and finite when $\varepsilon^B > (1-\ell/N)/(1-\ell)$, the markup existence condition, which is checked. The markup price is $r^B = (1+x)(1-\ell)/\Pi$, increasing in a^B with slope $\mathrm{d}r^B/\,\mathrm{d}a^B = (1-\ell)/[(1-\ell) - (1-\ell/N)/\varepsilon^B] \geq 1$. As $\eta \to \infty$, $\varepsilon^B \to \infty$ and $r^B \to a^B$. Since ε^B depends on x, the elasticity is evaluated at the solution, a scalar fixed point per type. Monotonicity of the uncovered cost in σ is through $w(\sigma)$.

A.10 The bank's problem: envelope and steady state

The bank maximises $\mathcal{W}_t(e_t) = \max \beta\, \mathbb{E}_t[e^{\text{post}}_{t+1} - e_{t+1} + \mathcal{W}_{t+1}(e_{t+1})]$ under the frictionless reset, subject to (3.11), (3.12), (3.13). A marginal euro of e_t at fixed choices raises A_t by one, earns I_{t+1} at settlement, and relaxes both constraints: $\nu_t = \mathcal{W}'_t(e_t) = \beta\mathbb{E}_t[\nu_{t+1} I_{t+1}/\Pi_{t+1}] + \mu_t + \phi_t$, with $\nu_{t+1} = \mathcal{W}'_{t+1}$. Under the frictionless reset the owners value a euro of next-period equity at exactly one, so $\nu \equiv 1$ and the envelope reads $1 = \beta I_{t+1}/\Pi_{t+1} + \mu_t + \phi_t$. In steady state with $\bar\phi = 0$, $\bar\mu = 1 - \beta\bar I/\theta$, Proposition 1. If $\bar I/\theta \geq 1/\beta$ then $\bar\mu \leq 0$, contradicting a binding constraint: the requirement is slack and capital has no price.

A.11 The impact value of relief

Off steady state with e_t predetermined and (3.12) binding, the pricing conditions hold at every type and may be read as equations for μ_t: for any bank-served type, $\frac{\mu_t \kappa_r w_t(\sigma) + \phi_t \kappa_\ell}{\beta \nu_{t+1}} = \frac{(1+x)(1-\ell)}{\Pi} - c^B - \mathbf{1}_{\mathcal{C}} \tau s - \frac{x(1-\ell/N)}{\varepsilon^B \Pi}$, with $w_t = w$ or v. The book must satisfy the binding constraint at e_t; demand is inelastic in rate space (elasticity of order $\frac{1}{1-\alpha}\frac{x}{1+x}$), so a given capital shortfall needs a large rise in rates, and μ_t rises with them one for one net of the wedge. The same inelasticity bounds the other direction: a capital surplus can be absorbed by new lending only through a fall in rates no larger than the charge itself, so the capacity that lending refills when the requirement is slack is small (Appendix A.18).

A.12 The fund

With full payout the fund's problem is static period by period: maximise $\beta\, \mathbb{E}_t[\text{resources at } t+1]$ subject to (3.15), multiplier $\beta\rho^F_t$, and $L^F(\sigma), T \geq 0$. Resources at $t+1$ are $\sum_{\mathcal{N}} L^F(\sigma)[R(\sigma) - \text{loss}(\sigma)] + \sum_{\mathcal{C}} \tau L^B[R + q - \mathbb{E}\min\{\text{loss}, \tau\}/\tau]$ (minus $I^Z Z/\Pi$ with borrowing on). Differentiating: loans, $R(\sigma)(1-\ell(\sigma)) = \rho^F$, (3.38); collateral, $R + q(\sigma) - \mathbb{E}\min\{\text{loss}(\sigma), \tau(\sigma)\}/\tau(\sigma) = \rho^F$, (3.39). The fund posts to type σ the real gross rate $\rho^F/(1-\ell(\sigma))$ and the net cost ρ^F. Its net income is $(\rho^F - 1)W^F$ plus the carry on borrowing, paid out.

A.13 The insurance market

Rearranging (3.39), $q = \mathbb{E}\min\{\text{loss}, \tau\}/\tau + (\rho^F - R)$, (3.41). Outside stress loss $= \ell R < \tau = n\ell R$, so the first term is $1/n$.

Covered cost and the cover condition. Per covered euro the bank pays the fee $\tau q = \mathbb{E}\min\{\text{loss}, \tau\} + \tau s$, bears $\mathbb{E}\max\{\text{loss} - \tau, 0\}$, and carries the charge on v. The sum of the first two is $\mathbb{E}\,\text{loss} = \ell R$: the covered all-in cost net of expected loss is the second branch of (3.34). Comparing the two branches, the bank covers iff $\mu\kappa_r(w - v)/(\beta\nu) \geq \tau s$, (3.42), with $\varrho = \kappa_r(w - v)$. The expected transferred loss cancels because it is a fair transfer.

$\tau(\sigma) = n\ell R$ with $R = r/(1 - \ell)$ for the type's net cost r and, in the markup region, $r = r^B(a^c)$: one scalar fixed point per type in the type's own rate; in the limit-pricing region $r = \rho^F$ and $\tau = n\ell\rho^F/(1 - \ell)$ directly. Monotonicity: the covered cost rises with σ through τ (both ℓ and R rise) and through v (3.17); hence a^B rises and the cutoff is unique.

Band boundaries (3.43)**.** Define $\Delta(\sigma) \equiv \mu\varrho(\sigma)/(\beta\nu) - \tau(\sigma)s$. On $\mathcal{U}_0$, $\varrho = 0$ and $\Delta < 0$. Just above the floor ϱ rises with w while τs is small, so Δ turns positive at a lower boundary σ_a; τ grows with the expected loss and ϱ falls to zero once the tranche is thin relative to the pool's charge, so Δ turns negative again at an upper boundary σ_b: $\mathcal{C} = [\sigma_a, \sigma_b] \cap \{\sigma \leq \sigma^*\}$. If Δ has more than two roots the band is a union of intervals and the statements hold interval by interval.

Clearing and uniqueness. Total demand for fund capital is $D^F(\rho^F) = \sum_{\sigma > \sigma^*(\rho^F)} L^F(\sigma; \rho^F) + \sum_{\sigma \in \mathcal{C}(\rho^F)} \tau(\sigma) L^B(\sigma; \rho^F)$. A higher ρ^F raises σ^*, removing types from the first sum; raises every fund-served type's rate, lowering L^F by (3.27); raises s one for one, which shrinks Δ and the band; and raises covered types' rates through their cost, lowering L^B, while the collateral per type, $\tau L^B \propto R^{1-1/(1-\alpha)} = R^{-\alpha/(1-\alpha)}$, falls with the rate. Every term falls: D^F is decreasing, supply is the constant $W^F(+Z)$, the root is unique. The wage, itself a function of the rates (Appendix A.17), enters all loans proportionally and is pinned by labour clearing, so the argument is unchanged.

If $\mu = 0$ then $\Delta = -\tau s < 0$ for every type: no coverage. At the price-taking fee the bank's saving per covered euro relative to leaving it uncovered is exactly $\Delta(\sigma)$, positive strictly inside the band; under flat willingness to pay (constant relief, constant τ) this surplus would be zero at every unit, and here it is positive on inframarginal types because relief per euro of expected loss varies across types.

A.14 Coexistence and the dominance result

Fund lending to type σ beats covered bank lending iff $\rho^F < a^c(\sigma)$, i.e. $R + s < c^B + \tau s + \mu\kappa_r v(\sigma)/(\beta\nu)$, i.e. $(1 - \tau)s < \mu\kappa_r v(\sigma)/(\beta\nu) - (R - c^B)$. *Dominance.* If v stayed at the floor w_0 with $\mu\kappa_r w_0/(\beta\nu)$ small (at a 2% quarterly shadow value, a 0.105 requirement and a 0.1 floor, about 2×10^{-4} per quarter against an excess return of order 2.5×10^{-3}), the inequality would require τ within a tenth of one; no realistic type satisfies it, and since $c^B \leq R$ and $\tau < 1$ the bank would insure every firm it serves and serve every firm: the fund's book disappears. *Coexistence.* Where the cover condition fails, $\mu\varrho/(\beta\nu) < \tau s$, the covered cost exceeds the uncovered one, $a^c > a^u$, and the bank lends uncovered; at the top type the condition for fund lending is then $\rho^F < a^u(\sigma_H)$, the no-insurance condition, which holds by assumption; by continuity a neighbourhood of the top is fund-served,

$\sigma^* < \sigma_H$: Proposition 2. With (3.17) relief at the top is at most τ/b per covered euro, so the cover condition fails there whenever $\mu/(b\beta\nu) < s$.

A.15 Flow of funds

Bank balance sheet (3.11): $L^B + Z + A = D^W + D^K + T + e$ (all in goods of t). The deposits that exist are the deposits lending created, by banks (L^B) and by the fund out of its own balances (L^F), less the part the public holds as currency instead: $D^W + D^K = L^B + L^F - M/P$. The fund's resources satisfy $L^F + T = W^F + Z$. Substituting, $A = L^B + L^F - M/P + T + e - L^B - Z = (L^F + T - Z) + e - M/P = W^F + e - M/P$, (3.45). Every loan euro cancels against its deposit; the facility holds the economy's unborrowed wealth less the currency outstanding. The consolidated government's liabilities, reserves and currency, sum to $e + W^F$.

The government's euro liabilities at the end of t are $P_t A_t + M_t$; during t it pays $(I_t - 1)P_{t-1}A_{t-1}$ of interest and the transfer $P_t \mathrm{Tr}_t$. With no other asset or revenue, $P_t A_t + M_t - (P_{t-1}A_{t-1} + M_{t-1}) = (I_t - 1)P_{t-1}A_{t-1} + P_t \mathrm{Tr}_t$; dividing by P_t gives (3.46).

A.16 Walras's law

Summing the budgets of workers ($P_t C_t^W = M_{t-1}^W + I_t^W D_{t-1}^W$ and the split), capitalists (3.6), the firm sector's settlement flows (revenue to debt service and dividends), the banks' settlement identity (3.14) with the payout identity, the fund's with full payout, and the government's (3.46), together with the currency identity $M_t = M_t^W + M_t^K$: every nominal transfer cancels (deposit interest between banks and households; facility interest between banks and the government; the transfer and the seigniorage between the government and capitalists; fees, indemnities and collateral interest between banks and the fund; loan repayments between firms and lenders; wages and rentals between firms and households), leaving $Y_t = C_t^W + C_t^K + X_t$, which is imposed numerically as a check.

A.17 The steady state

$\bar{\mu} = 1 - \beta\bar{I}/\theta$; $\bar{I}^W$ from (3.32); $\bar{c}^B$ from (3.31); $r = 1/\beta - 1 + \delta$; for each σ the low root $\bar{\omega}(\sigma)$ of (3.26) and $\ell(\sigma)$.

Given further a trial $\bar{\rho}^F$. Per type: the two branches of (3.34) (the covered one a fixed point, Appendix A.13), the cover decision, the markup price, the lender, the net cost $r(\sigma)$ and $R(\sigma) = r(\sigma)/(1 - \ell(\sigma))$. None of these depend on the wage. Labour clearing: $\int H(\sigma) g \, \mathrm{d}\sigma = \bar{H}$ with $H(\sigma) = \alpha_H L(\sigma)/(\alpha \bar{W})$ and $L = (\bar{\omega} z \Psi / R)^{1/(1-\alpha)}$, $\Psi \propto \bar{W}^{-\alpha_H}$, gives

$$\bar{W}^{\frac{1-\alpha_K}{1-\alpha}} = \frac{\alpha_H}{\alpha \bar{H}} \left(\frac{\alpha_H}{\alpha}\right)^{\frac{\alpha_H}{1-\alpha}} \left(\frac{\alpha_K}{\alpha r}\right)^{\frac{\alpha_K}{1-\alpha}} \int \left(\frac{\bar{\omega}(\sigma)\bar{z}}{R(\sigma)}\right)^{\frac{1}{1-\alpha}} g(\sigma) \, \mathrm{d}\sigma,$$

with $\bar{H}$ from Appendix A.1 (it depends on the cash share φ, which is itself determined below; at the order of the net retail rate the dependence is negligible and an outer iteration resolves it exactly). Then every $L(\sigma)$, $H(\sigma)$, $K(\sigma)$, and $\bar{K} = \int K(\sigma) g \, \mathrm{d}\sigma$. The capacity identity (3.15) is one equation in $\bar{\rho}^F$ with a decreasing left side: the inner root.

The outer root. With the loans known, the real rental bill is $B = r\bar{K} = (\alpha_K/\alpha)\bar{L}$, $\bar{L} \equiv \int L(\sigma) g \, \mathrm{d}\sigma$. The cash condition (3.23) at $\upsilon = 0$ and $\bar{\Pi} = \theta$, with $d^K = B - m^K$, is one equation in $\bar{m}^K$; the deposit condition (3.24) then returns $\beta\bar{I}/\theta = 1 - \lambda_K \bar{\Lambda}^{-\vartheta_K} ((1-a)\bar{\Lambda}/\bar{d}^K)^{1/\eta_M}$, which

must equal the trial value: the outer root in $\bar{I}/\theta$, or equivalently in $\bar{\mu}$. The workers' cash from (3.22) with $\bar{C}^W = (\bar{m}^W + \bar{I}^W \bar{d}^W)/\theta$ and $\bar{m}^W + \bar{d}^W = \bar{W}\bar{H}$ is a scalar equation in $\bar{m}^W$; then $\bar{P}_t = M_t/(\bar{m}^K + \bar{m}^W)$.

$\bar{e} = \kappa_r \overline{\text{RWA}}$ from the binding (3.12); $\bar{A} = \bar{e} + W^F - M_t/\bar{P}_t$; payouts $\bar{d}^B = \bar{e}^{\text{post}} - \bar{e}$, $\bar{d}^F = (\bar{\rho}^F - 1)W^F$; the transfer from (3.46); checks: (3.13) slack, $\bar{s} > 0$, $\varepsilon^B(\sigma) > (1 - \ell/N)/(1 - \ell)$, the low root of the threshold equation, goods clearing, the budget.

A.18 Adoption on impact

Let the no-insurance steady state have equity $\bar{e}$, bank book $\{\bar{L}(\sigma)\}$ and fund loans $\{\bar{L}^F(\sigma)\}$, with (3.12) binding at $\bar{\mu}$. Open the market at date 0 with $e_0 = \bar{e}$ and the frictionless reset, so $\nu_1 = 1$. Write $R(\mu) \equiv \sum_\sigma w(\sigma) L_0^B(\sigma; \mu)$ for the risk-weighted bank book when no cover is written, the fund lends $\bar{L}^F$, and every bank-served type is priced at the multiplier μ: by (3.35) each type's rate rises with μ through the charge $\mu\kappa_r w(\sigma)/\beta$, so by (3.27) R is decreasing, and $\kappa_r R(\bar{\mu}) = \bar{e}$.

(i) Cover $c(\sigma) \geq 0$ on the band replaces w by $v < w$ on the covered euros; fund lending beyond $\bar{L}^F$ removes euros from the bank book; both lower the risk-weighted book at any μ. If the requirement binds at date 0, $\kappa_r[R(\mu_0) - \sum_{\mathcal{C}}(w - v)c - (\text{displaced book})] = \bar{e} = \kappa_r R(\bar{\mu})$, so $R(\mu_0) \geq R(\bar{\mu})$ and $\mu_0 \leq \bar{\mu}$, with equality only when both corrections vanish; if it is slack, $\mu_0 = 0$.

(ii) By (3.42) at $\nu_1 = 1$, type σ is covered at date 0 only if $\mu_0 \varrho(\sigma)/\beta \geq \tau(\sigma) s_0$; with $s_0 > 0$ no type is covered at $\mu_0 = 0$, so cover requires the requirement to bind. Posting the collateral τc withdraws fund loans of the same amount from the tail, whose borrowers return to banks at weight w; the net release is $\sum_{\mathcal{C}}(w - v)c - w_{\mathcal{N}}\tau c > 0$ for τ small relative to $(w - v)/w_{\mathcal{N}}$. If it binds, the net release equals the refill $R(\mu_0) - R(\bar{\mu}) \leq R(0) - R(\bar{\mu}) \equiv \Delta_{\max}$, the extra book banks write when the whole charge is removed. From (3.27) and the pricing condition, $\log[R(0)/R(\bar{\mu})]$ is of the order of $\frac{1}{1-\alpha}\frac{\bar{\mu}\kappa_r \bar{w}}{\beta(1+x)}$, the capital charge's share of the gross loan rate times the demand elasticity, which is small; so date-0 cover is at most a small fraction of the band, and the band is written at date 1, when the reset has set e_1 to the insurance target. The marginal covered type may be covered in part, so an interior date-0 equilibrium with a small cover, $\mu_0 \in (0, \bar{\mu})$ and s_0 at that type's indifference exists when the fund has no idle capacity.

(iii) If the fund holds capacity $\bar{W}_0^F$ at date 0 beyond its no-insurance loans (it has no lending book, or it enters with its capital), that capacity earns nothing as collateral while no cover is demanded and is lent to the tail at the excess return s_0 that places it, taking the marginal bank-served types at the cutoff (3.43). If the bank book so displaced exceeds $\Delta_{\max}$, the requirement is slack at every $\mu_0 \geq 0$, hence $\mu_0 = 0$, and by (ii) no cover is written; at $\mu_0 = 0$ every bank-served type's uncovered cost is the same, so which types the fund takes is selected by the limit $\mu_0 \to 0^+$, from the riskiest down.

(iv) Total credit at date 0 is the bank book at μ_0 plus the fund's loans; it exceeds the no-insurance level by the fund's extra lending net of the displaced bank loans and by the refill $R(\mu_0) - R(\bar{\mu})$, with $\mu_0 \leq \bar{\mu}$ by (i). At date 1 the reset sets e_1 to the insurance steady state's target, the band is covered, and the difference between $\bar{e}$ and the new target leaves as a payout (Appendix A.19); the economy is at the insurance steady state up to the fund's adjustment. Nothing in the date-0 book is a refill of capital released by cover, since the cover is written after the reset.

A.19 Adoption across steady states

Hold $\bar{I}/\theta$, and so $\bar{\mu}$, fixed. For a covered type the net cost of credit falls from $r^B(a^u)$ to $r^B(a^c)$, i.e. by $\Delta(\sigma)$ scaled by the markup slope $\mathrm{d}r^B/\mathrm{d}a^B \geq 1$ in the markup region (and by exactly the fall of a^B up to the fund's price in the limit-pricing region); its borrowing rises by $\frac{1}{1-\alpha}$ times the proportional fall in $R = r/(1-\ell)$. The fund's capital is now demanded for collateral too, so $\bar{\rho}_1^F > \bar{\rho}_0^F$ (at the old ρ^F total demand exceeds capacity, Appendix A.13). Types with $a^u \in (\bar{\rho}_0^F, \bar{\rho}_1^F]$ move from the fund to uncovered bank lending at a net cost between the two, higher than before; types above $\bar{\rho}_1^F$ stay at the fund and pay more; both borrow less. Bank equity: $\Delta\bar{e} = \kappa_r[\sum w\,\Delta L^B - \sum_{\mathcal{C}} \varrho L^B]$, relief net of the capital the extra lending absorbs; under the frictionless reset the difference is paid out. The sign of $\sum_\sigma \Delta L(\sigma) g(\sigma)$ is the conjecture on the sign of the total credit response of Section 3.3: the gain on $\mathcal{C}$ is first order in Δ, the loss on the re-migrated types is first order in $\bar{\rho}_1^F - \bar{\rho}_0^F$, and no general ordering is available without the distribution. The feedback through the nominal block (Appendix A.20) lowers $\bar{\mu}$ when credit expands and damps, but does not reverse, (i).

A.20 The price level

Shares. On the clearing branch in steady state, with $c_m \equiv 1 - \beta/\theta$ and $c_d \equiv 1 - \beta\bar{I}/\theta = \bar{\mu}$, (3.23)–(3.24) read $\lambda_K \Lambda^{-\vartheta_K} \Lambda_m = c_m$ and $\lambda_K \Lambda^{-\vartheta_K} \Lambda_d = c_d$. Since Λ is homogeneous of degree one, $\Lambda_m m + \Lambda_d d = \Lambda$; define $s_m \equiv \Lambda_m m/\Lambda$ and $s_d \equiv \Lambda_d d/\Lambda = 1 - s_m$, the shares of the two monies in the aggregate, and $\omega_m \equiv m/B$, $\omega_d \equiv d/B$ their shares in the rental bill $B = m + d$. Dividing the two conditions, $s_m = c_m m/(c_m m + c_d d)$, and since $c_m > c_d$ (currency forgoes the deposit interest), $s_m > \omega_m$.

The elasticity (3.48). Take logs of the cash condition at fixed θ: $\log\lambda_K - \vartheta_K \log\Lambda + \frac{1}{\eta_M}(\log a + \log\Lambda - \log m) = \log c_m$, so $\mathrm{d}\log m = (1 - \eta_M\vartheta_K)\,\mathrm{d}\log\Lambda = -\Gamma_M\,\mathrm{d}\log\Lambda$ with $\Gamma_M = \eta_M\vartheta_K - 1$. Homogeneity gives $\mathrm{d}\log\Lambda = s_m\,\mathrm{d}\log m + s_d\,\mathrm{d}\log d$, and the rental identity $\mathrm{d}\log B = \omega_m\,\mathrm{d}\log m + \omega_d\,\mathrm{d}\log d$. Eliminating $\mathrm{d}\log d$,

$$\mathrm{d}\log m\left[1 + \Gamma_M s_m - \Gamma_M s_d \frac{\omega_m}{\omega_d}\right] = -\Gamma_M \frac{s_d}{\omega_d}\,\mathrm{d}\log B,$$

so that

$$\frac{\mathrm{d}\log m}{\mathrm{d}\log B} = -\frac{\Gamma_M s_d}{\omega_d + \Gamma_M(s_m\omega_d - s_d\omega_m)} = -\frac{\Gamma_M s_d}{\omega_d + \Gamma_M(s_m - \omega_m)},$$

using $s_m\omega_d - s_d\omega_m = s_m - \omega_m$. The denominator is positive since $s_m > \omega_m$; the elasticity is negative iff $\Gamma_M > 0$: (i) of Proposition 4. Then $\mathrm{d}\log\Lambda = -\mathrm{d}\log m/\Gamma_M > 0$ and $\mathrm{d}\log d = (\mathrm{d}\log B - \omega_m\,\mathrm{d}\log m)/\omega_d > 0$. Taking logs of the deposit condition, $\mathrm{d}\log c_d = -\frac{1}{\eta_M}[\Gamma_M\,\mathrm{d}\log\Lambda + \mathrm{d}\log d] < 0$: $\bar{\mu}$ falls and $\bar{I}$ rises, (ii). With the real rental bill a fixed share of credit, $\mathrm{d}\log B = \mathrm{d}\log\bar{L}$.

The price elasticity (3.49). From (3.47), $\mathrm{d}\log P = -\varsigma\,\mathrm{d}\log m^K - (1-\varsigma)\,\mathrm{d}\log m^W$. The first term is $\varsigma e_K\,\mathrm{d}\log\bar{L}$. From (3.22) at $\bar{\Pi} = \theta$, $\mathrm{d}\log m^W = \frac{1}{\vartheta_W}[\mathrm{d}\log\bar{C}^W - \mathrm{d}\log(\bar{I}^W - 1)]$ and, by (3.32), $\mathrm{d}\log(\bar{I}^W - 1) = \mathrm{d}\log(\bar{I} - 1)$: (iii). For (iv): $\theta\bar{C}^W = \bar{W}\bar{H} + (\bar{I}^W - 1)\bar{d}^W$ with $\bar{W}\bar{H} = (\alpha_H/\alpha)\bar{L}$, so $\mathrm{d}\log\bar{C}^W/\mathrm{d}\log\bar{L} = 1 + O(\bar{I}^W - 1)$, the correction being positive and of the order of the net retail rate; and $\mathrm{d}\log(\bar{I} - 1)/\mathrm{d}\log\bar{L} > 0$ by (ii). Hence $e_P > \varsigma e_K - (1-\varsigma)(1 + O(\bar{I}^W - 1))/\vartheta_W$, and the stated condition suffices up to a term of that order.

Impact (Proposition 5(i)). The nominal block has one state, M_t, and the real block adjusts within one period (Appendix A.18) with the fund's capital fixed. Let the real block be at its date-0 allocation at $t = 0$ and at the new steady state from $t = 1$. At $t = 1$ the demands are the new steady-state ones, so $P_1 = M_1/(\bar{m}_1^K + \bar{m}_1^W)$. At $t = 0$ the cash condition (3.23) holds with $\Pi_1 = P_1/P_0$ and the date-0 rental bill, and (3.22) with Π_1 and date-1 consumption; the currency identity $P_0 = M_0/(m_0^K + m_0^W)$ is then one scalar equation in P_0. When the date-0 and steady-state credit are close, $P_0 \simeq P_1/\theta$ and the jump of $\log P_0$ above its old path is e_P times the proportional credit expansion. The balances carried into date 0, $M_{-1}^W + I_0^W D_{-1}^W$ and $M_{-1}^K + I_0^K D_{-1}^K$, are nominal, so their real value falls by the jump: a one-off levy in proportion to holdings.

Dividends, payouts and the transfer enter (3.6) but not (3.7); on the clearing branch the forced balance is the rental bill alone, so (3.23)–(3.24) and (3.47) do not contain them. A retention rule or an injection cost changes Y_t^K and nothing in the currency condition.

Stress (the statement on what the mechanism model does not deliver in stress of Section 3.3). Let z_t fall unexpectedly at the settlement of t and return to z from $t + 1$. The loans contracted at t depend on $z_{t+1} = z$, so the rental bill B_t and the real demands m_t^K, m_t^W at t are those of the steady state, and so is P_t by (3.47). Workers' nominal spending at t is predetermined, so C_t^W is unchanged; K_{t+1} is unchanged, so X_t is unchanged; goods clearing then gives $C_t^K = Y_t - C_t^W - X_t$, which falls by the whole fall in output. On the income side this is the fall in firm equity payoffs and the losses borne by the lenders, all of which are capitalists' income. A persistent fall in z lowers every type's loan by (3.27), and the price level by Proposition 4.

A.21 A fixed-rate instrument

Suppose banks can hold or issue an instrument at a fixed nominal rate $\tilde{I}$. Posting a wholesale rate above $\tilde{I}$ loses money and posting below attracts no deposits while the bank funds at $\tilde{I}$, so competition pins $I^K = \tilde{I}$ and the facility, if indexed, with it. The capitalists' conditions must then hold at the given rate. If at $\upsilon = 0$ the two conditions imply $m^K + d^K > B$, capitalists carry a voluntary excess: (m^K, d^K) are determined by the two conditions alone and do not depend on the loans made; currency demand does not respond to lending. Otherwise $\upsilon > 0$ and $m^K + d^K = B$; subtracting the two conditions, $\lambda_K \Lambda^{-\vartheta_K}(\Lambda_m - \Lambda_d) = \beta(\tilde{I} - 1)/\Pi$, which in steady state ($\Pi = \theta$) pins the ratio d^K/m^K independently of B (both sides are homogeneous of degree zero in (m, d) once the ratio is fixed, up to the common factor $\Lambda^{-\vartheta_K}\Lambda_m$, which then fixes the level through υ). Currency demand is proportional to the rental bill: $\mathrm{d}\log m^K / \mathrm{d}\log B = 1$, and lending is deflationary. This is the result on a fixed-rate instrument of Section 3.1. A fixed-rate bond with no liquidity service offered to capitalists is never held if its rate is below Π/β, so the same conclusion holds for a bond market open to households.

A.22 Tightening the requirement

Raise κ_r at fixed $\bar{I}/\theta$, so $\bar{\mu}$ is fixed. (i) At the old ρ^F and s: both branches of (3.34) rise, uncovered through $\mu\kappa_r w$ and covered through $\mu\kappa_r \upsilon$ (both proportional to κ_r); by Appendix A.9 the markup price rises with a^B, so every bank-served type in the markup region pays more and borrows less by (3.27); limit-priced types pay ρ^F, unchanged, but the cutoff σ^* falls since a^B rises, and the types

that cross it pay ρ^F above their old bank price; fund-served types are unchanged. Total credit falls. (ii) $\varrho = \kappa_r(w - v)$ is proportional to κ_r while τs is not, so Δ rises at every type in the band's interior and the lower boundary σ_a falls. (iii) The demand for fund capital at the old ρ^F changes by the migration of the types between the old and new cutoff (positive) and by the change in collateral demand (wider band, smaller books; ambiguous). If the sum is positive, ρ^F and s rise: fund-served types pay more, covered types pay more through τs, and every type's cost rises; total credit falls and the price level falls by Proposition 4. The nominal feedback: a smaller rental bill raises $\bar{\mu}$ (Appendix A.20(ii) read in reverse), which raises every charge again.

A.23 Tranche exhaustion and its order

At settlement with realised productivity z' in place of the z expected when the loan was priced, the obligation RL is unchanged and revenue is $z'\omega H^{\alpha_H} K^{\alpha_K}$, so the realised threshold is $\bar{\omega}' = \bar{\omega} z/z'$ and the realised loss factor $\ell(\bar{\omega}')$. The tranche is exhausted when $\ell(\bar{\omega} z/z')R > \tau = n\ell(\bar{\omega})R$, i.e. when $\ell(\bar{\omega} z/z')/\ell(\bar{\omega}) > n$. For a small shock, $\log[\ell(\bar{\omega} z/z')/\ell(\bar{\omega})] \approx \epsilon(\sigma)\log(z/z')$ with $\epsilon(\sigma) = \mathrm{d}\log\ell/\,\mathrm{d}\log\bar{\omega} = G/(\bar{\omega}F - G) = 1/(\bar{\omega}/\mathbb{E}[\omega \mid \omega < \bar{\omega}] - 1)$. The denominator is the proportional gap between the threshold and the mean revenue of defaulting projects: for a safe type defaulting projects cluster just below the threshold, the gap is small and the elasticity large; for a risky type the defaulting mass sits far below the threshold and the elasticity is moderate. (For the lognormal, $\bar{\omega}F/G = \bar{\omega}\Phi(u)/\Phi(u - \sigma)$ falls with σ at the low root over the relevant range; verified numerically.) Hence for a common shock the ratio of realised to expected loss is largest for the safest covered pools and, under (3.16), exhaustion begins at the safe end of the band: part (i) of the result on tranche exhaustion of Section 3.3.

Under a tranche of common thickness, τ the same share of every covered pool, the multiple is type-specific, $n(\sigma) = \tau/(\ell(\bar{\omega})R)$, and falls with σ because the expected loss rises along the band. The exhaustion condition $\ell(\bar{\omega} z/z')/\ell(\bar{\omega}) > n(\sigma)$ is then equivalent to the level condition $\ell(\bar{\omega} z/z')R > \tau$: the ratio on the left falls with σ, but $n(\sigma)$ falls faster whenever the realised loss level rises with σ, which holds along the band at the calibration of the quantitative layer (at the 2008–09 shock the realised loss stands at 1.19, 1.23 and 1.27 times each pool's tranche from the safe to the risky end, while the ratios of realised to expected loss are 7.90, 7.11 and 6.40 against multiples of 6.66, 5.79 and 5.03). In general the level rises with σ whenever the pricing threshold $\bar{\omega}(\sigma)$ does not fall with risk fast enough to offset the thicker lower tail of the distribution, a condition the calibration satisfies. Exhaustion then begins at the risky end: part (ii).

A.24 Fund borrowing

The bank lends Z to the fund at zero surplus: a euro lent creates a deposit the fund passes to firms as wages and rentals, so it carries the funding cost c^B, and it carries the charge on w_Z: $(I^Z - 1)/\Pi = c^B - 1/\Pi + (\mu\kappa_r w_Z + \phi\kappa_\ell)/(\beta\nu)$. The fund borrows while $\rho^F > I^Z/\Pi$, i.e. while its excess return exceeds the regulatory spread net of the bank's funding gap; the cap $Z \le \kappa_Z W^F$ binds with multiplier $\rho^F - I^Z/\Pi > 0$. Capacity is $(1 + \kappa_Z)W^F$, the fund's net income gains the multiplier times $\kappa_Z W^F$, and the loop "banks finance their protection seller" is on the balance sheets but inframarginal to the coverage decision.

B The quantitative model in full

This appendix states the quantitative model of Section 4 in full, in the order of its sections. The paragraphs given in Section 4.1 are not repeated; a note marks where each belongs.

The additions, in the order in which they appear:

1. *Wholesale deposits with their own switching friction.* Capitalists place their balances across banks through the same technology as workers, with an elasticity η_K; the wholesale rate is a markdown on the riskless rate, and $\eta_K \to \infty$ recovers the competitive tier of the mechanism model (Section B.2).
2. *Multi-period projects.* A project that does not default survives with probability γ; its continuation value restrains scale and changes the credit elasticity banks perceive; $\gamma = 0$ recovers one-period projects (Section B.3).
3. *A resolution loss* ζ: in default the lender recovers a fraction $1 - \zeta$ of revenue; default becomes a real cost (Section B.3).
4. *Operating costs* of banks, per euro of loan, per euro of retail deposit and a fixed cost per period; additive, neutral at zero (Section B.4).
5. *The regulation's own weights*: the internal-ratings weight as a function of the type's default probability, and the securitisation formula for the retained senior tranche, in place of the stand-ins of the mechanism model (Section 4.1).
6. *A bank-level loss draw* ξ with dispersion σ_b: each bank's realised losses scale with a draw of mean one; it gives issuance, failure and the value of equity a probability structure in closed form; $\sigma_b \to 0$ removes it (Section 4.1).
7. *The capital cycle*: a retention rule and a costly injection χ for both intermediaries; $\chi = 0$ with full payout is the frictionless reset (Sections 4.1 and B.5).
8. *Limited liability, failure and re-entry* for both intermediaries, and *deposit insurance* financed through the budget (Sections 4.1, B.5 and B.7).
9. *Fund borrowing from banks*, the switch of the mechanism model, on (Section B.5).
10. *Finite-maturity protection with rollover*: contracts survive with probability γ_X; $\gamma_X = 0$ recovers one-period contracts (Section B.6).

B.1 The environment

The economy has workers (mass one), capitalists, a continuum of firms indexed by their ex-ante risk σ, N symmetric banks, one credit fund, and a government that consolidates the central bank, the treasury and the deposit-insurance scheme.

Frictions. The six frictions of the mechanism model carry over: payment in advance, so that bank lending creates the deposits households carry; limited liability and default of firms; risk-sensitive capital regulation with a lower weight on insured pools; switching frictions for borrowers across banks and for depositors across banks, now on both deposit tiers; trapped non-bank capital; and a

currency stock whose growth the central bank fixes, held by both households. This layer adds four frictions of its own. *Costly equity*: an intermediary rebuilds capital below its target from retained earnings, and raises new equity only at a proportional cost; a bank whose own losses exceed the sector's refills the difference by issuing. *Limited liability of intermediaries*: owners inject only if what they keep is worth more than the injection; otherwise the intermediary is abandoned, its depositors are paid by the deposit-insurance scheme, and a new intermediary enters. *Bank-level risk*: each bank's loss rates scale with an undiversifiable draw. *A resolution loss* in firm default. Everything else is standard, and each addition is formalised where its object appears.

The instrument. Here a contract, once written, survives to the next period with probability γ_X, so that at any date a bank holds coverage of several vintages at the fees each locked in. The tranche is written on the contract's life: at each settlement the seller bears the realised loss up to its per-period share, $(1-\gamma_X)\tau$ per covered euro, the tranche being spread over the contract's expected life $1/(1-\gamma_X)$, while the collateral τ stays posted throughout. At $\gamma_X = 0$ the whole tranche is at risk each period, the mechanism model's contract.

Timing. Within period t: (1) *settlement*, one simultaneous stage: output is produced and sold at P_t; loans are repaid or defaulted on, with the resolution loss; insurance contracts settle on the active coverage; the facility and deposits pay interest; each bank's loss draw is realised; intermediaries pay out, retain, issue, or are abandoned and replaced; the deposit-insurance scheme pays the depositors of failed banks; the government levies the taxes that finance it and pays its transfer; households consume, capitalists also buy investment goods. (2) *contracting*: banks post loan margins and both deposit rates, the fund posts its lending terms and its demand for bank credit, firms choose a lender and their inputs, new insurance contracts are written and collateral posted. (3) *payment*: wages and rentals are paid into deposits, households choose how much to hold as currency and where to place the rest, and the banks' net positions settle at the central bank.

B.2 Households

Workers. One object is new: when a bank fails, workers pay at the settlement stage a lump-sum tax $\mathrm{Tr}_t^W \leq 0$, their share of the deposit-insurance outlay (Section B.7). The spending constraint is

$$P_{t+1}C_{t+1}^W \leq M_t^W + I_{t+1}^W D_t^W + P_{t+1}\mathrm{Tr}_{t+1}^W, \tag{B.1}$$

and it binds as before, since the deposit return is below impatience. Taking the wage, the deposit rates, prices and the tax as given, the worker chooses hours, the split and the placement; the first-order conditions are those of the mechanism model, with C_{t+1}^W now net of the tax. The tax is lump sum, so it enters no margin directly; it enters both conditions through next period's consumption, a wealth effect that is zero outside crisis periods. Workers hold no other asset and pay no deposit-insurance premium: the scheme is public (Section B.7).

Wholesale deposits across banks. In the mechanism model capitalists earned the facility rate at every bank and split their balances by indifference. Here they face the same friction as workers,

with its own elasticity: a balance D_t^K placed as $\{D_{i,t}^K\}$ must satisfy

$$\Big[\sum_{i=1}^{N} N^{1/\eta_K}(D_{i,t}^K)^{\frac{\eta_K+1}{\eta_K}}\Big]^{\frac{\eta_K}{\eta_K+1}} \le D_t^K, \qquad \eta_K > 0, \tag{B.2}$$

and the capitalist, taking the posted wholesale rates as given, places the balance to maximise interest income. The solution is the share system of the mechanism model with η_K in place of η_D (Appendix C.1):

$$\frac{D_{i,t}^K}{D_t^K} = \frac{1}{N}\Big(\frac{I_{i,t+1}^K - 1}{I_{t+1}^K - 1}\Big)^{\eta_K}, \qquad I_{t+1}^K - 1 = \Big[\frac{1}{N}\sum_i (I_{i,t+1}^K - 1)^{1+\eta_K}\Big]^{\frac{1}{1+\eta_K}}, \tag{B.3}$$

an equal split at equal rates and interest income equal to the index rate times the balance. The wholesale tier is more elastic than the retail one, $\eta_K > \eta_D$: firms' and large holders' deposits respond to market rates by more than households' (Albertazzi et al., 2026), and their term deposits sit near the policy rate (European Central Bank, 2026d). The two tiers differ by this parameter and nothing else; $\eta_K \to \infty$ is the mechanism model.

Capital, budget, receipts. The budget at the settlement stage of t is

$$P_t C_t^K + P_t X_t + M_t^K + D_t^K = M_{t-1}^K + I_t^K D_{t-1}^K + P_t r_t K_t + P_t Y_t^K, \tag{B.4}$$

with Y_t^K the real income from what capitalists own: the payouts of the banks and of the fund net of the equity injected into them, grossed up by the proportional issuance costs χ of a bank and χ^F of the fund; the dividends of projects; and the government's transfer Tr_t^K, net of the capitalists' share of the deposit-insurance outlay. The equity injected includes that of the banks and funds that re-enter after a failure. The receipts constraint $M_t^K + D_t^K \ge P_t r_t K_t$ and the first-order conditions are those of the mechanism model; on the clearing branch

$$\lambda_K \Lambda_t^{-\vartheta_K}\Big(\frac{a\Lambda_t}{m_t^K}\Big)^{1/\eta_M} = 1 - \beta\,\mathbb{E}_t\Big[\frac{1}{\Pi_{t+1}}\Big], \qquad \lambda_K \Lambda_t^{-\vartheta_K}\Big(\frac{(1-a)\Lambda_t}{d_t^K}\Big)^{1/\eta_M} = 1 - \beta\,\mathbb{E}_t\Big[\frac{I_{t+1}^K}{\Pi_{t+1}}\Big], \tag{B.5}$$

and $r = 1/\beta - 1 + \delta$, where I^K is now the wholesale index rate the capitalist earns, not the facility rate. The deposit condition still pins the rate at which capitalists hold the forced balance; what has changed is the link from that rate to the riskless rate, which Section 4.1 gives.

B.3 Firms and credit demand

Project continuation, the resolution loss, the project's value and the threshold condition are in Section 4.1.

Loan size and the perceived elasticity. Across steady states the elasticity of credit demand to the real gross loan rate is the benchmark $1/(1-\alpha)$, because the threshold is pinned. The elasticity a bank perceives when it sets this period's rate is a different object: the continuation value next period does not depend on this period's rate, so the threshold moves with the rate and the response is

$$\varepsilon(\sigma) \equiv -\frac{\partial \log L_t(\sigma)}{\partial \log I_{t+1}^L(\sigma)}\Big|_{W,r,V_{t+1}} = \frac{1}{1-\alpha+\mathcal{D}(\sigma)}, \tag{B.6}$$

$$\mathcal{D}(\sigma) \equiv -\frac{\alpha\,\mathcal{A}(\bar{\omega})}{\bar{\omega}\Big[(1-F)-(1-\alpha)\bar{\omega}f+(1-\alpha)\gamma\dfrac{V_{t+1}}{Y_{t+1}}\dfrac{\mathrm{d}(\bar{\omega}f)}{\mathrm{d}\bar{\omega}}\Big]},$$

where $\mathcal{A}(\bar{\omega}) \equiv (1-\alpha)\gamma\bar{\omega}f\,V_{t+1}/Y_{t+1} \geq 0$ is the survival term of (4.2) (Appendix C.2). At $\gamma = 0$, $\mathcal{D} = 0$ and the perceived elasticity is the benchmark. At the low root the bracket is positive, so $\mathcal{D} \leq 0$: the continuation value makes a type's borrowing *more* sensitive to this period's rate, because a dearer loan raises the threshold and the project protects its survival by cutting scale, and cutting scale raises the survival cost per unit of output. The second-order condition is $1-\alpha+\mathcal{D} > 0$, imposed as a check; the size of the departure is evaluated at the calibration. This is the elasticity that enters the banks' pricing condition.

The loss rate. With the resolution loss the lender's expected loss per euro lent is

$$\ell(\sigma)\,\frac{I^{L}_{t+1}(\sigma)}{\Pi_{t+1}}, \qquad \ell(\sigma) \equiv F(\bar{\omega}) - (1-\zeta)\frac{G(\bar{\omega})}{\bar{\omega}}, \tag{B.7}$$

the loss factor of the mechanism model with the recovery scaled by $1-\zeta$ (Appendix C.2). The lender's expected receipts $[(1-\zeta)G + \bar{\omega}(1-F)]Y$ are increasing in the promised rate only on the low-rate side of a hump; the branch condition $1-F > \zeta\bar{\omega}f$ selects it and is imposed as a check. Default now destroys ζ of defaulting output, which leaves the goods market (Section B.8).

B.4 Banks

Balance sheet, deposits and funding. The N banks are symmetric at the contracting stage; the reset rule of Section 4.1 keeps them so after the draw. A loan of one euro creates α_H/α euros of wage deposits and α_K/α euros of rental deposits at the lending bank; both are placed across banks by their share systems, so in the symmetric equilibrium the lending bank keeps $1/N$ of each and the rest settles through the facility. Its marginal funding cost of a loan euro, in real terms at settlement, is

$$c^{B}_{t+1} = \frac{1}{\Pi_{t+1}}\Big[I_{t+1} - \frac{\alpha_H}{\alpha N}\big(I_{t+1} - I^{W}_{t+1}\big) - \frac{\alpha_K}{\alpha N}\big(I_{t+1} - I^{K}_{t+1}\big)\Big], \tag{B.8}$$

the facility rate on every euro except the retained shares of each tier, on which it pays the two marked-down rates; the deposits that arrive from rivals' lending earn the two spreads and are the deposit franchise, a profit line separate from lending. At $\eta_K \to \infty$ the last term vanishes and (B.8) is the mechanism model's.

The two deposit rates and the riskless rate, the regulation, the loss draw, the pricing condition, the capital cycle, and failure, deposit insurance and re-entry are in Section 4.1.

The owners' choices of rates, coverage and book in Sections 4.1 and B.6 maximise V^{B}, which counts the states $\xi \leq \xi^{f}$ only: losses beyond the abandonment point fall on the scheme and enter no first-order condition of the bank. That is the externality the capital requirement acts on, and Section 4.3 states what it implies.

B.5 The fund

Its capital is a state, W_t^F, with target $\bar{W}^F$, and it borrows $Z_t \leq \kappa_Z W_t^F$ from banks, so that its resources are allocated between loans and collateral,

$$\sum_{\sigma \in \mathcal{N}} L_t^F(\sigma) + T_t = W_t^F + Z_t, \qquad T_t = \sum_{\sigma} \tau(\sigma) S_t(\sigma), \tag{B.9}$$

with T_t the collateral on the active coverage of all vintages. Taking every price as given, the fund chooses its loans, the collateral it posts on new contracts and its borrowing; attaching $\beta \rho_t^F$ to (B.9), the first-order conditions are (Appendix C.7)

$$\text{loans to type } \sigma: \qquad \big(1 - \ell(\sigma)\big) \frac{I_{t+1}^L(\sigma)}{\Pi_{t+1}} = \rho_t^F, \tag{B.10}$$

$$\text{collateral on new coverage:} \qquad q_t^S(\sigma) \text{ as in Section B.6}, \tag{B.11}$$

$$\text{borrowing:} \qquad Z_t = \kappa_Z W_t^F \text{ whenever } \rho_t^F > I_{t+1}^Z / \Pi_{t+1}, \tag{B.12}$$

with $s_t \equiv \rho_t^F - I_{t+1}/\Pi_{t+1} > 0$ the excess return of fund capital, the single price that rations its capacity, and I^Z the rate at which the bank lends to the fund at zero surplus (Appendix A.24: the funding cost plus the charge on w_Z). Borrowing is the channel through which a failed fund reaches the banks that financed it; without it the seller's default would be a loss to the fund's investors alone.

The fund's capital cycle is in Section 4.1.

The fund's failure. With $W_{t+1}^{\text{post}} < 0$ the fund is insolvent: its loan losses and tranche payments exceed its capital. Its collateral has already absorbed the tranche payments, so the shortfall falls on its bank creditors through Z. The owners refill to the target if the franchise, the capitalised stream of the excess return, $\beta(\bar{\rho}^F - 1)\bar{W}^F/(1-\beta)$ in steady state, is worth more than the injection $(1+\chi^F)(\bar{W}^F - W_{t+1}^{\text{post}})$, and abandon otherwise. On abandonment the banks lose $\min\{-W_{t+1}^{\text{post}}, Z_t\}$ on their fund loans, which enters their post-settlement equity, and a new fund is endowed with the target capital by the capitalists at the issuance cost. The fund's failure is a systemic event, since the fund is diversified over banks and only an aggregate shock can make it insolvent; there is no public backstop for it, which is the asymmetry between a regulated and an unregulated lender.

B.6 The insurance market

The contract with finite maturity, and demand, supply and the covered band, are in Section 4.1.

The risk line and clearing. The sets of the mechanism model, the lightest-weighted types uncovered, a band of newly covered types, uncovered types the bank keeps, and the fund-served tail above the migration cutoff, are defined by the lender rule and the cover condition on *new* coverage; inherited coverage persists on types that have left the band. One price, s_t, clears the fund's capacity between its loans, the collateral on active coverage and its borrowing, through (B.9): a higher s raises the cutoff, narrows the band and raises the supply fee, every demand for fund capital falls and the root is unique as in the mechanism model (Appendix A.13), the active collateral of past vintages entering as a predetermined use of capacity. The coexistence and strict-gain propositions of the mechanism model hold with the calibrated weights, since relief at the top of the risk line still falls below the collateral's cost (Section 4.1).

B.7 The government, deposit insurance and the price level

The government runs the facility, issues currency, insures deposits and balances its budget with lump-sum transfers. Currency grows at the fixed gross rate θ and is held by the two households; the facility pays I_{t+1} on the banks' net balance and is indexed to the wholesale market through (4.4); there is no bond. The clearing of the wholesale deposit market is the Walrasian selection of the mechanism model: the wholesale rate is the rate at which capitalists hold the rental at an interior optimum, and the riskless rate follows from it by the markdown.
Deposit insurance and its financing are in Section 4.1.

Flow of funds, budget, price level. Every loan euro cancels against the deposit it created and failed banks' deposits are made whole, so the flow of funds of the mechanism model holds with the fund's capital a state,

$$A_t = e_t + W_t^F - \frac{M_t}{P_t}, \tag{B.13}$$

the budget is (4.24) summed, $\mathrm{Tr}_t^W + \mathrm{Tr}_t^K + J_t =$ the ordinary residual, and the price level is the currency stock over the two households' real demand, with m_t^K from the cash condition in (B.5) given the real rental bill and m_t^W from the workers' cash condition. Nothing in this layer enters (3.47) except through the loans made and the wholesale rate: payouts, issuance, failures and the deposit-insurance payment move balances at the facility, not the forced balances, so the proposition of the mechanism model that the price level is a function of the loans made and of nothing else the intermediaries do survives every switch (Proposition 6).

B.8 Equilibrium and steady state

Definition 2 (Equilibrium)**.** *Given the productivity sequence, the currency rule with M_0, the regulatory parameters, the fund's target $\bar{W}^F$, and initial balances, equity, fund capital and contract states, an equilibrium is a sequence of prices $\{P_t, W_t, r_t\}$, rates $\{I_{t+1}, I_{t+1}^W, I_{t+1}^K\}$, loan rates and fees $\{I_{t+1}^L(\sigma)\}$, $\{q_t(\sigma)\}$, the fund's return ρ_t^F, allocations of firms $\{H_t(\sigma), K_t(\sigma), L_t(\sigma), V_t(\sigma)\}$ and of households $\{H_t, C_t^W, C_t^K, X_t, K_t, m_t^W, m_t^K, d_t^W, d_t^K\}$, lender assignments, the stocks of protection $\{S_t(\sigma)\}$ with their locked-in fees, balance-sheet positions $\{L_t^B(\sigma), L_t^F(\sigma), Z_t, T_t, A_t, e_t, W_t^F\}$, the issuance and failure objects $\{\xi_t^*, \xi_t^f, \pi_t, \varpi_t, \nu_t, V_t^B, J_t\}$, payouts, injections, taxes and transfers, and multipliers $\{\mu_t, \phi_t\}$, such that:*

1. *workers optimise ((B.1) binding, the placement, (3.21));*
2. *capitalists optimise ((B.4), the law of motion of capital, the wholesale placement (B.3), (B.5) on the clearing branch);*
3. *each type's projects solve (4.1)–(4.2) at the rate of its lender, and the lender rule of the mechanism model holds;*
4. *banks' rates satisfy (4.13) or the limit-pricing constraint, their deposit rates (4.3), their capital the rules of Section 4.1 with (4.14) and (4.15), their coverage the demand side of (4.22), their abandonment (4.17) with (4.18), with (4.5)–(4.6) and complementary slackness;*
5. *the fund satisfies (B.9)–(B.12), its capital rule and its abandonment rule;*

6. *the facility is indexed by* (4.4)*, the taxes are* (4.24)*, the flow of funds* (B.13) *holds;*

7. *markets clear: labour,* $\int H_t(\sigma)g\,\mathrm{d}\sigma = H_t$*; capital,* $\int K_t(\sigma)g\,\mathrm{d}\sigma = K_t$*; new coverage on each type,* $q^D = q^S$*; currency,* $M_t = P_t(m_t^W + m_t^K)$*; and goods,*

$$Y_t = C_t^W + C_t^K + X_t + \zeta \sum_\sigma G\big(\bar\omega_t(\sigma)\big)\, z_t H_{t-1}(\sigma)^{\alpha_H} K_{t-1}(\sigma)^{\alpha_K} + c_L \sum_\sigma L_{t-1}^B(\sigma) + c_D D_{t-1}^W + c_0 + \chi\, i_t^B + \chi^F i_t^F,$$

the resolution loss being ζ *times the output of defaulting projects and* i_t^B*,* i_t^F *the equity injected into banks and the fund, whose issuance costs are resources; the constraint is implied by the budgets (Walras's law, Appendix C.12).*

A steady state has z *constant, every real quantity, rate and probability constant, nominal quantities growing at* θ*, the sector of banks symmetric with the mass* $\bar\varpi$ *replaced each period, and the fund at its target.*

The steady state as nested roots. The nest of the mechanism model gains two fixed points, both scalar (Appendix C.9). Given a trial real riskless return $\bar I/\theta$: $\bar\mu$ from (4.16) for a trial $\bar\nu$, the deposit rates, the funding cost, the rental, the thresholds type by type from the steady-state form of (4.2) (a scalar root per type), the loss factors and the regulatory weights. Given further a trial $\bar\rho^F$: each type's costs, the cover decision, the rates, the lender, the wage from labour clearing, every loan, the coverage and collateral; the inner root is the capacity identity. Then the draw block: the retained loss bases, the issuance threshold, $\bar\pi$ and $\bar\nu$, the latter returned to the first step, a fixed point in one scalar that converges in a few iterations because $\bar\nu \in [1, 1+\chi]$; the abandonment threshold from $\bar V^B$, which solves (4.18) in steady state in one line; the failure probability and the outlay. Finally the outer root in $\bar I/\theta$ from the capitalists' deposit condition, with the wholesale markdown between them. The price level and the checks follow as in the mechanism model, plus the franchise condition $\bar V^B \geq (1+\chi)\bar e$, the branch condition, the second-order condition of the firm, and the fund's $\beta\bar\rho^F < 1 + \chi^F$.

What the layer keeps, the propositions of neutrality and of sign preservation, is in Section 4.1.

B.9 Switches, their neutral values, and what is parked

Every addition of this document is a switch. The wholesale switching elasticity η_K, neutral at infinity. Project survival γ, at zero. The resolution loss ζ, at zero. The operating costs c_L, c_D, c_0, at zero. The loss dispersion σ_b, at zero, which removes the risk charge, the risk-transfer value, the issuance probability and failure. The issuance costs χ, χ^F, at zero with full payout, which is the frictionless reset. The borrowing cap κ_Z, at zero. Contract survival γ_X, at zero. The regulatory weights, which replace the stand-ins of the mechanism model and are neutral only in the sense that the stand-ins are a special case of their shape. The workers' share of the outlay, at the labour share, with zero and the population share as comparisons. The mechanism model's own switches, elastic labour, lending market power, the leverage rule and aggregate productivity, stay on.

Parked, with their reasons recorded: a corporate/SME split, the continuum doing its work; a fixed real foreign demand for currency, a sensitivity on the price elasticity; firms owning their capital

and borrowing to invest, a different model; multiple bank relationships; a full bailout, which breaks the participation decision; a backstop financed by reserves, which needs reserves in the nominal anchor; debt smoothing of the backstop, which needs a bond; a deposit-insurance fund financed by bank contributions, the statutory first layer; a monitoring wedge on covered pools, which needs a residual stake; oligopsony in the insurance market, which no result needs.

C Derivations: the quantitative model

Every new or changed condition is derived here; a condition that is identical to the mechanism model's is referenced to Appendix A. Perfect foresight over aggregates, the draw explicit; time subscripts dropped where no confusion arises; $R(\sigma) \equiv I^L_{t+1}(\sigma)/\Pi_{t+1}$ and $R \equiv I_{t+1}/\Pi_{t+1}$ as local shorthands.

C.1 Wholesale placement, the two markdowns, the riskless rate, the funding cost

Placement. The capitalist's problem is the mechanism model's placement problem (Appendix A.2) with η_K in place of η_D and the wholesale rates in place of the retail ones: maximise $\sum_i (I^K_i - 1) D^K_i$ subject to (B.2). The constraint is homogeneous of degree one and convex; the first-order conditions give $D^K_i/D^K = \frac{1}{N}((I^K_i - 1)/(I^K - 1))^{\eta_K}$ with the index $I^K - 1 = [\frac{1}{N}\sum_i (I^K_i - 1)^{1+\eta_K}]^{1/(1+\eta_K)}$ and duality, (B.3); at symmetry $\partial \log D^K_i / \partial \log(I^K_i - 1) = \eta_K(1 - 1/N) = \varepsilon_K$. The receipts constraint and the two money conditions of the capitalist are untouched, since the placement is a choice within the deposit total.

The two markdowns. Bank i values a retail deposit euro at $I - \Pi c_D$ (it earns the facility rate and costs c_D in goods of $t+1$) and a wholesale euro at I. Retail profit $(I - \Pi c_D - I^W_i) D^W_i(I^W_i)$ with elasticity ε_D gives $I^W_i - 1 = \frac{\varepsilon_D}{1+\varepsilon_D}(I - 1 - \Pi c_D)$; wholesale profit $(I - I^K_i) D^K_i(I^K_i)$ with elasticity ε_K gives $I^K_i - 1 = \frac{\varepsilon_K}{1+\varepsilon_K}(I - 1)$: (4.3). Both are interior for any $N \geq 2$ and finite elasticity; $\varepsilon_K \to \infty$ gives $I^K = I$.

The capitalists' deposit condition in (B.5) is one equation in I^K_{t+1} given the real rental bill and Π_{t+1} (Appendix A.3); inverting the wholesale markdown gives (4.4). The facility pays I_{t+1} by indexation. Nothing is pinned by competition against a fixed rate, so the mechanism model's flattening lemma (Appendix A.21) does not apply: the bank side posts a markdown on a rate that moves with the depositors' condition.

The funding cost. A loan euro creates α_H/α retail and α_K/α wholesale euros at the lending bank; by the two share systems $1/N$ of each stays and $(N-1)/N$ leaves through the facility. The settlement cost per loan euro is $\frac{1}{\Pi}[\frac{N-1}{N} I + \frac{1}{N}(\frac{\alpha_H}{\alpha} I^W + \frac{\alpha_K}{\alpha} I^K)]$, which is (B.8). The deposits that arrive from rivals earn $(I - I^W)/\Pi - c_D$ per retail euro and $(I - I^K)/\Pi$ per wholesale euro, the two franchise lines, and enter no marginal condition (Appendix A.8).

C.2 Firms with continuation and a resolution loss

Write R for the type's real gross loan rate, $L = WH + rK$, $Y = zH^{\alpha_H}K^{\alpha_K}$ (realised output ωY), $\bar{\omega} = RL/Y$, $\Gamma = G + \bar{\omega}(1 - F)$ and V' for next period's value, which does not depend on today's

inputs. The owners' payoff at settlement is $(\omega-\bar\omega)^+Y$, with expectation $(1-\Gamma)Y$; a non-defaulting project continues with probability γ. Hence (4.1).

First-order condition in H. The choice enters through Y and through $\bar\omega$:

$$0=\mathbb{E}\Big[-\Gamma'(\bar\omega)\frac{\partial\bar\omega}{\partial H}Y+(1-\Gamma)\frac{\partial Y}{\partial H}-\gamma f\frac{\partial\bar\omega}{\partial H}V'\Big],\qquad \Gamma'=1-F,\quad \frac{\partial Y}{\partial H}=\frac{\alpha_H}{H}Y,\quad \frac{\partial\bar\omega}{\partial H}=\frac{RW}{Y}-\bar\omega\frac{\alpha_H}{H}.$$

Substituting and collecting the terms in α_H/H with the identity $(1-\Gamma)+(1-F)\bar\omega=1-G$,

$$\frac{\alpha_H}{H}\,\mathbb{E}\big[(1-G)Y+\gamma f\bar\omega V'\big]=\mathbb{E}\Big[RW\Big(1-F+\frac{\gamma fV'}{Y}\Big)\Big]\equiv W\,\mathcal{C},$$

and the condition in K is the same with (α_K,r). Dividing the two, $rK/(WH)=\alpha_K/\alpha_H$: the input proportions of (4.2). Adding them, and using $RL=\bar\omega Y$ in the right-hand side,

$$\alpha\big[(1-G)Y+\gamma f\bar\omega V'\big]=\bar\omega Y(1-F)+\gamma f\bar\omega V'\quad\Longleftrightarrow\quad \alpha(1-G)=\bar\omega(1-F)+(1-\alpha)\gamma\bar\omega f\frac{V'}{Y},$$

the threshold condition of (4.2). At $\gamma=0$ it is the mechanism model's (Appendix A.4).

Steady state. From (4.1) at a steady state, $\bar V=\beta[(1-\Gamma)\bar Y+\gamma(1-F)\bar V]$, so $\bar V/\bar Y=\beta(1-\Gamma)/(1-\beta\gamma(1-F))$, a function of $\bar\omega$ alone; the threshold equation is then one equation in $\bar\omega$ with parameters $(\alpha,\sigma,\gamma,\beta)$. The survival term is nonnegative, so the root is below the mechanism model's. Scale follows from $\bar\omega Y=RL$ with $Y=zL^\alpha\Psi$ as in Appendix A.4: $L=(\bar\omega z\Psi/R)^{1/(1-\alpha)}$, and across steady states $-\,\mathrm{d}\log L/\,\mathrm{d}\log R=1/(1-\alpha)$ since $\bar\omega$ is pinned.

The perceived elasticity. Hold W, r and V' fixed and vary R. Write $\Theta(\bar\omega)\equiv\alpha(1-G)-\bar\omega(1-F)$ and $\mathcal{B}(\bar\omega)\equiv(1-\alpha)\gamma V'\bar\omega f$, so that the threshold condition reads $\Theta=\mathcal{B}/Y$ and $\Theta=\mathcal{B}/Y$ is the survival term called $\mathcal{A}$ in the main text. Differentiating, with $\,\mathrm{d}\log Y=\alpha\,\mathrm{d}\log L$,

$$\Theta'\,\mathrm{d}\bar\omega=\frac{\mathcal{B}'}{Y}\,\mathrm{d}\bar\omega-\frac{\mathcal{B}}{Y}\alpha\,\mathrm{d}\log L\quad\Longrightarrow\quad \mathrm{d}\log\bar\omega=-\frac{\alpha\,\Theta}{\bar\omega(\Theta'-\mathcal{B}'/Y)}\,\mathrm{d}\log L,$$

using $\mathcal{B}/Y=\Theta$. From $\bar\omega=RL^{1-\alpha}/(z\Psi)$, $\,\mathrm{d}\log\bar\omega=\,\mathrm{d}\log R+(1-\alpha)\,\mathrm{d}\log L$. Combining,

$$-\frac{\mathrm{d}\log L}{\mathrm{d}\log R}=\frac{1}{1-\alpha+\mathcal{D}},\qquad \mathcal{D}=\frac{\alpha\Theta}{\bar\omega(\Theta'-\mathcal{B}'/Y)},$$

with

$$\Theta'=-(1-F)+(1-\alpha)\bar\omega f,\qquad \frac{\mathcal{B}'}{Y}=(1-\alpha)\gamma\frac{V'}{Y}\frac{\mathrm{d}(\bar\omega f)}{\mathrm{d}\bar\omega},$$

which is (B.6) after taking the sign of the denominator outside. The main text writes $\mathcal{D}(\sigma)$ with the sign of the denominator taken outside, so the $\mathcal{D}$ there is minus the expression here. At the low root $\Theta'<0$, the condition under which the right side of the threshold equation crosses the left from below (Appendix A.4); with the continuation term the denominator is $-\bar\omega[(1-F)-(1-\alpha)\bar\omega f+(1-\alpha)\gamma(V'/Y)\,\mathrm{d}(\bar\omega f)/\,\mathrm{d}\bar\omega]$, negative when the bracket is positive, so $\mathcal{D}\le 0$ and the perceived elasticity is at or above the benchmark. The second-order condition of the project in (H,K) is $1-\alpha+\mathcal{D}>0$; both are checked at every solution.

The loss factor. In default the lender receives $(1-\zeta)\omega Y$ against a claim of $\bar\omega Y$. Expected shortfall per euro lent: $\mathbb{E}[(\bar\omega-(1-\zeta)\omega)\mathbf{1}\{\omega<\bar\omega\}]Y/L=(\bar\omega F-(1-\zeta)G)Y/L=(F-(1-\zeta)G/\bar\omega)R$, using $\bar\omega Y=RL$: (B.7). The lender's receipts $[(1-\zeta)G+\bar\omega(1-F)]Y$ have derivative $(1-F-\zeta\bar\omega f)Y$ in $\bar\omega$, positive on the low-rate side of the hump iff $1-F>\zeta\bar\omega f$, the branch condition. The destroyed output $\zeta\,\mathbb{E}[\omega\mathbf{1}\{\omega<\bar\omega\}]Y=\zeta GY$ per project is the resolution-loss term of goods clearing.

C.3 The regulatory weights

The pool weight. The internal-ratings weight for a corporate exposure with default probability p, loss given default λ_{reg} and maturity M_{reg} is (CRR, 2026, Article 153(1))

$$w^{\text{IRB}}(p,\lambda_{\text{reg}}) = 12.5\,\lambda_{\text{reg}}\Big[\Phi\Big(\frac{\Phi^{-1}(p)+\sqrt{\varrho_{\text{reg}}(p)}\,\Phi^{-1}(0.999)}{\sqrt{1-\varrho_{\text{reg}}(p)}}\Big)-p\Big]\frac{1+(M_{\text{reg}}-2.5)b_{\text{reg}}(p)}{1-1.5\,b_{\text{reg}}(p)}, \quad \text{(C.1)}$$

with the asset correlation $\varrho_{\text{reg}}(p) = 0.12\frac{1-e^{-50p}}{1-e^{-50}}+0.24\big(1-\frac{1-e^{-50p}}{1-e^{-50}}\big)$ and the maturity term $b_{\text{reg}}(p) = (0.11852 - 0.05478\ln p)^2$ (Basel Committee on Banking Supervision, 2017). Symbols with the subscript reg are the regulation's own and are used nowhere else. In the model $p = F(\bar{\omega}(\sigma);\sigma)$ and $\lambda_{\text{reg}} = \ell(\sigma)/F$, both pinned type by type in steady state, and M_{reg} is set at the regulation's default of 2.5 years (the effective-maturity rule, bounded between one and five years, is not used), so $w(\sigma)$ is a function of the type alone, increasing in σ over the calibrated range. The regulation floors the inputs, $p \geq 0.05\%$ and $\lambda_{\text{reg}} \geq 0.25$ under own estimates, with $\lambda_{\text{reg}} = 0.40$ for senior unsecured corporate exposures under the foundation approach, and the formula carries no scaling factor, the 1.06 multiplier of the earlier framework having been removed.

The covered weight. The bank retains the senior tranche attaching at $\tau(\sigma)$ and detaching at one. The securitisation formula gives the senior tranche's capital per euro of the tranche as (CRR, 2026, Article 261)

$$K_{\text{reg}}(\tau) = \frac{e^{a_{\text{reg}}(1-K_A)} - e^{a_{\text{reg}}(\tau-K_A)^+}}{a_{\text{reg}}\big((1-K_A)-(\tau-K_A)^+\big)}, \qquad a_{\text{reg}} = -\frac{1}{p\,K_A}, \qquad K_A = 0.08\,w(\sigma), \qquad \text{(C.2)}$$

for $\tau \geq K_A$, with K_A the pool's capital at the 8% minimum (the buffer does not enter the formula) and p the supervisory parameter (one for a standard transaction, one half for a simple, transparent and standardised one); a tranche attaching below K_A carries the full charge on the part below and the formula on the part above; the retained tranche's weight per euro of the tranche is $v^{\text{SEC}} = \max\{v_0,\, 12.5\,K_{\text{reg}}(\tau)\}$, with the floor v_0 (15%, 10% for the standardised case), and per euro of the pool it is the tranche weight times the tranche's share $1-\tau$; regulation caps the retained tranche's weight at the pool's, so per euro of pool the covered weight cannot exceed $(1-\tau)w$, the min of (4.8). The rules build K_A from the pool's standardised-approach capital and send an internal-ratings pool through the SEC-IRBA, with its own supervisory parameter; the model applies the SEC-SA form to the pool's internal-ratings capital $0.08\,w(\sigma)$, with the SEC-SA parameter and floors, a stylisation of the SEC-IRBA (CRR, 2026, Articles 255, 259, 261–262). The slice sold carries no capital. The properties used in the text: v equals the floor where the tranche attaches well above K_A, rises with K_A at a given τ, and reaches the cap when $\tau \leq K_A$, so that $\varrho(\sigma) = \kappa_r(w-v)$ is zero at the floor, positive in the middle and equal to the charge on the slice sold, $\kappa_r\tau w$, at the top; relative to the collateral it costs, relief falls at the top because the expected loss, and with it the collateral, grows faster than the weight, the shape that the mechanism model's one-parameter stand-in reproduced. The exact statutory expressions, including the treatment of a tranche straddling K_A and the floors, are those of the Basel framework and of the Capital Requirements Regulation.

C.4 The loss draw: closed forms

For $\log\xi \sim N(-\sigma_b^2/2, \sigma_b^2)$ and a threshold $k > 0$, with $u_k \equiv (\log k + \sigma_b^2/2)/\sigma_b$,

$$\Pr[\xi > k] = \bar\Phi(u_k), \qquad \mathbb{E}[\xi\,\mathbf{1}\{\xi > k\}] = \bar\Phi(u_k - \sigma_b), \qquad \mathbb{E}[(\xi - k)^+] = \bar\Phi(u_k - \sigma_b) - k\,\bar\Phi(u_k),$$

the lognormal partial expectation. Everything below is an application.

Per covered euro the fund pays $\min\{\xi\ell R, (1-\gamma_X)\tau\} = \ell R \min\{\xi, n\}$, so $\mathbb{E}_\xi \min\{\xi\ell R, (1-\gamma_X)\tau\} = \ell R\big[\Phi(u_n - \sigma_b) + n\bar\Phi(u_n)\big]$ and the bank's residual $\mathbb{E}(\xi - n)^+\ell R$ with $\mathbb{E}(\xi - n)^+$ as above. Outside stress and at $\sigma_b \to 0$ the payment is ℓR and the residual zero, the mechanism model's case.

Post-settlement equity. Let U_t^u and U_t^c be the expected losses on the uncovered and on the covered book,

$$U_t^u \equiv \sum_\sigma \big(L_t^B(\sigma) - S_t(\sigma)\big)\,\ell(\sigma)\frac{I_{t+1}^L(\sigma)}{\Pi_{t+1}}, \qquad U_t^c \equiv \sum_\sigma S_t(\sigma)\,\ell(\sigma)\frac{I_{t+1}^L(\sigma)}{\Pi_{t+1}},$$

and $\bar e_{t+1}^{\text{post}}$ the mean post-settlement equity. Since a covered pool loses to the bank only above the draw n,

$$e_{t+1}^{\text{post}}(\xi) = \bar e_{t+1}^{\text{post}} - U_t^u\,(\xi - 1) - U_t^c\Big[(\xi - n)^+ - \mathbb{E}(\xi - n)^+\Big]. \tag{C.3}$$

Write $u^* \equiv u_{\xi^*}$ and $u^f \equiv u_{\xi^f}$ for the standardised issuance and failure thresholds.

Issuance. With the sector at or above its target, bank i issues when $e^{\text{post}}(\xi) < e_{t+1}$, i.e. by (C.3) when $U^u(\xi - 1) + U^c[(\xi - n)^+ - \mathbb{E}(\xi - n)^+] > \bar e^{\text{post}} - e_{t+1} \equiv \bar d \geq 0$. If the solution satisfies $\xi^* \leq n$, $\xi^* = 1 + (\bar d + U^c\mathbb{E}(\xi - n)^+)/U^u$; otherwise $\xi^* = [\bar d + U^u + U^c(n + \mathbb{E}(\xi - n)^+)]/(U^u + U^c)$. Then $\pi = \bar\Phi(u^*)$, $\nu = 1 + \chi\pi$ (Appendix C.5), and $\mathrm{Cov}(\mathbf{1}_{\text{iss}}, \xi) = \mathbb{E}[\xi\mathbf{1}\{\xi > \xi^*\}] - \pi = \bar\Phi(u^* - \sigma_b) - \bar\Phi(u^*) > 0$ for $\sigma_b > 0$: (4.14). Aggregate issuance and payouts are the complementary partial expectations, $i = U^u[\bar\Phi(u^* - \sigma_b) - \xi^*\bar\Phi(u^*)] + U^c[\ldots]$ with the covered term by the same identity above n, deterministic in the aggregate by the law of large numbers. In a common shortfall the same formulas hold with $\bar e^{\text{post}}$ in place of e_{t+1}, so $\bar d = 0$ and $\xi^* = 1$ when $U^c\mathbb{E}(\xi - n)^+$ is negligible.

The risk charge and the risk-transfer value. The owners value a settlement flow $a + \mathfrak{b}\xi$ at $\mathbb{E}[(1 + \chi\mathbf{1}_{\text{iss}})(a + \mathfrak{b}\xi)] = \nu a + \mathfrak{b}[\nu + \chi\mathrm{Cov}(\mathbf{1}_{\text{iss}}, \xi)]$: deterministic flows carry ν, draw-scaled flows the covariance premium. Dividing by ν gives the factor $1 + \kappa_\xi$ of (4.13) on the uncovered loss. For the transferred loss $\ell R\min\{\xi, n\}$, $\mathrm{Cov}(\mathbf{1}_{\text{iss}}, \min\{\xi, n\}) = \mathbb{E}[\min\{\xi, n\}\mathbf{1}\{\xi > \xi^*\}] - \pi\mathbb{E}\min\{\xi, n\}$; for $\xi^* \geq n$ the first term is $n\pi$ and the covariance is $\pi(n - \mathbb{E}\min\{\xi, n\}) \geq 0$; for $\xi^* < n$ it is $\bar\Phi(u^* - \sigma_b) - \bar\Phi(u_n - \sigma_b) + n\bar\Phi(u_n) - \pi\mathbb{E}\min\{\xi, n\} \geq 0$. Multiplying by $\chi\ell R/\nu$ gives RT of (4.21). Both are of second order in σ_b: as $\sigma_b \to 0$ with $\bar d > 0$, $u^* \to +\infty$ and every covariance vanishes.

Failure and the outlay. The failure threshold ξ^f solves $e^{\text{post}}(\xi^f) = e^*$ with $e^* = e_{t+1} - V^B/(1 + \chi) \leq 0$, by the same piecewise formula with $\bar e^{\text{post}} - e^*$ in place of $\bar d$; $\varpi = \bar\Phi(u^f)$. For $\xi > \xi^f \geq n$, $-e^{\text{post}}(\xi) = (U^u + U^c)\xi - [U^u + U^c(n + \mathbb{E}(\xi - n)^+) + \bar e^{\text{post}}]$, so

$$J = (U^u + U^c)\,\bar\Phi(u^f - \sigma_b) - \big[U^u + U^c\big(n + \mathbb{E}(\xi - n)^+\big) + \bar e^{\text{post}}\big]\bar\Phi(u^f);$$

for $\xi^f < n$ the covered term applies only above n and the formula gains the two partial expectations between ξ^f and n, by the same identity. $J \geq 0$ by construction and $J \to 0$ as $\sigma_b \to 0$.

C.5 The capital cycle

The bank's problem. At the contracting stage the sector chooses rates, new coverage, the loan to the fund and next period's equity e_{t+1} to maximise

$$\mathcal{W}_t(e_t) = \max\ \beta\,\mathbb{E}_t\Big[\Big(e^{\text{post}}_{t+1}(\xi) - e_{t+1} - \chi\big(e_{t+1} - e^{\text{post}}_{t+1}(\xi)\big)^+ + \mathcal{W}_{t+1}(e_{t+1})\Big)\mathbf{1}\{\xi \le \xi^f_t\}\Big]$$

subject to (3.11), (4.5) (μ_t), (4.6) (ϕ_t), and the rules: payouts above target only, issuance of the idiosyncratic shortfall at cost χ, no issuance of a common shortfall unless $\nu_{t+1} \ge 1+\chi$. The first-order condition for the target, in the states in which the bank survives, is $\mathcal{W}'_{t+1}(e_{t+1}) = \mathbb{E}[1+\chi\mathbf{1}_{\text{iss}}] = 1+\chi\pi_{t+1} \equiv \nu_{t+1}$: a marginal euro of target is a euro not paid out in the no-issuance states and a euro not raised at $1+\chi$ in the issuance states. In a common shortfall the target is not reached and ν is the multiplier on the capital the sector has, between $1+\chi\pi$ and $1+\chi$.

Envelope. A marginal euro of e_t at fixed choices sits at the facility, earns I_{t+1}, and relaxes both constraints: $\nu_t = \mathcal{W}'_t(e_t) = \beta\mathbb{E}_t[\nu_{t+1}I_{t+1}/\Pi_{t+1}] + \mu_t + \phi_t$, (4.15). In steady state with $\bar\phi = 0$, $\bar\mu = \bar\nu(1-\beta\bar I/\theta)$, and the riskless rate is the wholesale clearing rate grossed up by (4.4): the result on the steady-state price of regulatory capital of Section 4.1. If the gap is positive the requirement binds, by complementary slackness; if it were slack, $\bar\mu = \bar\phi = 0$ would give $\bar\nu = \beta\bar\nu\bar I/\theta < \bar\nu$, a contradiction.

The retention rule's dynamics. After a common loss, $\bar e^{\text{post}}_{t+1} < \kappa_r \text{RWA}^{\text{desired}}_{t+1}$; with no issuance of the common part the sector's equity is $e_{t+1} = \bar e^{\text{post}}_{t+1}$, its book is the one that binds (4.5) at that equity, the pricing conditions read as equations for μ_t at the constrained book (Appendix A.11), and no payout is made until retained earnings return equity to the requirement on the desired book. With $\chi = 0$ the sector refills at once, the frictionless reset; with $\chi \to \infty$ it never issues; in between it issues the common part when ν reaches $1+\chi$.

C.6 Failure, the value function, re-entry

Abandonment. At settlement the owners of bank i compare refilling, worth $V^B_{t+1} - (1+\chi)(e_{t+1} - e^{\text{post}}(\xi))$, with abandoning, worth zero under limited liability. They refill iff $e^{\text{post}}(\xi) \ge e^*_{t+1} = e_{t+1} - V^B_{t+1}/(1+\chi)$, (4.17). Under the franchise condition $V^B_{t+1} \ge (1+\chi)e_{t+1}$, $e^* \le 0$: a bank is abandoned only when its losses exceed its equity by more than the franchise is worth net of the issuance cost; a solvent bank is never abandoned.

A new bank endowed with e_{t+1} costs its owners $(1+\chi)e_{t+1}$ and is worth V^B_{t+1}; under the franchise condition entry is profitable, so the mass ϖ of failed banks is replaced and the sector's equity and book are those of a sector of N identical banks. The entrants' surplus, $V^B_{t+1} - (1+\chi)e_{t+1} \ge 0$ per bank, accrues to the capitalists as a class and is counted in Y^K.

The value function. In the survival states the owners receive the payout net of issuance cost and keep the continuation value; in the failure states nothing. Hence (4.18). In steady state,

$$\bar V^B = \frac{\beta\,\mathbb{E}\big[\big(e^{\text{post}}(\xi) - \bar e - \chi(\bar e - e^{\text{post}}(\xi))^+\big)\mathbf{1}\{\xi \le \xi^f\}\big]}{1-\beta(1-\bar\varpi)},$$

with the numerator in closed form: $\mathbb{E}[(e^{\text{post}} - \bar e)\mathbf{1}\{\xi \le \xi^f\}]$ is $(1-\varpi)\bar d$ minus the partial expectations of the two loss bases below ξ^f, and $\chi\mathbb{E}[(\bar e - e^{\text{post}})^+\mathbf{1}\{\xi \le \xi^f\}]$ is χ times the partial expectations

between ξ^* and ξ^f, all by the identity of Appendix C.4. Since ξ^f depends on $\bar{V}^B$ through e^*, the steady-state value is a scalar fixed point, with $\bar{V}^B$ decreasing in $\bar{\varpi}$ and $\bar{\varpi}$ decreasing in $\bar{V}^B$, hence unique.

The result on the failure probability and the requirement of Section 4.3. (i) For $\sigma_b > 0$ the draw is unbounded above and $\xi^f < \infty$ when $V^B < \infty$, so $\varpi > 0$ and $J > 0$; J enters (4.24), not (4.18), and the bank's first-order conditions are derivatives of (4.18). (ii) At a given book and loss bases, a higher κ_r raises e_{t+1} one for one with κ_rRWA and raises $\bar{e}^{\text{post}}$ by the return on the extra equity; e^* rises by less than e_{t+1} since V^B rises too; the failure threshold ξ^f, which solves $U^u(\xi^f - 1) + U^c[\cdot] = \bar{e}^{\text{post}} - e^*$, rises, and ϖ and J fall. The effect on credit is the mechanism model's (Appendix A.22). (iii) Covering type σ moves $S(\sigma)\ell R$ from U^u to U^c, where it enters only above n, and lowers the required equity by ϱS, which is paid out; the threshold moves with the ratio of the loss bases to equity, whose change has no general sign.

C.7 The fund

With payouts above target only, the fund's problem at the contracting stage is to maximise $\beta\mathbb{E}_t$[resources at $t+1$] net of costs subject to (B.9), the cap on borrowing, and L^F, S-collateral, $Z \geq 0$; multiplier $\beta\rho_t^F$ on the capacity identity. Resources at $t+1$:

$$\sum_{\mathcal{N}} L^F(1-\ell)R + \sum_{\sigma} \tau S\Big[R + q - \frac{\mathbb{E}\min\{\xi\ell R, (1-\gamma_X)\tau\}}{\tau}\Big] - \frac{I^Z Z}{\Pi},$$

with q the fee bill per unit of collateral on the active coverage. Differentiating: loans, (B.10); new collateral, the supply fee of Appendix C.8; borrowing, the fund borrows to the cap iff $\rho^F > I^Z/\Pi$ with multiplier $\rho^F - I^Z/\Pi$ on the cap (Appendix A.24). The fund's capital follows $W_{t+1}^{\text{post}} = \rho_t^F W_t^F +$ (realised − expected) loan losses and tranche payments at the aggregate state, the payout $d^F = \max\{W^{\text{post}} - \bar{W}^F, 0\}$, no payout below target, injection iff $\nu^F \geq 1 + \chi^F$ with $\nu_t^F = \beta\rho_t^F \nu_{t+1}^F$ below target and $\beta\rho_t^F$ at it; abandonment iff $W^{\text{post}} < \bar{W}^F - V^F/(1+\chi^F)$ with $W^{\text{post}} < 0$, $V^F = \beta(\bar{\rho}^F - 1)\bar{W}^F/(1-\beta)$ in steady state; on abandonment the banks' loan Z is impaired by $\min\{-W^{\text{post}}, Z\}$, which enters (C.3) as a common term, and a new fund is endowed with $\bar{W}^F$.

C.8 Rollover co-states

Geometric survival makes $(S_{t-1}(\sigma), Q_{t-1}(\sigma))$ sufficient for all vintages. Let the bank's value function carry the contract states and define, per covered euro, the co-states $\varkappa_t^S \equiv \partial\mathcal{W}_t/\partial(\gamma_X S_{t-1})$ and $\varkappa_t^Q \equiv \partial\mathcal{W}_t/\partial(\gamma_X Q_{t-1})$. An inherited covered euro relieves the requirement now by ϱ, valued μ_t; transfers at settlement the loss up to the tranche, a draw-scaled flow worth $\mathbb{E}\min\{\xi\ell R, (1-\gamma_X)\tau\} + \nu\,\text{RT}$ in owner units times β; and survives with probability γ_X:

$$\varkappa_t^S = \mu_t\varrho + \beta\big[\nu_{t+1}\mathbb{E}\min\{\xi\ell R, (1-\gamma_X)\tau\} + \nu_{t+1}\text{RT}_t + \gamma_X\varkappa_{t+1}^S\big], \qquad \varkappa_t^Q = \beta\big[-\nu_{t+1} + \gamma_X\varkappa_{t+1}^Q\big],$$

the second a negative annuity, $\bar{\varkappa}^Q = -\beta\bar{\nu}/(1-\beta\gamma_X)$ in steady state. New coverage of ΔS euros at fee q adds ΔS to S_t and $q\tau\Delta S$ to Q_t; the first-order condition is $\varkappa_t^S + q\tau\varkappa_t^Q \geq 0$ with equality at an interior amount, so $\mathcal{V}_t^B \equiv \varkappa_t^S$ and $\mathcal{B}_t^B \equiv -\tau\varkappa_t^Q = \beta\tau[\nu_{t+1} - \gamma_X\varkappa_{t+1}^Q]$ in (4.22). For the fund, which values flows at one and discounts at β, an inherited covered euro costs the tranche payment

and the collateral's carry τs_t each period while alive, and an inherited unit of fee bill pays one:

$$\varkappa_t^{F,S} = \beta\big[-\mathbb{E}\min\{\xi\ell R, (1-\gamma_X)\tau\} - \tau s_t + \gamma_X \varkappa_{t+1}^{F,S}\big], \qquad \varkappa_t^{F,Q} = \beta\big[1 + \gamma_X \varkappa_{t+1}^{F,Q}\big],$$

so $\mathcal{V}_t^F \equiv -\varkappa_t^{F,S}$ and $\mathcal{B}_t^F \equiv \tau\varkappa_t^{F,Q}$, with $\bar{\varkappa}^{F,Q} = \beta/(1-\beta\gamma_X)$. At $\gamma_X = 0$: $q^D = [\mu\varrho/(\beta\nu) + \mathrm{RT} + \mathbb{E}\min\{\xi\ell R, (1-\gamma_X)\tau\}]/\tau$ and $q^S = \mathbb{E}\min\{\xi\ell R, (1-\gamma_X)\tau\}/\tau + s$, so new coverage is bought iff $\mu\varrho/(\beta\nu) + \mathrm{RT} \geq \tau s$, which is (4.23); the transferred loss cancels as in the mechanism model (Appendix A.13). With γ_X near one only the expiring fraction of the stock reprices each period; a fall in fund capacity raises s and the cost of new protection through $\mathcal{V}^F$, while inherited coverage keeps delivering relief at locked fees and keeps its collateral posted, which is how a large inherited book transmits stress to s through (B.9).

C.9 The steady state

Given $\bar{I}/\theta$ and $\bar{\nu}$: $\bar{\mu}$; the deposit rates by (4.3) with $\bar{I}$ from (4.4); $\bar{c}^B$; $r = 1/\beta - 1 + \delta$; per type the low root of the steady-state threshold equation (Appendix C.2), ℓ, F, w by (C.1), ε by (B.6) evaluated at $\bar{V}/\bar{Y}$. Given a trial $\bar{\rho}^F$: per type the uncovered and covered costs (the covered one a fixed point in the type's own rate through τ and v), the cover decision by (4.23) at the steady-state RT, the markup price from (4.13), the lender, $R(\sigma)$; the wage from labour clearing as in Appendix A.17, with $\bar{H}$ from the workers' hours condition at the steady-state tax $\bar{\mathrm{Tr}}^W = -(\bar{W}\bar{H}/\bar{Y})\bar{J}$; every loan, coverage $\bar{S} = \bar{L}^B$ on covered types, collateral $\bar{T}$; the capacity identity with $\bar{Z} = \kappa_Z \bar{W}^F$ gives the inner root. Then the draw block: U^u, U^c, $\bar{d} = \bar{e}^{\mathrm{post}} - \bar{e}$ with $\bar{e} = \kappa_r \overline{\mathrm{RWA}}$, ξ^*, $\bar{\pi}$, a new $\bar{\nu} = 1 + \chi\bar{\pi}$ returned to the first step until it converges; $\bar{V}^B$ and ξ^f as the fixed point of Appendix C.6; $\bar{\varpi}$, $\bar{J}$, the taxes. The outer root: the capitalists' deposit condition at the rental bill $(\alpha_K/\alpha)\bar{L}$ returns $\bar{I}^K$, hence $\bar{I}/\theta$ through (4.4), to match the trial. Then $\bar{P}_t$, $\bar{A}$, payouts, the transfer, and the checks.

C.10 Neutrality and sign preservation

Proposition 6. At $\eta_K \to \infty$, (4.3)–(4.4) give $I^K = I$ and (B.8) loses its last term: the mechanism model's deposits section. At $\gamma = 0$, (4.1) is the one-period payoff, (4.2) loses its survival term, $\mathcal{D} = 0$: the mechanism model's firm section. At $\zeta = 0$, (B.7) is the mechanism model's loss factor and the branch condition is $1 - F > 0$. At zero operating costs the all-in cost, the retail markdown and goods clearing are the mechanism model's. At $\sigma_b = 0$, e^{post} is deterministic, $\pi = \kappa_\xi = \mathrm{RT} = 0$, $\nu = 1$, $\varpi = J = 0$: the pricing and cover conditions are the mechanism model's and the budget has no outlay. At $\chi = 0$ with full payout the capital rule is the frictionless reset and (4.15) has $\nu \equiv 1$. At $\kappa_Z = 0$, $Z = 0$. At $\gamma_X = 0$ the co-states vanish and (4.22) is (4.23) with $\mathrm{RT} = 0$. With the mechanism model's weights in place of (4.7)–(4.8) the regulation is the mechanism model's. The equilibrium definition then lists the mechanism model's conditions and the steady state nest is the mechanism model's two roots.

Proposition 6. (i) c_L, c_D, c_0 enter (4.12), (4.3) and goods clearing additively; none enters the money conditions or the elasticities of Proposition 4. (ii) The markdown raises $\bar{I}$ above $\bar{I}^K$ at a given $\bar{I}^K$; the clearing step is the capitalists' condition in I^K, unchanged; $\bar{\mu}$ rises by (4.16); the price elasticity of the mechanism model depends on $\bar{I}^K$, not on $\bar{I}$. (iii) By Appendix C.2, $\varepsilon \geq 1/(1-\alpha) > 0$ and the steady-state elasticity is the benchmark. (iv) $\partial\ell/\partial\zeta = G/\bar{\omega} > 0$ for every type; relief per euro of expected loss falls by the common factor and the band's boundaries

move, but Δ of the mechanism model keeps its sign structure. (v) $\kappa_\xi \geq 0$ raises the all-in cost of every type, RT ≥ 0 enters the cover condition with a plus, $\bar{\nu} \geq 1$ scales $\bar{\mu}$; all vanish with σ_b. (vi) In steady state payouts equal profits, the sector sits at the requirement, and the capital released by coverage is paid out: the steady-state conditions are the reset's at the same $\bar{\nu}$ (Appendix C.5). (vii) At $\gamma_X = 0$ the fees are the one-period ones; for $\gamma_X > 0$ the steady-state fees are the annuity ratios of the same flows, equal to the one-period fees. (viii) J and the taxes enter (B.1), (B.4) and (4.24); the forced balances are the rental bill, a fixed share of the loans; the currency conditions and (3.47) are the mechanism model's.

C.11 Stress and the incidence of a crisis

The result of Section 4.3 that protection is dearer when banks need it. Let the realised aggregate state at settlement t leave $\bar{e}^{\text{post}}_{t+1} < \kappa_r \text{RWA}^{\text{desired}}_{t+1}$ and $W^{\text{post}}_{t+1} < \bar{W}^F$. (i) By the retention rule the sector does not refill the common part; its book is the one that binds (4.5) at $\bar{e}^{\text{post}}$, and μ_t solves the pricing conditions at that book (Appendix A.11): demand is inelastic in rate space, so a given capital shortfall needs a large rise in rates and μ_t rises; the target FOC gives ν_{t+1} between $1 + \chi\pi$ and $1 + \chi$. (ii) The fund's capacity in (B.9) is $W^{\text{post}} + Z$ with $Z \leq \kappa_Z W^{\text{post}}$, lower, while the collateral $\sum \tau\gamma_X S_{t-1}$ on inherited coverage is predetermined; total demand for fund capital at the old ρ^F exceeds capacity, so ρ^F and s rise (Appendix A.13), q^S rises by (4.22), and fund-served types pay more and borrow less. (iii) $\mu\varrho/(\beta\nu)$ rises with μ and falls with ν, τs rises; the sign of the band's change is quantitative; q^S rises unambiguously. (iv) Both capitals follow their retention rules; with no injection the sector's equity rises by retained earnings each period and the fund's by its net income, so μ_t and s_t return to their steady-state values along a path whose speed is set by earnings, and by χ, χ^F where the injection thresholds are reached. Steady-state levels are those of Appendix C.10(vi).

The result on who pays for a crisis of Section 4.3. Workers' consumption in the crisis period is $C^W_t = (M^W_{t-1} + I^W_t D^W_{t-1})/P_t + \text{Tr}^W_t$ with $\text{Tr}^W_t = -(\bar{W}\bar{H}/\bar{Y})J_t$; the nominal balances are predetermined, P_t falls with credit by Proposition 4, and the tax is the labour share of the outlay. The real wage bill $W_t H_t$ falls with the loans made. Capitalists' Y^K_t carries the intermediaries' losses, the issuance costs, the dividends of defaulting projects and $-(1 - \bar{W}\bar{H}/\bar{Y})J_t$; their forced balance is the rental bill, which falls with credit, and the nominal loans their intermediaries hold lose real value as P falls, which raises defaults (the revaluation of nominal loans by an unanticipated fall in the price level). Across steady states J is the steady-state outlay, already in the taxes, and the price path is θ.

C.12 Walras's law

Summing the budgets of workers (with the tax), capitalists (B.4), the firm sector's settlement flows (revenue to debt service, resolution loss and dividends), the banks' settlement identity with the payout, issuance and failure accounting, the fund's with its payout, injection and the carry on Z, the deposit-insurance payment and the government's budget, together with the currency identity: deposit interest, facility interest, the transfer, the taxes and the outlay, fees, tranche payments and collateral interest, loan repayments and the fund-loan carry, wages and rentals all cancel, and

the issuance costs, operating costs and the resolution loss remain as uses of goods, leaving the goods-clearing condition of Section B.8, imposed numerically as a check.

D Additional results

Table 7: Recalibrated sensitivities (each run hits the seven targets)

Run	Change	η	$\bar{\nu}$	ξ^f	Failures (per year)	ROE	Coll. spread (pp)
Baseline	—	12.16	1.00064	129	2×10^{-12}	20.2%	3.55
Low dispersion	$\sigma_b = 0.37$	12.13	1.00000	129	0	20.2%	3.56
High dispersion	$\sigma_b = 1.07$	12.24	1.00185	129	8×10^{-7}	20.2%	3.49
Low issuance cost	$\chi = 0.0315$	12.15	1.00038	132	2×10^{-12}	20.2%	3.55
High issuance cost	$\chi = 0.12$	12.20	1.00144	122	4×10^{-12}	20.2%	3.56
One-period contracts	$\gamma_X = 0$	12.16	1.00064	134	2×10^{-12}	20.2%	3.56
No resolution loss	$\zeta = 0$	6.74	1.00000	1544	0	27.6%	2.16