Banks and Non-Banks: Competitors in loans origination, partners in regulatory arbitrage

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Abstract

This paper studies how interactions between banks and non-banks can exacerbate regulatory arbitrage and affect competition in the loan market. I develop a two-stage game in which a bank and a non-bank first compete for loan origination and then contract on the performance of the resulting portfolios. The bank differs from the non-bank as it can issue government-insured deposits and is subject to capital requirements. Capital requirements are proportional to expected losses and apply to individual exposures, while the deposit guarantee operates at the balance-sheet level. This regulatory asymmetry creates arbitrage opportunities. The optimal contract reallocates cash flows away from states in which the rest of the balance sheet performs poorly towards states in which it performs well. I show that contracts such as Synthetic Risk Transfers (SRT), which appear to offload risk from the banking sector, can instead increase the value of the implicit subsidy from the deposit guarantee. Finally, I show that the optimal contract can expand credit supply, though at the cost of greater rent extraction.

Keywords: Non-Banks Financial Institutions, Financial Innovation, Bank Regulation

1 Introduction

Non-bank financial intermediaries are increasingly important players in credit markets. Non-banks include a wide variety of institutions such as private credit funds, pension funds and insurance companies. Unlike

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banks, they face lighter regulation and lack access to public guarantees such as deposit insurance, yet they perform similar functions, including credit intermediation. Although often portrayed as competitors to banks[1], their growing ties with the banking sector suggest a more complex relationship. Non-banks frequently interact with banks through transactions that range from simple asset sales to more complex arrangements.

Synthetic Risk Transfers (SRT) provide a useful example of an interaction between a bank and a non-bank. In an SRT, a bank pays a fee to a counterparty, typically a pension fund or a private credit fund, in exchange for protection against losses on a specific portfolio. This credit protection provides the bank with regulatory capital relief, as losses are contractually shifted to the counterparty. While the IMF (2024) questions whether these transfers genuinely make banks safer, practitioners argue that they support credit growth through the capital reliefs.

This paper models banks and non-banks as both competitors and partners. Partnerships take the form of contracts that reallocate cash flows and risk. These contracts increase credit supply, but they do so by extracting more rents from the deposit guarantee. Contrary to common wisdom, even contracts that appear to reduce banks' risk positions, such as SRTs, can still increase this implicit subsidy.

To capture this dual dynamic of competition and partnership, I develop a two-stage game. In the first stage, a bank and a non-bank compete for loan origination. In the second stage, they contract on the performance of the resulting portfolios to maximize joint profits.

In the contracting stage, the initial question is whether gains from trade exist. In a Modigliani & Miller (1958) world contracts would be irrelevant; they would simply reallocate cashflows without creating value. The presence of a deposit guarantee, however, generates a deviation from this benchmark. Deposits are the cheapest source of funding because the guarantee absorbs downside risk, and depositors do not require compensation for the risk of default. Bank profits can therefore be expressed as the net present value of asset cashflows plus the implicit subsidy from the deposit guarantee (Merton, 1977). Capital requirements are introduced with the objective of limiting bank's reliance on deposit and thereby reducing the size of the subsidy.

To illustrate a simple form of regulatory arbitrage, suppose the bank can choose among assets with the same expected return but different volatilities. If capital requirements do not adjust to risk, the bank will always select the most volatile asset, since downside losses are absorbed by the guarantee and higher volatility maximizes the value of the implicit subsidy (Kareken & Wallace, 1978). In this setting, gains from trade emerge: the bank and the non-bank can design contracts that further amplify the volatility of cashflows

[1] According to Morgan Stanley and Oliver Wyman (2024), banks risk losing 8–11% of their credit intermediation revenues because of competition from private credit funds.

accruing to the bank and extract rents from the deposit guarantee (Malherbe & McMahon, 2024).

In practice, capital requirements are risk-based, so banks face a trade-off between higher volatility and higher capital charges. While real-world regulation is complex, to capture this risk-adjustment mechanism in a tractable way, I assume a simple rule: capital requirements are proportional to the expected losses of the associated exposure. Importantly, this rule preserves one essential regulatory feature: capital requirements are set at the level of individual exposures, while the deposit guarantee acts as a put option on the entire balance sheet. This asymmetry creates potential gains from contracting. The banks hold other assets beyond the portfolio underlying a given contract. The optimal contract reallocates cashflows across states of the world to maximize the value of the implicit subsidy. Specifically, it shifts cashflows away from states in which the rest of the balance sheet performs poorly and toward states in which it performs well, taking into account how capital requirements adjust to this reallocation.

To shed light on the key mechanisms, I first present a simplified version of the model in which the contract space is restricted to synthetic risk transfers (SRTs). An SRT, when considered in isolation, appears to shift risk away from the banking sector, however, it may increase rather than reduce the value extracted from the deposit guarantee. The intuition is that the insurance payout is tied to the performance of the SRT underlying portfolio, while the associated capital relief reduces the equity buffer available for losses on other assets. I then extend the analysis by allowing full flexibility in the contract space. In this more general setting, contracts can specify not only the allocation of cash flows generated by the underlying portfolios but also the creation of derivative instruments.

Because contracts can reshape payoffs ex post, they alter the incentives faced by banks and non-banks when they compete for loan origination. In the first stage, they compete in a Cournot fashion. In the Modigliani-Miller (MM) benchmark, without the deposit guarantee, each agent maximizes the net present value of loans given the competitor's quantity. With the guarantee, however, bank profits also include the implicit subsidy. The bank chooses its optimal loan supply, with the subsidy generating a wedge between the MM quantity and the quantity actually chosen. Consider first the case in which the bank and the non-bank cannot contract. When the bank has no other exposures, the wedge is always positive, so the bank over-lends relative to the NPV benchmark (Kareken & Wallace, 1978). With other risks already on the balance sheet, the sign of the wedge becomes ambiguous (Bahaj & Malherbe, 2020): if the marginal loan pays off in default states, the cashflows accrue to taxpayers and the bank may under-lend. However, if the bank and the non-bank can contract, the logic changes again. By shifting cashflows away from default states, contracts make the wedge unambiguously positive, restoring the incentive to expand lending. The welfare implications are mixed. On the one hand, contracting induces banks to expand credit supply, which mitigates inefficiencies associated

with imperfect competition, albeit excessive expansion incentives may also result in the financing of negative-NPV loans. On the other hand, the expansion is driven by banks' incentives to extract greater value from the deposit guarantee. As a result, borrowers may benefit from increased credit availability and improved lending terms, at the cost of a larger implicit subsidy ultimately borne by taxpayers.

Beyond its theoretical contributions, the model also serves as a flexible framework to analyze and compare existing contracting practices. While the optimal contract provides a useful benchmark for understanding how regulatory arbitrage shapes financial innovation, banks in reality choose from a menu of standardized contracts. In Section 5.2**,** I compare the extent of rent extraction under existing contracts to that implied by the optimal benchmark, across different characteristics of banks' asset portfolios.

The insights of the model carry policy implications. Contracts between banks and non-banks can exacerbate the limitations of Pillar 2 capital requirements and stress-testing frameworks. Section 6 discusses how these tools fail to capture the build-up of concentrated risks through financial linkages and contractual design.

This paper contributes to the literature on how financial innovation can be designed to extract rents through regulatory arbitrage. Korinek (2016) develops a model in which bailouts arise endogenously and shows that banks can use financial innovation to amplify the distortions created by such bailouts. Malherbe & McMahon (2024) show that financial innovation exacerbates the over-investment incentives generated by deposit insurance. My model shares with these contributions the central insight that banks seek to concentrate losses in states of the world where they benefit from implicit or explicit guarantees. However, it introduces two key innovations. First, it extends the analysis by incorporating both endogenous, risk-based capital requirements and legacy assets. These elements together allow the model to capture an overlooked form of regulatory arbitrage: capital requirements apply at the level of individual exposures, while deposit insurance operates at the level of the balance sheet. This disconnect allows banks to extract a larger implicit subsidy even when they reduce the riskiness of part of their cashflows. Second, the paper embeds financial innovation within the broader context of the relationship between banks and non-banks. The paper also relates to Harris *et al.* (2024), who predict that banks optimally specialize in assets that exhibit correlated tail risk. While their paper provides an important benchmark, my paper introduces a different dimension: the trade-off between specialization and market power. In principle, a bank weighs the benefit of concentrating exposures- thereby increasing the value of the deposit guarantee- against the declining NPV of loans as lending expands beyond the optimal level. Moreover, while Harris *et al.* (2024) in non-banks only reduce the bank's attainable NPV, in my framework non-banks also actively facilitate rent extraction.

The literature shows that financial innovation allows banks to expand lending but often by exploiting regulatory loopholes or creating fragility. Gennaioli *et al.* (2013) highlight how securitization reduces idiosyncratic

risk but increases exposure to systematic shocks. Also Shin (2009) provides evidence that securitization enabled banks to expand their balance sheets prior to the global financial crisis, thereby amplifying systemic risk. My mechanism similarly produces balance sheet expansion, but it arises primarily from rent extraction from deposit guarantees, not from general equilibrium amplification. Empirical studies also show that financial innovation can give rise to regulatory arbitrage. Acharya *et al.* (2013) demonstrate that securitization can deliver capital relief without transferring risk to outside investors, Fuster & Vickery (2018) find that banks facing capital pressures reclassify long-duration securities as held to maturity, shielding capital ratios from mark-to-market volatility without reducing underlying exposures. Fuster *et al.* (2024) document that banks strategically avoid realizing losses on underwater securities to protect regulatory capital, even at the cost of muted risk management.

The paper also contributes to the growing literature on the interaction between banks and non-banks. Acharya *et al.* (2024) emphasize the deep interconnections between the two sectors, showing how the presence of non-banks enables banks to reshape their business models. Related theoretical work models this relationship through (Donaldson *et al.*, 2021), adverse selection and screening advantages (Hu & Zryumov, 2025) or liquidity dependence on banks (Farhi & Tirole, 2021). Cetorelli *et al.* (2025) provide a model-based survey that unifies existing theoretical frameworks on the coexistence of banks and non-banks through a functional lens of financial intermediation.

Empirical contributions highlight differences in funding costs: banks benefit from deposits and guarantees (Sarto & Wang, 2025; Jiang *et al.*, 2024), while non-banks face lighter regulation (Buchak *et al.*, 2018; Irani *et al.*, 2021; Chernenko *et al.*, 2025). These differences are reflected in competition for mortgages (Buchak *et al.*, 2018; Sarto & Wang, 2025) and corporate borrowing (Chernenko *et al.*, 2025; Bednarek *et al.*, 2025; BIS, 2025). Evidence also shows that banks fund their non-bank competitors: Jiang (2023) finds that banks provide credit lines to non-banks, internalizing their downstream competition; Chernenko *et al.* (2025) show that banks may prefer to lend to non-banks rather than to middle-market firms because of lower capital requirements and servicing costs.

Overall, the paper shows how contractual relationships between banks and non-banks expand the scope of regulatory arbitrage. By characterizing optimal contracts and credit supply in a setting with risk-based capital requirements, deposit guarantees, and legacy exposures, the model provides a tractable framework that models non-banks both as competitors and as strategic partners. The paper also clarifies the welfare trade-off whereby larger credit provision comes at the cost of a higher implicit subsidy ultimately borne by taxpayers.

2 Model setup

2.1 Players and timeline

The players are a bank i and a non-bank j, let $\mathcal{P} = \{i, j\}$ denote the set of players, and let p be a generic element of $\mathcal{P}$. Assume that all agents are risk-neutral and the gross risk-free R_f rate is normalized to 1, information is symmetric. Only the bank can issue insured deposits and are subject to capital requirements. Capital requirements are risk-based, in particular, I assume that if a bank holds an asset that returns $K \sim F_K$, with support $[\underline{K}, \bar{K}]$, the required capital ratio is given by:

$$\gamma_K = \min \left\{ \xi \int_{\underline{K}}^{1} (1 - K) dF_K(K), 1 \right\} \tag{1}$$

where $\xi > 0$ controls the stringency of capital requirements. Capital requirements are designed such that required capital is proportional to expected losses: an asset is in the loss region when the return is lower than 1, and $1 - K$ is the loss given default. I set $\xi = 1$, see the Appendix B for comparative statics on ξ. While real-world regulation is more complex, this rule captures its essence: each exposure has an associated capital requirement, losses are measured relative to book value, and more volatile cash flows entail higher capital charges. Crucially, this formulation allows us to map any distribution of cash flows into a corresponding capital requirement. This feature is key, as the bank and the non-bank can design contracts that determine the distribution of cash flows accruing to the bank. Alternatively, one could specify a capital relief (or top-up) rule based on the difference in expected losses implied by the original portfolio and by the contractual redistribution of cash flows.

I assume that the bank is funded exclusively through insured deposits and regulatory capital. Thanks to the deposit guarantee, the bank does not internalize the full cost of deposits, and therefore capital requirements are binding[2]. The non-bank, instead, is fully equity-funded. This assumption allows me to isolate the mechanism driven by regulatory arbitrage from other forms of agency frictions[3].

The model is formulated as a two-stage game that unfolds over three dates, $t = 0, 1, 2$. The bank is a going concern and therefore holds existing asset on its balance sheet at $t = 0$[4]. Specifically, the bank holds y units of assets yielding a stochastic return $A \sim F_A$, with support $\mathcal{A} = [\underline{A}, \bar{A}]$. Let γ_A denote the capital

[2] Provided that the bank's probability of default is larger than zero.

[3] Jiang (2023) shows that when banks finance non-banks they account for the downstream competition in the loan market. Chernenko *et al.* (2025) finds that banks prefer to lend to non-banks rather than to middle market firms because of lighter capital requirements. While this model will not be able to capture the effect non-bank financing on competition, it will be able to reallocate cashflows ex-post and mimic a debt contract between the bank and the non-bank and capture the different capital treatment.

[4] Because the non-bank is fully financed by equity, the presence of other assets on its balance sheet is irrelevant.

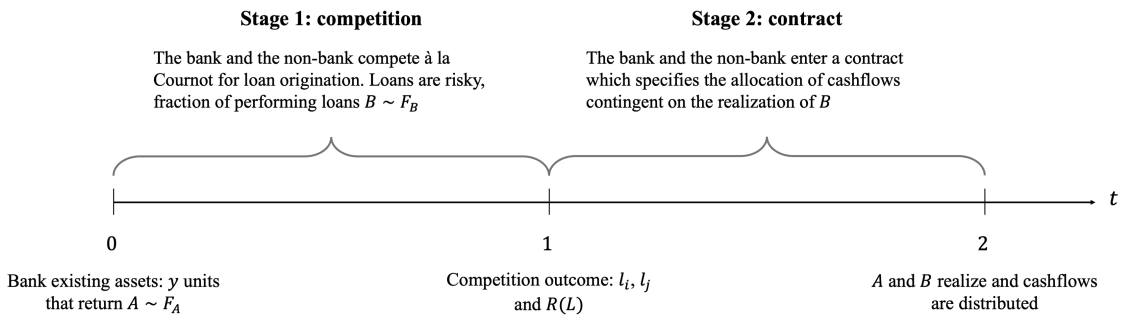


Figure 1: Timeline

requirement associated with the existing assets[5]. Between $t = 0$ and $t = 1$ (Stage 1), the bank and the non-bank compete for loan origination in a Cournot fashion. They face an exogenous loan demand and choose a quantity $l_p \in \mathbb{R}_+$ taking the opponent's quantity as given. Let $R(L)$ denote the inverse demand, which maps total loan issued $L = l_i + l_j$ to the gross loan interest rate. Loans are risky and the fraction of performing loans is governed by the random variable $B \sim F_B$, with support $\mathcal{B} = [0, 1]$. Let γ_B be the capital requirement associated with the newly issued loans which is computed according to (1). Finally, let $F(A, B)$ denote the joint distribution function of A and B. After the competition outcome is determined, in Stage 2, the bank and the non-bank can enter a contract which specifies the allocation of cashflows contingent on the realization of B. At $t = 2$, A and B realize and cashflows are distributed. The timeline of the game is summarized in Figure 1.

2.2 Contract space

We can classify contracts into two broad categories. The first category comprises revenues-allocation contracts, in which the bank and the non-bank agree on how to divide the cashflows generated by the previously originated loans. Examples include loan sales, collateralized loan obligations (CLO), and mortgage-backed securities (MBS). The second category consists of derivative contracts, where the parties agree to split a fixed amount of cash contingent on the performance of the underlying portfolios. These include instruments such as credit default swaps (CDS), credit linked notes and synthetic securitization (SRT). The model accommodates both types of structure.

In the case of derivative contracts, the parties must commit an upfront amount of cash $c \in \mathbb{R}_+$ that is

[5]It is not relevant for the results of the model whether γ_A is an exogenous parameter or it is calibrated according to the capital requirement rule 1.

subsequently redistributed based on the realization of B. This feature captures a real-world constraint: for instance, in SRTs, if protection is not funded ex-ante, the transaction does not qualify for capital relief. The bank and the non-bank set up a Special Purpose Vehicle (SPV), which holds on its balance sheet the previously originated loans and, possibly, the cash which returns the risk-free rate. A contract specifies how the SPV's cashflows are allocated conditional on B.

Importantly, contracts cannot be written contingent on the realization of A. This reflects two realistic constraints. First, the bank's balance sheet is complex and opaque, making it reasonable to assume that A is not verifiable by the non-bank. Second, regulatory frameworks often require that certain assets remain on the bank's balance sheet or restrict contracting on specific loan types. For example, under standard securitization frameworks, true-sale treatment requires the bank to relinquish control over securitized assets. Therefore, when control must be retained—for instance, to preserve relationship-lending or monitoring incentives—the bank cannot securitize the loans.

The creation of the SPV ensures that the non-bank's payoff depends solely on B: if the assets were held directly on the bank's balance sheet, depositors would have seniority over the non-bank, and its payoff would therefore depend on the realization of A.

Formally, a contract is denoted by

$$\theta = \{x_p, \kappa_p(B), \tau_p \text{ for } p = i, j\}$$

where x_p is the exposure of the party p, $\kappa_p(B)$ is the return on the exposure, and τ_p represents the advance payments made before the realization of cashflows. It is important that the allocation of cashflows is expressed as the product of the exposure to compute as capital requirements are expressed as a fraction of the exposure. Let γ_θ be the capital requirement associated with the contract.

The feasibility and the participation constraints delimit the contract space. A contract is feasible if :

$$\begin{aligned}
&(FC_1) \quad \tau_i + \tau_j = c \\
&(FC_2) \quad \kappa_i(B)x_i + \kappa_j(B)x_j = BR(L) + c \quad \forall B \\
&(FC_3) \quad x_i + x_j = L + c
\end{aligned}$$

First, the total upfront payments must sum to the committed amount of cash (FC_1). Second, the total state-contingent payoffs must match the available resources in every state of the world (FC_2). Third, the sum of contractual exposures must equal the original loan exposure plus the cash committed to the derivative

instrument (FC_3), or in other words, the bank and the non-bank can increase the sum of their exposures only by creating derivative instruments.

A contract is said to be implementable if both parties are willing to participate. The participation constraints ensure that the bank and the non-bank are at least as well off as they are without the contract. Bank's profits without the contract are given by:

$$\int_{\Delta^C} \left[Ay + BR(L)l_i - (1-\gamma_A)y - (1-\gamma_B)l_i\right] dF(A,B) - \gamma_A y - \gamma_B l_i$$

where $\Delta = \{(A,B) : (1-\gamma_A)y + (1-\gamma_B)l_i \geq Ay + BR(L)l_i\}$ is the default region and Δ^C is its complement. Following Merton (1977), bank profits can be expressed as the sum of the NPV generated by the assets and the implicit subsidy generated by the deposit guarantee :

$$\pi_i = \underbrace{(E[A]-1)y + (E[B]R(L)-1)l_i}_{\text{NPV}} + \underbrace{\int_{\Delta} Z(A,B)dF(A,B)}_{\text{implicit subsidy}}$$

where $Z(A,B) = (1-\gamma_A)y + (1-\gamma_B)l_i - Ay - BR(L)l_i$ is the shortfall. Normalize $E[A] = 1$ to make notation compact. Under the contract, bank's profits are given by:

$$\pi_i^\theta = E[\kappa_i(B)]x_i - (l_i + \tau_i) + \int_{\Delta_\theta} Z_\theta(A,B)dF(A,B)$$

where $Z_\theta(A,B) = (1-\gamma_A)y + (1-\gamma_\theta)x_i - Ay - \kappa_i(B)x_i$ and $\Delta_\theta = \{(A,B) : Z_\theta(A,B) \geq 0\}$. The bank changes its expected revenues from $E[B]R(L)l_i$ to $E[\kappa_i(B)]x_i$ by entering the contract and paying τ_i Note τ_i that is funded through a mix of capital and deposits such that the capital requirement γ_θ binds. The subsidy under the contract reflects the new cashflows and the new capital requirement. Therefore the bank's participation constraint is given by:

$$(PC_i) \qquad E[\kappa_i(B)]x_i + W_\theta - \tau_i \geq E[B]R(L)l_i$$

where

$$W_\theta = \int_{\Delta_\theta} Z_\theta(A,B)dF(A,B) - \int_{\Delta} Z(A,B)dF(A,B)$$

is the change in the expected subsidy. Re-arranging the equation, this means that the maximum that the

bank is willing to pay[6] is equal to the increase in expected revenues plus the change in expected subsidy. While for the non-bank only the NPV matters:

$$\pi_j = (E[B]R(L) - 1)\, l_j$$
$$\pi_j^\theta = E[\kappa_j(B)]x_j - \tau_j - l_j$$

Hence, its participation constraint is equal to:

$$(PC_j) \qquad E[\kappa_j(B)]x_j - \tau_j \geq E[B]R(L)l_j$$

which means that the non-bank is willing to pay at most the increase in its expected revenues.
Let Θ be the set of feasible and implementable contracts. Define the null contract $o \in \Theta$ as the contract such $c = 0$, $\kappa_p(B) = BR(L)$, $x_p = l_p$ and $\tau_p = 0$ for $p \in \{i, j\}$, which is equivalent to not entering any contract and getting the outside option.

2.3 Equilibrium Concept

Definition. A contract $\theta \in \Theta$ is optimal if it maximises the joint profits:

$$\theta \in \arg\max_{\theta \in \Theta} \pi_i^\theta + \pi_j^\theta$$

Note that by substituting the feasibility constraints into the joint profit objective function the optimization problem becomes:

$$\max_{\theta \in \Theta} (E[B]R(L) - 1)\, L + \int_{\Delta_\theta} Z_\theta(A, B) dF(A, B)$$
$$\text{s.t. } \gamma_\theta = \int_{\mathcal{L}_\theta} (1 - \kappa_i(B)) dF_B(B)$$
$$\text{feasibility constraints}$$
$$\text{participation constraints}$$

The first term of the objective function is the NPV of total loans which cannot be affected by the contract. This is a consequence of Modigliani-Miller theorem: a contract is a reallocation of cashflows and cannot create value. The objective function therefore boils down to the expected value of the implicit subsidy. The design

[6] or the minimum the bank need to receive in case $\tau_i < 0$.

of the optimal contract can be seen as a three player game: the bank, the non-bank and the government. The bank and the non-bank are the contracting parties and impose their participation constraints. The government does not participate in the contract but imposes the capital requirement rule. Therefore, the optimal contract maximises the resources that the financial sector can extract from taxpayers taking the capital requirement rule as given. Following this intuition, I now show that the contract θ^* that maximises the subsidy subject to the capital requirement rule can always be implemented. By substituting the feasibility constraints into the participation constraints can be re-written as:

$$\begin{aligned} (PC_i) \qquad & \tau_i \leq E[\kappa_i(B)]x_i - E[B]R(L)l_i + W_\theta \equiv \bar{\tau} \\ (PC_j) \qquad & \tau_i \geq E[\kappa_i(B)]x_i - E[B]R(L)l_i \equiv \underline{\tau} \end{aligned}$$

Evaluated at θ^*, it must be that $W_{\theta^*} \geq 0$ because the null contract is in the set of feasible and implementable contracts. Therefore for any $\tau_i \in [\underline{\tau}, \bar{\tau}]$, the participation constraints are respected. I impose that τ_i is pinned down by a parameter $\alpha \in [0, 1]$ which represent the bank's bargaining power, specifically:

$$\tau_i = \alpha\underline{\tau} + (1 - \alpha)\bar{\tau}$$

when $\alpha = 1$, the bank has full bargaining power and the non-bank participation constraint binds; conversely, when $\alpha = 0$, all the bargaining power rests with the non-bank. Note that the bargaining power does not affect the amount of rents that are extracted by the deposits guarantee, but only how those are split. Therefore, α does not affect the design of the returns $\kappa(\cdot)$'s or of the exposures x's; however, it does affect the competition stage.

In stage 1, the bank and the non-bank compete in a Cournot fashion anticipating that they are going to implement the optimal contract and that rents are going to be split according to the bargaining power. The bank choose l_i to maximize:

$$\pi_i^{\theta^*}(l_i, l_j) = E[\kappa_i^*(B)]x_i^* - \tau_i^* - l_i + \int_{\Delta_\theta^*} Z_\theta^*(A, B)dF(A, B)$$

by substituting τ_i^*

$$\pi_i^{\theta^*}(l_i, l_j) = (E[B]R(L) - 1)\, l_i + (1 - \alpha)\int_{\Delta} Z(A, B)dF(A, B) + \alpha\int_{\Delta_\theta^*} Z_\theta^*(A, B)dF(A, B)$$

This objective function shows that the bank maximizes the sum of three components: NPV from lending,

the value of its outside option (weighted by $1-\alpha$), and the surplus generated under the optimal contract (weighted by α). The weights reflect the bargaining power of the bank: the larger α, the more the bank benefits from the surplus generated by the contract; the smaller α, the more it relies on the value of its outside option.

Following the same steps for the non-bank:

$$\pi_j^{\theta^*}(l_i, l_j) = (E[B]R(L) - 1)\, l_j + (1-\alpha)W_\theta^*$$

The non-bank internalizes in its objective function the the share of the rents that it is going to get through the contract.

Definition. A tuple $(\theta^*(l_i, l_j, \alpha), l_i^*, l_j^*)$ is an equilibrium of the game if

- θ^* is optimal for every $(l_i, l_j) \in \mathbb{R}_+^2$ and τ_i^* is pinned down by α
- The bank and the non-bank choose l_i^* and l_j^* to maximize their own profits taking the other's quantity as given:

$$l_i^* = \arg\max_{l_i \in \mathbb{R}_+} \pi_i^{\theta^*}(l_i, l_j^*)$$
$$l_j^* = \arg\max_{l_j \in \mathbb{R}_+} \pi_j^{\theta^*}(l_i^*, l_j)$$

  where $\pi_p^{\theta^*}$ are the profits of player $p \in \{i, j\}$ when the contract $\theta^*(l_i, l_j)$ is implemented.

To study the effect of the optimal contract on competition and credit supply I will compare the equilibrium quantities (l_i^*, l_j^*) to a benchmark in which the bank and the non-bank only compete ($\Theta = o$). In order to make the comparison meaningful I make assumptions such that the equilibrium exists and it is unique.

Definition. A tuple (o, l_i^o, l_j^o) is the equilibrium of the game under the restriction $\Theta = o$.

In the following sections, I set $\alpha = 1$. In Section 5.1 , I relax the assumption and show the results for any $\alpha \in [0, 1]$.

3 Restricted Contract Space: Synthetic Risk Transfers

Before turning to the general model, I present a simplified version in which the contract space is restricted to synthetic risk transfers (SRT). As in the general model, the bank and the non-bank first compete for loans and then enter a contract.

In an SRT, the bank pays a fee to the non-bank in exchange for protection against credit losses on a loan portfolio, up to a maximum amount. To qualify for capital relief, the SRT must be funded, meaning that the non-bank deposits in advance the maximum amount of protection into an SRT vehicle. In this setting, designing the optimal contract simply consists of choosing the optimal maximum amount of insurance. Any unused funds are returned to the non-bank.

In the model's notation, the contract $\theta = \text{SRT}$ denotes a synthetic risk transfer. The bank's exposure is given by $x_i = l_i$, and the cash deposited in the SRT vehicle is $c \in [0, l_i]$. When $c = 0$, there is no insurance; when $c = l_i$ there is full insurance.

The bank return is given by

$$\kappa_i(B) = BR(L) + I(B)$$

where $I(B)$ is the insurance payout per unit of exposure:

$$I(B) = \begin{cases} 0 & \text{if } B \geq 1/R(L) \\ 1 - BR(L) & \text{if } \tilde{B} < B < 1/R(L) \\ c/l_i & \text{if } B \leq \tilde{B} \end{cases}$$

where $\tilde{B}$ is the threshold level of portfolio performance such that $(1 - \tilde{B}R(L))l_i = c$; that is, $\tilde{B}$ defines the lower bound of insurance coverage.

The new capital requirement is given by:

$$\begin{aligned} \gamma_{SRT} &= \int_{\mathcal{L}_{SRT}} (1 - BR(L) - I(B))dF(B) \\ &= \gamma_B - E[I(B)] \end{aligned}$$

The capital relief is equal to the expected value of the insurance payments as these absorb part of the portfolio losses.

Bank's profits under the SRT are given by:

$$\pi_i^{SRT} = \underbrace{(E[B]R(L) - 1)\, l_i}_{\text{NPV loans}} + \underbrace{E[I(B)]l_i - \tau_i}_{\text{NPV SRT}} + \underbrace{\int_{\Delta_{SRT}} Z_{SRT}(A, B)dF(A, B)}_{\text{subsidy}}$$

The non-bank exposure is equal to $x_j = l_j + c$. Beyond its portfolio, the non-bank deposits c in the SRT

vehicle, which it recovers in $t = 2$ net of the insurance payments. Formally:

$$\kappa_j(B)x_j = BR(L)l_j + c - I(B)l_i$$

The non-bank profits are therefore:

$$\pi_j^{SRT} = \underbrace{(E[B]R(L) - 1)\, l_j}_{\text{NPV loans}} + \underbrace{\tau_i - E[I(B)]l_i}_{\text{NPV SRT}}$$

From the non-bank perspective the initial investment is the cash deposited in advance net of the fee τ_i received. The assumption of bank's full bargaining power implies that the SRT is paid at its actuarially fair value $\tau_i = E[I(B)]$. The optimal SRT is designed by picking the optimal c that maximises the joint profits:

$$\max_{c\in[0,l_i]} (E[B]R(L) - 1)\, L + \int_{\Delta_{SRT}} Z_{SRT}(A, B)dF(A, B)$$
$$\text{such that } \gamma_{SRT} = \gamma_B - E[I(B)]$$

The SRT cannot change the NPV of total loans hence the first term of the objective function is not affected by c. Note that a global maximum always exists as the objective function is a continuous function of c and it is defined over a compact set. For the sake of this application assume that $F(A, B)$ is continuous and differentiable in both arguments and restrict the attention to the cases in which the maximum is interior. The global maximum is characterized by the first order condition:

$$-\Pr\left(\Delta_{SRT} \cap \{B \leq \tilde{B}\}\right) + \Pr\left(\Delta_{SRT}\right)\Pr\left(B \leq \tilde{B}\right) = 0$$

The sign of the LHS depends on the statistical association[7] of the two events $\{\Delta_{SRT}\}$ and $\{B \leq \tilde{B}\}$. If the bank is more likely to default when $B \leq \tilde{B}$, the events are positively associated, the maximum insurance coverage c^* is lower . Conversely, if the events are negatively associated, the bank will choose a higher coverage. Note that these two events do not necessarily overlap because banks has other assets on its balance sheet. The intuition is the following: the key trade-off is that a higher insurance coverage will lead to lower capital requirements which increase the value of the implicit subsidy; on the other hand if the insurance pays out in the states of the world in which the bank defaults, then the insurance payments accrue to tax-payers and decrease the value of the deposit insurance. If the events $\{B \leq \tilde{B}\}$ and Δ_{SRT} are

[7]Two events E_1 and E_2 are statistically associated if $\Pr(E_1 \cap E_2) \neq \Pr(E_1)\Pr(E_2)$. In particular, two events are positively associated if $\Pr(E_1 \cap E_2) > \Pr(E_1)\Pr(E_2)$, that is, when one event happens, the other is more likely to happen; two events are negatively associated when $\Pr(E_1 \cap E_2) < \Pr(E_1)\Pr(E_2)$, that is, when one event happens the other is less likely to happen.

positively associated then the insurance payments ultimately accrue to tax-payers and the capital relief is not sufficient to offset this force. On the other hand if the two events are negatively associated then most of the insurance payments accrue to the bank and the capital relief increases the subsidy. This application illustrates that even when banks use contracts that appear to transfer risk outside the banking system, they do not necessarily become safer. On the contrary, such contracts may be designed to extract greater rents from the deposit guarantee. The extent of rent extraction depends critically on the joint distribution of returns and the structure of capital regulation.

As the SRT fee is set at its actuarially fair value, the non-bank's objective function remains unchanged relative to the no SRT scenario. By contrast, the bank's objective function under the SRT contract becomes:

$$\max_{l_i \in \mathbb{R}_+} \left(E[B]R(L) - 1\right) l_i + \int_{\Delta^*_{SRT}} Z^*_{SRT}(A,B) dF(A,B)$$

The contract reshapes the default area: it changes both the set of states of the world in which the bank defaults and the size of the shortfall between deposits and cashflows in those states. Figure 2, compares the bank's default regions with and without an SRT. The baseline default frontier (black line) reflects the capital requirement and the cashflows in the absence of the contract. Under the SRT (red dashed line), the capital requirement associated to the underlying portfolio is lower in all states of the world. In states with high loan performance, the insurance does not pay out, so the lower capital requirement alone expands the default region (red area). In states with low loan performance the insurance payout increases the bank's cashflows and more than offsets the lower capital requirement, allowing the bank to survive in states where it would otherwise default (green area).

To simplify the analysis consider γ_B an exogenous parameter. The shift of the bank's best response function is given by the difference in the marginal subsidies (with the SRT or not) and it is given by the sum of two components:

$$\begin{aligned} &\int_{\Delta_{SRT} \setminus \Delta} \left(1 - \gamma_B - B(R(L) + R'(L) l_i)\right) dF(A,B) \\ &+ \int_{\Delta_{SRT}} \left(E[I(B)] + \frac{E[I(B)]}{\partial l_i} l_i - I(B) - \frac{\partial I(B)}{\partial l_i} l_i \right) dF(A,B) \end{aligned}$$

The first term compares the sign of the marginal subsidy associated with the plain portfolio across the two default regions. The marginal subsidy is given by the additional unit of deposits minus the marginal revenues $B(R(L) + R'(L)l_i)$. Under the assumption that the inverse demand elasticity is lower than one, the marginal subsidy tends to be positive when B is low and negative when B is high. Since the SRT shifts defaults from

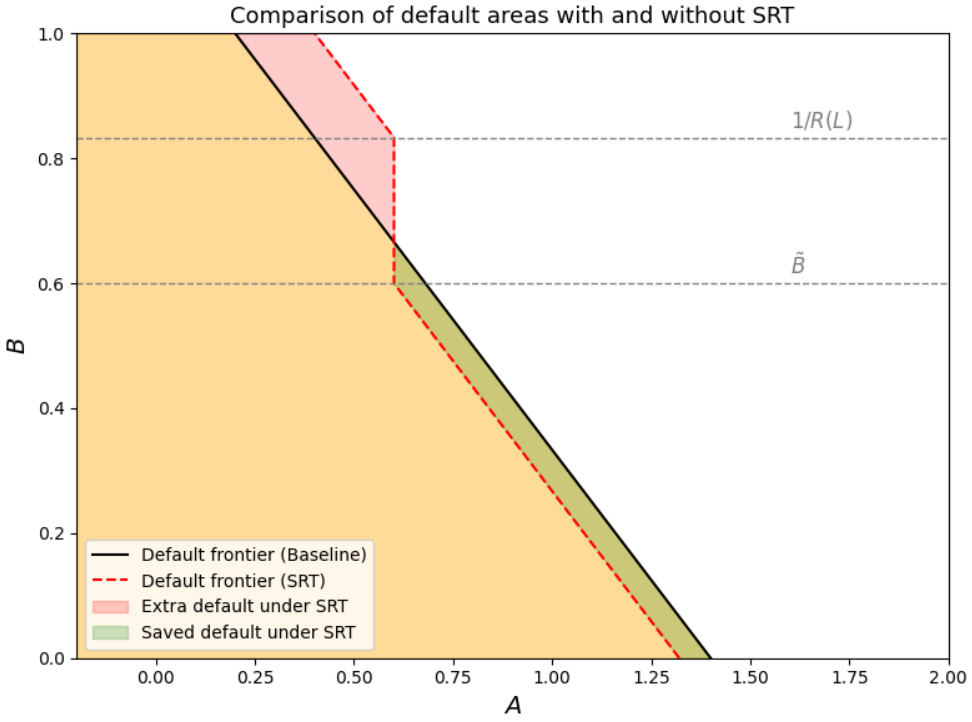


Figure 2: **Comparison of default areas with and without SRT.** The axes show the possible realizations of A (return of the rest of the balance sheet) and B (fraction of performing loans of the insured portfolio). The solid black line denotes the default frontier without the SRT: for all (A, B) below this line the bank defaults. The red dashed line denotes the default frontier with the SRT. The green region highlights the states in which the bank survives only when protected by the SRT, while the red region highlights the states in which the bank survives without the SRT (and therefore benefits from a lower capital requirement).

low-B regions to high-B regions, this term may be negative, although the overall sign also depends on the joint density $f(A, B)$. The second term captures effect of having the marginal loan covered by the SRT: it measures the difference between the marginal capital relief and the marginal insurance payout received in the SRT default area. On the one hand, the bank enjoys lower capital requirements; on the other, insurance payments in default states ultimately accrue to taxpayers. The sign is ambiguous. However, the insurance coverage is chosen optimally. As shown earlier, when insurance payments and defaults are positively associated, the optimal insurance coverage is low, so the magnitude of the second term is small. By contrast, when the insurance mainly pays out when the bank survives and the optimal coverage is high and the term is large and positive. As I will show in the general model, the impact of the contract on competition is limited when the optimal contract closely resembles the null contract (low insurance coverage in this case). Conversely, when the contract substantially alters state-contingent cashflows, it has a larger effect on competitive outcomes.

4 The General Model

4.1 Contracting Stage

I now allow the functional form of the contract to arise endogenously. In the contracting stage, the bank and the non-bank take as given the loan quantities issued in the competition stage l_i and l_j and the equilibrium interest rate $R(L)$. An optimal contract is a contract that maximises the joint surplus of the bank and the non-bank, subject to the feasibility and participation constraints. In Section 2, I have shown that the design of the optimal contract boils down to:

$$\begin{aligned} &\max_{\theta \in \Theta} \int_{\Delta_\theta} Z_\theta(A, B) dF(A, B) \\ &\text{s.t. } \gamma_\theta = \int_{\mathcal{L}_\theta} (1 - \kappa_i(B)) dF(B) \qquad \text{regulatory constraint} \end{aligned}$$

where $\mathcal{L}_\theta = \{B : \kappa_i(B) < 1\}$. The only relevant choice variables are $\kappa_i(B)$ and x_i, all other variables can be obtained through the feasibility and participation constraints.

Assumption 1. *$x_i \in [0, \bar{x}]$, where $\bar{x} = \psi l_i$.*

The objective function is convex in x_i (see Lemma 1). Therefore, I impose the constraint $x_i \leq \bar{x}$. This assumption prevents the bank to have an arbitrarily large exposure to loans' performance. While this assumption ensures technical tractability, it also reflects a reasonable constraint: since increasing exposure

requires creating a derivative instrument and committing cash at $t = 1$, it effectively places a cap on the amount of cash left idle.

Lemma 1. *The objective function is convex in x_i and, without loss of generality, $x_i^* = \bar{x}$.*

Proof. See Appendix □

The optimization problem reduces to find the optimal $\kappa_i(B)$ subject to the regulatory constraint.

Lemma 2. *An optimal function is in the set of functions: $\kappa_i : [0,1] \to \Delta\{0,1\}$.*

Proof. See Appendix for full proof. One necessary condition for optimality is that point-wise deviations must not be profitable: fix $\kappa_i(b) = k$, it must not be profitable to take a small deviation from k and keep the rest of the function unchanged**.** Formally for all $b \in \mathcal{B}$:

$$-\Pr(\Delta_\theta|b) + \Pr(\Delta_\theta)1\{k \leq 1\} \leq 0$$

The implicit subsidy is convex in k, hence the are three candidates points 0, 1 and $k \to +\infty$, i.e. the extremes of the domain and the kink. At $k = 1$ there is a kink because $k \gtrless 1$ determines whether or not a marginal increase in k affects the capital requirement. Why $k \to \infty$ is never strictly preferred? The reason is that whenever $k \geq 1$ there is no gain in increasing k as it does not lower the capital requirement but only increases the cashflows accruing to tax-payers. Recall that in terms of NPV the bank is perfectly compensated by the transfers τ. Also note that when $\Pr(\Delta_\theta|b) = 0$ the bank is indifferent between any $k \geq 1$. Hence the optimal function is in the class of functions $\kappa : [0,1] \to \Delta\{0,1\}$. As the conditional and unconditional probability of default depend also on γ_θ, hence the optimal contract must be a fixed point. Allowing a probability combination of $\{0,1\}$ insures the existence of a fixed point. □

Define

$$\phi(b,\gamma) = \int_{\underline{A}}^{A_0} ((1-\gamma_A)y + (1-\gamma)\bar{x} - Ay)\, dF(A|b) - \int_{\underline{A}}^{A_1} ((1-\gamma_A)y - \gamma\bar{x} - Ay)\, dF(A|b)$$

where $A_0 = (1-\gamma_A) + (1-\gamma)\bar{x}/y$ and $A_1 = (1-\gamma_A) - \gamma\bar{x}/y$. The function $\phi(b,\gamma)$ can be interpreted as a private profitability index: it measures the net gain for the bank from setting $\kappa_i(b) = 0$, rather than $\kappa_i(b) = 1$ in a given state $B = b$ for a fixed γ.

Proposition 1. *An optimal contract $\kappa_i^*(B)$ always exists and can be constructed through the following algorithm:*

1. Fix $\gamma \in [0,1]$

2. Compute the private profitability index $\phi(b,\gamma)$ for all $b \in [0,1]$

3. Rank states b according to the profitability index and set:

$$\kappa_i^{\gamma}(B) = \begin{cases} 0 & \textit{for the top measure-}\gamma\textit{ set of } b's \\ 1 & \textit{otherwise} \end{cases}$$

If necessary, allow randomization at the threshold to match the constraint

$$\int_0^1 (1 - \kappa_i(B)) dF(B) = \gamma$$

4. Optimize over $\gamma \in [0,1]$ to maximize the total surplus

Proof. See Appendix. □

Once γ is fixed, there is a budget constraint on the measure of the subset of B where $\kappa_i(B) = 0$. To maximize the implicit subsidy under this constraint, the bank should allocate $\kappa_i(B) = 0$ to the most profitable types, i.e. those with the highest profitability index $\phi(b,\gamma)$. An optimal $\kappa_i^{\gamma}(B)$, for each γ is an indicator function over the top-γ measure of types ranked by $\phi(B,\gamma)$[8]. Finally, we optimize over γ to select the contract that delivers the highest overall value.

4.2 Competition Stage

Assume that the bank and the non-bank compete in a Cournot fashion[9]Non- bank objective function is given by

$$\max_{l_j} \left(E[B] R(L) - 1 \right) l_j$$

which is the equivalent to a Cournot competition without the contract. The result arise from the assumption that the bank has all the bargaining power and therefore the non-bank is indifferent between entering the contract or not. In Section 4, I relax this assumption and allow for intermediate bargaining power.

[8]If the distribution places positive mass around the threshold, the threshold can be implemented via randomized selection. Concretely, assign $\kappa_i(B) = 0$ with probability p and $\kappa_i(B) = 1$ with probability $1 - p$, where p is chosen to ensure that $\Pr(\kappa_i(B) = 0) = \gamma$.

[9]Cournot competition is equivalent to a two-stage game, in which the bank first raises regulatory capital and the non-bank raises its funds, and second, they compete à la Bertrand in the loan market. One important assumption is that both the bank and the non-bank have to pay a sufficiently high premium to expand their (regulatory) capital in the second stage (Lattanzio, 2025).

Assumption 2. *Assume that $R(L)$ is continuous and differentiable in L. Also assume that $R'(L) < 0$ and $\eta(L) = -\frac{R'(L)L}{R(L)} < 1$ for all L.*

Bank objective function

$$\max_{l_i} E[\kappa_i^*(B)]x_i^* - \tau_i^* - l_i + \int_{\Delta_\theta^*} Z_\theta^*(A,B)dF(A,B)$$

s.t. feasibility constraints

participation constraints

which is equivalent to

$$\max_{l_i} \left(E[B]R(L) - 1\right) l_i + \int_{\Delta_\theta^*} Z_\theta^*(A,B)dF(A,B)$$

The difference between having a contract or not is only reflected in the subsidy.

Assumption 3. *Assume that $F(A|B)$ is atomless for every B.*

These assumption ensures that $\int_{\Delta_\theta^*} Z_\theta^*(A,B)dF(A,B)$ is differentiable with respect to l_i and that I can use the envelope theorem. Restrict the attention to cases in which $\gamma_\theta^* \in (0,1)$.

Assumption 4. *Assume that, under the null contract and under the optimal contract, the objective function of the bank is strictly concave in l_i.*

These assumptions that the Cournot equilibrium exists and is unique under both scenarios. The bank's best response function shifts with respect to the one with no contract. The size of the shift is given by the difference in the marginal subsidy

$$\underbrace{\psi \int_{\Delta_\theta^*} (1 - \gamma_\theta^* - \kappa_i^*(B))dF(A,B)}_{\text{marginal subsidy with contract}}$$

$$\underbrace{-\left(\int_{\Delta} \left[1 - \gamma_B - BR(L)\left(1 - \eta_i(L)\right)\right] dF(A,B) - \Pr(\Delta)\gamma_B'(L)\right)}_{\text{marginal subsidy without contract}}$$

where $\eta_i(L) = -R'(L)l_i/R(L)$ and $\gamma_B' = -\int_0^{1/R(L)} BR'(L)dF_B$. The sign of the shift is in principle ambiguous. The first term is the marginal subsidy with the contract which, by construction is positive. The second term is the marginal subsidy without the contract which can be decomposed into two other terms: the marginal shortfall and the capital adjustment. The latter term has an overall positive sign as $\gamma_B'(L) > 0$.

In Bahaj & Malherbe (2020) capital requirements are exogenous hence the marginal subsidy is given only by the first term, which has an ambiguous sign. If A and B are cashflow aligned, i.e. B is likely to be smaller than $1-\gamma_B$ when $A < 1-\gamma_A$, then the marginal shortfall is positive, whereas if A and B are not cashflow aligned, then it is negative. Hence, the size of the shift is larger when A and B are not cashflow aligned.

Figure 3 shows a useful example. Consider two cases: (i) the fraction of performing loans is governed by B or (ii) by $\tilde{B} = 1 - B$ is indifferent in terms of the optimal contract as the fundamentals of the problem are identical. Therefore the optimal return function is symmetric $\tilde{\kappa}_i^*(\tilde{B}) = \kappa_i^*(1-B)$ and the capital requirement equal $\tilde{\gamma}_\theta^* = \gamma_\theta^*$. In other words, considering the random variable B or $\tilde{B}$ is just a matter of re-labeling which does not change the primitive of the problem. Hence the marginal subsidy under the optimal contract is identical across the two cases (green line). The best-response function of the non-bank (orange line) is also fixed, reflecting the bank's full bargaining power. In contrast, the bank's best response without a contract differs across cases. I build $F(A, B)$ so that A and B are cashflow aligned. In case (i), the bank issues loans when the interest rate is sufficiently high, whereas in case (ii), it abstains from lending entirely, as associated cash flows would mainly accrue to taxpayers. This example shows that when cashflows are not ex-ante aligned the contract plays an important role in terms of bank's lending decisions.

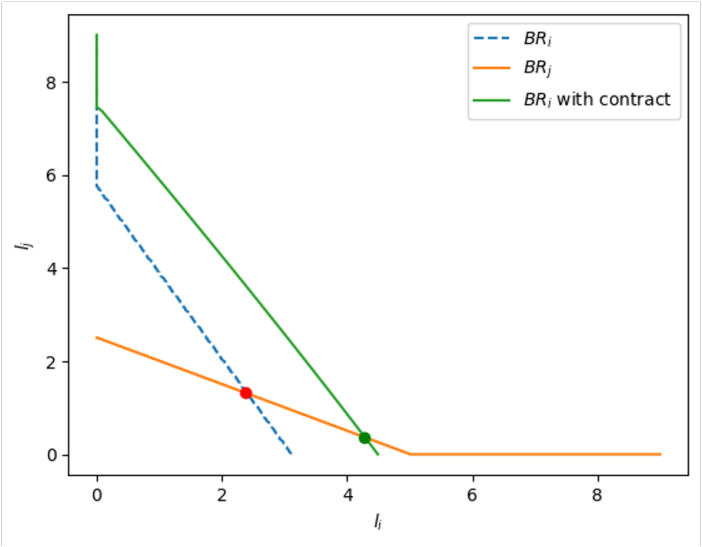
5 Comparative statics:

5.1 Bargaining power

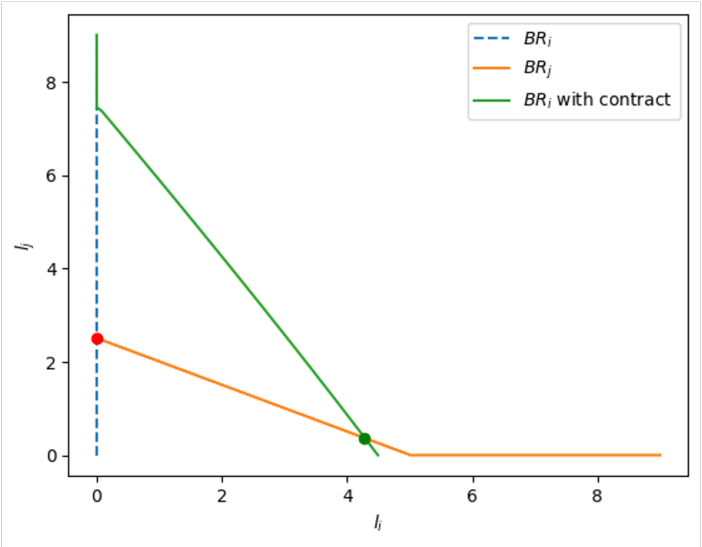
In the baseline model, I assume that the bank has full bargaining power. In this section, I relax that assumption and instead assume Nash bargaining with transferable utility - where utility is identified with monetary profits. Let $\alpha \in [0, 1]$ denote the bank's bargaining power: when $\alpha = 1$, the bank has full bargaining power (as in the baseline); when $\alpha = 0$, all the bargaining power rests with the non-bank. Under Nash bargaining, the bank receives its outside option plus a share α of the net surplus W_θ^*, i.e. the joint surplus minus the outside options of both parties:

$$W_\theta^* = \int_{\Delta_\theta^*} Z_\theta^*(A, B) dF(A, B) - \int_{\Delta} Z(A, B) dF(A, B)$$

A key observation is that bargaining power affects only the upfront transfers τ, not the structure of the optimal contract. The exposure levels and the returns are chosen to maximize the total surplus, which is independent of α. In other words, the contract is designed to maximize the size of the surplus, while bargaining power determines how that surplus is divided through monetary transfers.



(a) Case i



(b) Case ii

Figure 3: **The shift of the best response.** The figure shows the best-response function of the non-bank (orange line), the best response of the bank with no contract (dashed blue line) and the best response function of the bank with the optimal contract. The red dot is the equilibrium outcome with no contract, the green dot is the equilibrium outcome with the optimal contract. The simulation is calibrated as follows: $A = R_A \cdot U$ and $B = \rho U + (1-\rho)V$, where U and $V \sim Beta(2,2)$ independent, $R_A = 1.2$, $\rho = 0.5$, $y = 20$, $\psi = 1$, and the inverse demand function is $\max\{2.5 - 0.1L, 0\}$

While δ does not influence the contract structure, it plays an important role in shaping competition. The bank's objective function is

$$\max_{l_i} \left(E[B]R(L) - 1\right) l_i + (1-\alpha) \int_{\Delta} Z(A,B) dF(A,B) + \alpha \int_{\Delta^*_\theta} Z^*_\theta(A,B) dF(A,B)$$

This objective function shows that the bank maximizes the sum of three components: the profits from lending, the value of its outside option (weighted by $1-\alpha$), and the surplus generated under the optimal contract (weighted by α). The weights reflect the bargaining power of the bank: the larger α, the more the bank benefits from the surplus generated by the contract; the smaller α, the more it relies on the value of its outside option. Compared to the Cournot benchmark with no contract, the best response function shifts by

$$\alpha \left(\psi \int_{\Delta^*_\theta} (1 - \gamma^*_\theta - \kappa^*_i(B)) dF(A,B) - \int_{\Delta} \frac{\partial Z(A,B)}{\partial l_i} dF(A,B) \right)$$

which implies that, relative to the baseline case where $\alpha = 1$, the magnitude of the shift is smaller. Nevertheless, the qualitative insights developed in the baseline model remain valid under Nash bargaining.
The non-bank objective function becomes

$$\max_{l_j} \left(E[B]R(L) - 1\right) l_j + (1-\alpha) \left(\int_{\Delta^*_\theta} Z^*_\theta(A,B) dF(A,B) - \int_{\Delta} Z(A,B) dF(A,B) \right)$$

The shift in the best response function is given by

$$(1-\alpha) R'(L) l_i \Pr(\Delta) \left(\underbrace{E[B|\Delta]}_{\text{direct effect}} - \underbrace{\Pr(\mathcal{L}) E[B|\mathcal{L}]}_{\text{indirect effect (cap. req.)}} \right)$$

where $\mathcal{L} = \{B : B < 1/R(L)\}$. The sign of this shift is generally ambiguous, as it reflects the net effect of two opposing forces. On one hand, a higher loan rate directly increases the bank's marginal residual cashflow in default states, reducing the value of the expected subsidy. On the other hand, a higher loan rate improves the cashflows for a fixed default rate, which relaxes the capital requirement and, in turn, increases the expected subsidy. In other words the non-bank compete more or less aggressively depending on whether a marginal decrease in $R(L)$ improves or worsens the cashflow alignment. The direct effect tends to prevail when cashflows are aligned in the sense that $\Delta \equiv \mathcal{L}$, when B performs relatively well in the default region, or when the probability of being in the loss region is low. The latter is true when low default rates are more likely or when the margins are high. In this case, the non-bank compete less aggressively to increase the rate

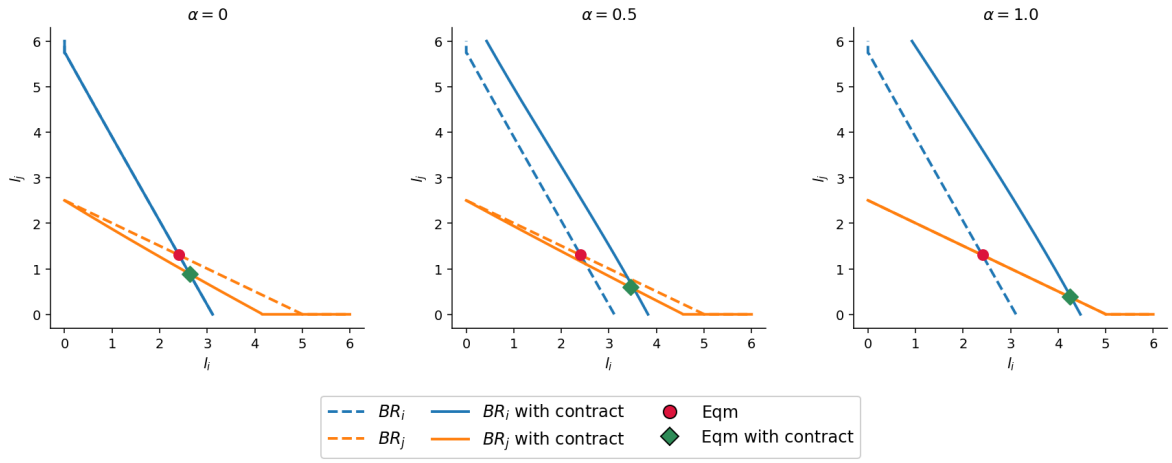


Figure 4: **Bargaining power.** The figure plots the best response functions of the bank (blue) and the non-bank (orange). Dashed lines correspond to the benchmark case in which the two parties compete without contracting, while solid lines correspond to the case in which they also enter a contract. The red dot marks the equilibrium without the contract, and the green square marks the equilibrium with the contract. The parameter α captures the bank's bargaining power, with $\alpha = 0$ indicating full bargaining power for the non-bank and $\alpha = 1$ indicating full bargaining power for the bank. The simulation is calibrated as follows: $A = R_A \cdot U$ and $B = \rho U + (1-\rho)V$, where U and $V \sim Beta(2,2)$ independent, $R_A = 1.2$, $\rho = 0.5$, $y = 20$, $\psi = 1$, and the inverse demand function is $\max\{2.5 - 0.1L, 0\}$

and erode the bank's outside option. In contrast, the indirect effect dominates when the probability of loss is high and the expected value of B in default is small relative to the one in the loss region. This situation may arise when A provides an effective hedge for intermediate values of B, so the bank fails only in extreme states. In this case, the non-bank will compete more aggressively.

Figure 4 shows an example in which the direct effect prevails. The dashed lines are the Cournot best response functions without the contract, hence they are fixed across the three figures. When the non-bank has all the bargaining power ($\alpha = 0$), the bank best response function coincides with the one without contracting, while the non-bank best response function is shifted inward with respect to the no contract case, which means that that the non-bank is competing less aggressively. As the bargaining power shifts from the non-bank to the bank, both best response functions shift outward, leading to a more competitive outcome.

5.2 Riskiness of the underlying portfolio

In this section I model explicitly the joint distribution of A and B and I show how standard contracts perform relative to the optimal contract across different characteristics of the underlying distribution of returns. I model the dependence between A and B through a one-factor Vasicek model. Let $Z \sim \mathcal{N}(0,1)$ be a common economy-wide shock, and let ϵ_A and $\epsilon_B \sim \mathcal{N}(0,1)$ be the idiosyncratic shocks; all mutually independent.

Define the latent Gaussian scores:

$$\tilde{X}_A = \rho_A Z + \sqrt{1-\rho_A^2}\epsilon_A$$
$$\tilde{X}_B = \rho_B Z + \sqrt{1-\rho_B^2}\epsilon_B$$

with loadings $\rho_A, \rho_B \in (-1, 1)$. A and B represent portfolios performances, hence so I impose continuous, bounded marginals via a probability–integral transform: first I apply the standard normal cdf Φ to $\tilde{X}$s and obtain $U_A = \Phi(\tilde{X}_A)$ and $U_B = \Phi(\tilde{X}_B)$, which preserve the rank dependence introduced by the common factor Z, then I impose the marginals

$$A = F_A^{-1}(U_A)$$
$$B = F_B^{-1}(U_B)$$

where F_A and F_B are cumulative distribution functions with support $\mathcal{A}$ and $\mathcal{B}$, respectively.

Claim 1. If $\rho_A \rho_B > 0$, if $F_B(B) \overset{\text{FOSD}}{\succ} F'_B(B)$ the optimal contract under F'_B implies lower losses then the optimal contract under F_B.

Proof. See Appendix. □

When the underlying is riskier than the rest of the balance sheet, transforming it into a safer asset and benefiting from lower capital requirements improves alignment with the rest of the balance sheet: residual cash flows are more likely to be negative in the same states and thereby increases the value of the put option embedded in the deposit guarantee.

While the optimal contract serves as a useful benchmark, financial intermediaries choose from a finite set of standardized contracts. To compare the the value of the implicit subsidy across different contracts and different distributions, I impose $B \sim \text{Beta}(\alpha_B, \beta_B)$. Figure 5 shows the value of the implicit subsidy under five contracts, with all values normalized to the the value of the null contract, i.e. $\kappa_i(B) = BR(L)$. The orange bar represents the optimal contract, which by construction, is always the highest bar. The second bar represents a sale: the bank sells the loans to the non-bank and retains no exposure. The third bar represents a SRT, in which the non-bank provides insurance against the losses of the underlying portfolio. Finally the forth and the fifth bar represent respectively a junior and a senior tranche of the portfolio. If the bank holds the junior tranche it absorbs the first losses, amplifying its exposure to low-B realizations. Whereas if the bank holds the senior tranche it is paid first and take losses only after the junior tranche is exposed. In terms

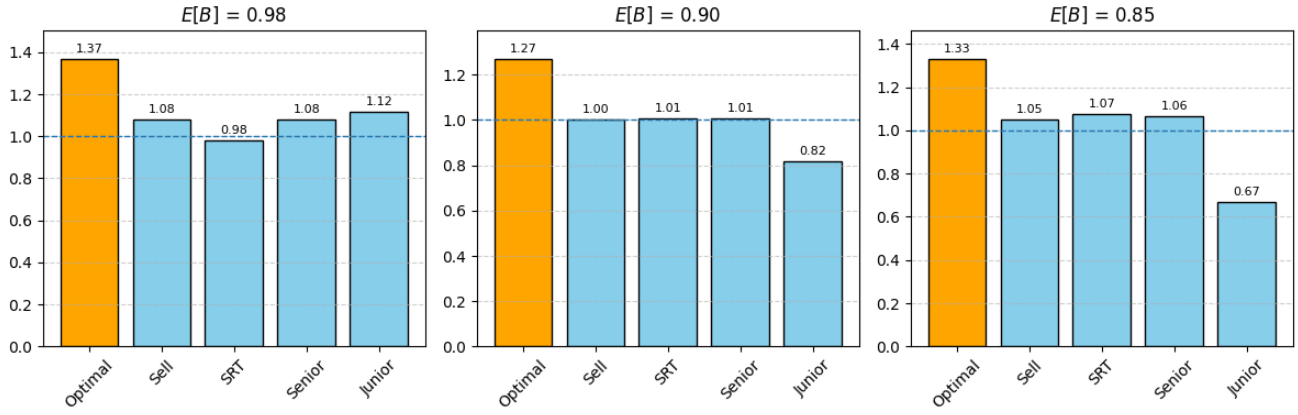


Figure 5: **Comparison across real world contracts.** The figure shows the value of the implicit subsidy under five contracts, with all values normalized to the the value of the null contract, i.e. $\kappa_i(B) = BR(L)$. The orange left bar represents the value of the subsidy under the optimal contract $\kappa_i^*(B)$. Sell represents a sale contract $\kappa_i(B) = 0$ for all B. The SRT: $\kappa_i(B) = \max\{1 - BR(L), K\}$ if $BR(L) < 1$ and $\kappa_i(B) = BR(L)$ otherwise. The senior tranche return is given by $\kappa_i(B) = \max\{BR(L), \tilde{B}R(L)\}/\tilde{B}$, while the one on the junior tranche as $\kappa_i(B) = \max\{0, (B - \tilde{B})R(L)\}/(1 - \tilde{B})$.

of cashflows profile, this is equivalent to a secured loan from the bank to the non-bank, which ultimately holds the portfolio. The panel vary β_B, which controls the skewness of the marginal distribution of B: a higher β_B places more probability mass on low values of B[10]. As β_B increases contracts that imply lower expected losses with respect to the null (sale, SRT, and senior tranche) deliver higher implicit subsidy values, while the junior tranche weakens.

6 Policy Relevance

The model highlights the regulatory arbitrage between exposure-based capital requirements and balance sheet level guarantees: banks have incentives to concentrate losses in the same state of the world to maximize the value of the guarantee. Consistently with this logic, Harris *et al.* (2024) predict that banks have highly concentrated portfolios. In principle, capital regulation aims to counteract this behavior. In particular, Pillar 2 prescribes additional capital add-ons that are computed at the balance-sheet level. Among these, the add-ons for concentration risk are especially relevant, since they directly address imperfect diversification. Under Pillar 2, banks must compute the Herfindahl–Hirschman Index (HHI) for their entire portfolio, covering single-name, industry, and geographic concentration, with portfolio shares based on risk-weighted assets.

[10]In the standard Vasicek framework this is equivalent to increasing the unconditional probability of default of the single loan.

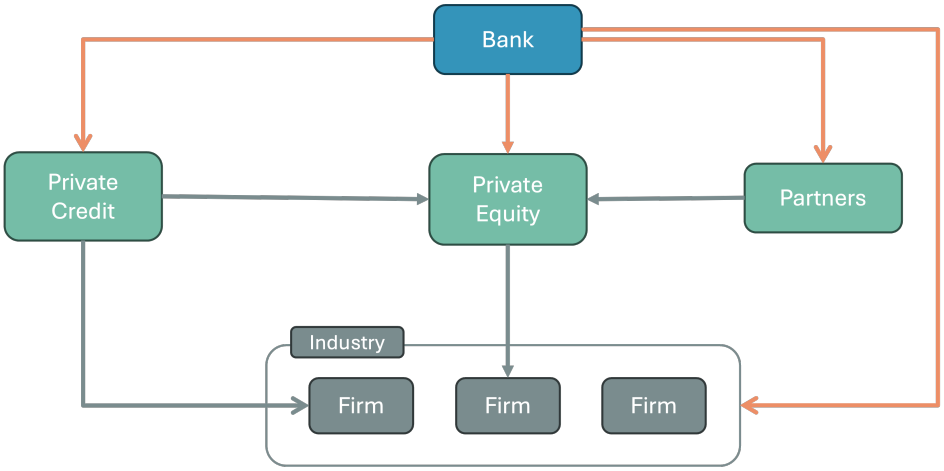


Figure 6: **Linkages Across Banks, Private Equity, and Private Credit.** The figure represents a hypothetical situation in which a bank lends to firms in a given industry, while also providing credit to a private equity fund invested in that industry, to the fund's partners, and to a private credit fund that in turn lends to firms in the same industry. The orange lines are loans issued by the bank, while the gray lines are relationships that do not directly involve banks. The diagram is a personal re-interpretation of the article "How private equity tangled banks in a web of debt" published in the Financial Times on 24/07/2024.

Supervisors then map the HHI index to a capital add-on. For example, in the UK framework, a sectoral HHI between 25% and 40% triggers an add-on of 0.5%–1% of RWA [11]. Crucially, these add-ons depend only on the HHI value, not on the underlying industry composition of the bank portfolio. Hence, even in a simple setting where banks only lend directly to firms and hold loans on their books, the measure has clear limitations. Interconnections with non-banks make these limitations more severe. Consider the situation in Figure 6: a bank may lend to firms in a given industry, while also providing credit to a private equity fund invested in that industry, to the fund's partners, and to a private credit fund that in turn lends to the same firms. All these exposures ultimately depend on the same industry, yet in the Pillar 2 framework they are fragmented across categories: direct loans count as industry exposures, loans to funds as financial-sector exposures, and loans to partners as personal loans (excluded from the HHI calculation). As a result, the bank's true concentration risk is underestimated. Although the most recent revisions to Pillar 2 grant supervisors greater discretion, the limited disclosure obligations of non-banks mean regulators may still be unable to "see-through" these entities. This issue is also relevant for stress test frameworks which fail to capture this network effect.

Beyond the actual exposure to a sector, the model highlights another important limitation of existing capital rules: even if a bank lends to different industries, contracts are designed so that cashflows move together.

[11] from "The PRA's methodologies for setting Pillar 2 capital", May 2025

What matters, therefore, is not only sectoral exposure, but whether cashflows align across exposures. To study how different regulatory approaches capture this alignment of cash flows, I use the same framework introduced in the previous section, where A and B are governed by the latent variables $\tilde{X}_K = \rho_K Z + \sqrt{1-\rho_K^2}\epsilon_K$ for $K = \{A, B\}$ and have marginal distributions $\text{Beta}(\alpha_K, \beta_K)$. Assume that A and B represent the return of two different sectors and consider four types of capital requirements. First, the baseline rule**:** capital requirements are computed on the single exposures separately, hence the bank's leverage ratio is

$$\gamma = \frac{\gamma_A y + \gamma_B l_i}{y + l_i}.$$

Second, a HHI add-on, intended to mimic Pillar 2 framework, where the portfolio shares are proportional to capital requirements [12]:

$$\omega_A = \frac{\gamma_A y}{\gamma_A y + \gamma_B l_i}$$
$$\omega_B = \frac{\gamma_B l_i}{\gamma_A y + \gamma_B l_i}$$

The leverage ratio is given by $\gamma' = \gamma + \zeta \text{HHI}$, where ζ is a parameter chosen by the regulator and HHI$=$ $\omega_A^2 + \omega_B^2$. The third rule, considers an adjusted measure of the HHI index, which replaces sectors with risk-factors. Consider the latent risk-weighted portfolio:

$$\begin{aligned}\tilde{P} &= \omega_A y + \omega_B l_i \\ &= (\omega_A \rho_A + \omega_B \rho_B) Z + \omega_A \sqrt{1-\rho_A^2}\epsilon_A + \omega_B \sqrt{1-\rho_B^2}\epsilon_B\end{aligned}$$

the share of the variance explained by each factor is given by:

$$s_Z = \frac{(\omega_A \rho_A + \omega_B \rho_B)^2}{\text{Var}(\tilde{P})}$$
$$s_{\epsilon_K} = \frac{\omega_K^2 (1-\rho_K^2)}{\text{Var}(\tilde{P})} \quad \text{for } K = \{A, B\}$$

The leverage ratio is given by $\gamma'' = \gamma + \zeta \text{HHI}_{\text{adj}}$, where $\text{HHI}_{\text{adj}} = s_Z^2 + s_{\epsilon_A}^2 + s_{\epsilon_B}^2$. This adjusted index aims at better capture indirect exposures and cross-sector correlations. Finally targeted rule sets γ^t so that the

[12] This is equivalent to have them proportional to risk-weights.

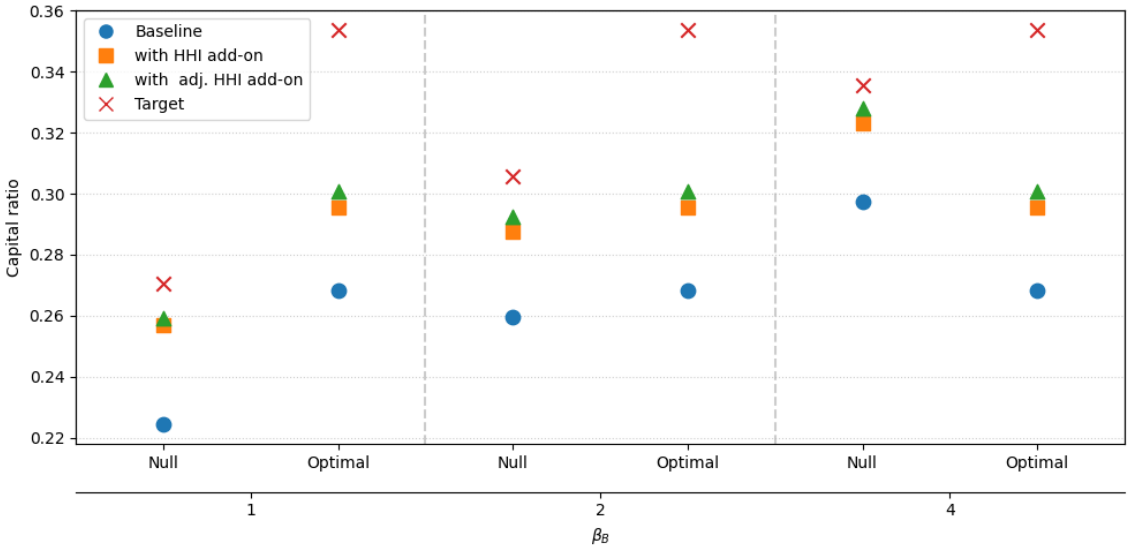


Figure 7: **Capital ratios under alternative capital requirement rules.** The figure reports the capital ratios (capital divided by total assets) implied by the baseline rule, the HHI add-on, the adjusted HHI add-on, and the targeted rule.The definitions of the capital requirement rules are provided in the text. Results are shown for both the null contract and the optimal contract, across different values of β_B, which govern the marginal distribution of B. The simulation is calibrated as follows, $\bar{A} = 1.1$, $R(L) = 1.15$, $\rho_A = 0.9, \rho_B = 0.6$, $A/\bar{A} \sim \text{Beta}(5, 2)$, $B \sim \text{Beta}(2, \beta_B)$, $y/x = 4$.

average subsidy stays constant at a given level t:

$$\int_{\Delta} \left((1-\gamma^t)(y+l_i) - Ay - BR(L)l_i\right) = t(y+l_i)$$

This capital rule eliminates the arbitrage and ensures that for a given size, $y + l_i$, the bank cannot extract any further rents. Analogously, I evaluate each capital requirement under the scenario in which banks are allowed to implement the optimal contract. The optimal contract itself is derived under the baseline capital requirement, meaning that the bank does not internalize the presence of HHI add-ons when designing it. This ensures that the comparison is conservative: the leverage ratios reported here represent a lower bound on the rents that banks could extract once concentration add-ons are taken into account.

Figure 7 plots the leverage ratios implied by the four capital requirement regimes under both the null contract and the optimal contract. On the x-axis, I vary the parameter β_B, which governs the marginal distribution of B. As β_B increases, the Beta distribution shifts more probability mass toward zero, making low values of B more likely. The comparison shows that the optimal contract systematically exacerbates the gap between the targeted requirement and the other measures, consistent with its design to maximize the implicit subsidy.

It also shows that the adjusted HHI index produces higher leverage ratios than the simple HHI, since it looks through sectoral labels and measures concentration directly at the level of underlying risk factors. Yet this refinement remains incomplete: linear correlations cannot capture the full alignment of cash flows generated by contractual design. This limitation becomes clear in the rightmost panel, where the targeted ratio rises when moving from the null to the optimal contract, while all other leverage ratios fall. The reversal of monotonicity indicates that the distortion cannot be addressed simply by raising concentration add-ons.

7 Conclusion

By allowing banks to reallocate cashflows across states of the world, banks and non-banks can design contracts that maximize the implicit subsidy generated by the deposit guarantee. The optimal contract moves cashflows away from states where the rest of the balance sheet performs poorly, balancing the gain from increasing the state contingent value of the guarantee against the higher capital requirements induced by greater expected losses. Importantly, the paper shows that the implicit subsidy can increase even when the bank transforms its cashflows into safer claims. This highlights how difficult it is to design capital requirements that are robust to contractual innovation, and why add-ons based only on linear correlations may be ineffective. The involvement of non-banks further complicates the picture: in some settings they intensify competition and reduce bank profits, while in others they act as strategic partners, enabling banks to lend in otherwise unattractive markets and increasing overall profitability. The welfare implications are therefore ambiguous: credit supply expands, but this comes at the cost of a larger subsidy ultimately borne by taxpayers.

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A Proofs

Lemma 1: The derivative of the objective function with respect to x_i

$$s_x \equiv \int_{\Delta_\theta} (1 - \gamma - \kappa_i(B)) dF(A, B)$$

and the second derivative

$$\int_0^1 \frac{(1 - \gamma - \kappa_i(B))^2}{y} f(A_0(B), B) dB \geq 0$$

hence $x_i^* \in \{0, \bar{x}\}$. WLOG I can set $x_i^* = \bar{x}$ because even if $x_i = 0$ is indeed optimal I can replicate the same payoff by setting $\kappa_i(B) = 0$ for all B. In other words by setting $x_i^* = \bar{x}$, I am just eliminating a redundant contract. Also this implies that the marginal subsidy s_x in equilibrium is non-negative.

Lemma 2: If a function is optimal it must be robust to point-wise deviations. Therefore, $\forall B \in [0,1]$ the point-wise variational inequality must hold

$$-\mathbb{P}_{A|B}(\Delta_\theta|b) + \mathbb{P}_{AB}(\Delta_\theta) \cdot 1\{b \in \mathcal{L}_\theta\} \leq 0$$

This inequality highlights the key trade-off underlying the optimal contract. Let $\kappa_i(b) = k$. A marginal decrease in k has two opposing effects. First a state-contingent effect: for $B = b$ lowering k reduces the bank's available cashflows to repay depositors and therefore the expected subsidy increases in that state. This is reflected in the term $-\mathbb{P}_{A|B}(\Delta_\theta|b)$, which captures the marginal increase in subsidy due to reduced repayment capacity conditional on $B = b$. Second, a cross-state effect via regulation: if $k < 1$, the contract interacts with regulation. A reduction in k increases the expected losses, thereby increasing the total required capital. As a result, the implicit subsidy decreases in all states of the world. This effect is captured by the second term $\mathbb{P}_{AB}(\Delta_\theta) \cdot 1\{b \in \mathcal{L}_\theta\}$, which reflects how the adjustment at b feeds back into the global structure of the capital constraint.

Proof. In particular, an optimal $\kappa_i^*(B)$ must be such that

$$\kappa_i^*(b) = \begin{cases} 0 & \text{if } \mathbb{P}_{A|B}(\Delta_\theta^*|b) > \mathbb{P}_{AB}(\Delta_\theta^*) \\ \in [0,1] & \text{if } \mathbb{P}_{A|B}(\Delta_\theta^*|b) = \mathbb{P}_{AB}(\Delta_\theta^*) > 0 \\ 1 & \text{if } 0 < \mathbb{P}_{A|B}(\Delta_\theta^*|b) < \mathbb{P}_{AB}(\Delta_\theta^*) \\ \geq 1 & \text{if } 0 = \mathbb{P}_{A|B}(\Delta_\theta^*|b) < \mathbb{P}_{AB}(\Delta_\theta^*) \end{cases}$$

When the conditional probability of default is larger than the unconditional probability of default, the point-wise variational inequality is negative, so it is optimal to set $k = 0$. If the conditional and the unconditional probability are equal, the objective function is flat in $[0,1]$ and then decreasing. If the unconditional is larger that the conditional probability of default, the function is increasing in $[0,1]$ and then decreasing, hence the optimal is $k = 1$. Finally, when the conditional probability is equal to zero, the function is increasing in $[0,1]$ and then flat. □

Proposition 1: The optimization problem can be re-written in the following way:

$$\max_{\gamma_\theta \in [0,1]} \max_{\kappa \in \mathcal{K}_\gamma} \mathcal{V}(\kappa; \gamma_\theta)$$

where

$$\mathcal{V}(\kappa, \gamma_\theta) = \int_{\Delta_\theta} ((1 - \gamma_A - A)y + (1 - \gamma_\theta - \kappa_i(B))x_i)$$
$$\mathcal{K}_\gamma = \left\{ \kappa_i : [0,1] \to [0,1] \text{ such that } \int_0^1 (1 - \kappa_i(B)) dF_B(B) = \gamma \right\}$$

Suppose $\phi(b) > \phi(b')$, if $b' \in \mathcal{L}_\theta$ it must be that $b \in \mathcal{L}_\theta$. Proof: suppose not, $b \notin \mathcal{L}_\theta$. Then κ_1^* cannot be optimal. Consider the following deviations:
if $f(b) < f(b')$: set $\tilde{\kappa}(b) = 0$ and $\tilde{\kappa}(b') = 0$ with probability p and $=1$ with probability $1 - p$. Where p is such that $(1 - p)f(b') = f(b)$, so that the measure of the loss region stays constant.

$$\begin{aligned} \mathcal{V}(\kappa^*; \gamma) - \mathcal{V}(\tilde{\kappa}; \gamma) &= -\phi(b)f(b) + \phi(b')(1 - p)f(b') \\ &= -(\phi(b) - \phi(b'))f(b) < 0 \end{aligned}$$

by definition κ^* cannot be an optimum.
if $f(b) \geq f(b')$: set $\tilde{\kappa}(b) = 0$ with probability p and $\tilde{\kappa}(b) = 1$ with probability $1 - p$, such that $pf(b) = f(b')$. Then set $\tilde{\kappa}(b') = 1$.

$$\begin{aligned} \mathcal{V}(\kappa^*; \gamma) - \mathcal{V}(\tilde{\kappa}; \gamma) &= -\phi(b)pf(b) + \phi(b')f(b') \\ &= -(\phi(b) - \phi(b'))f(b') < 0 \end{aligned}$$

by definition κ^* cannot a optimum.
Hence, given γ the selection mechanism is the following: order bs according to $\phi(b; \gamma)$ and select from the highest up to the point where you select the measure γ. In other words, let $\mu_\gamma(B) = \mathbb{P}_B(\{B' : \phi(B', \gamma) > \phi(B, \gamma)\})$ also let $\mathbb{P}_B(B)$ be the probability mass of B (which I allow to be different from zero). Then

$$\kappa_i^*(B; \gamma) = \begin{cases} 0 & \text{if } \mu_\gamma(B) + \mathbb{P}_B(B) \leq \gamma \\ 1 - \frac{\gamma - \mu(B)}{\mathbb{P}_B(B)} & \text{if } \mu_\gamma(B) < \gamma < \mu_\gamma(B) + \mathbb{P}_B(B) \text{ and } \mathbb{P}_B(B) \neq 0 \\ 1 & \text{if } \mu_\gamma(B) \geq \gamma \end{cases}$$

The optimal selection rule ensures that the correspondence $\gamma \mapsto \mathcal{K}_\gamma$ has a closed graph and compact values, $\mathcal{V}(\kappa;\gamma_\theta)$ is upper-semicontinuous in κ, hence for every γ the optimal contract exists. Let

$$V(\gamma_\theta) := \max_{\kappa \in \mathcal{K}_\gamma} \mathcal{V}(\kappa;\gamma_\theta)$$

The maximum is attained when we maximise over γ_θ: by Berge's maximum theorem $V(\gamma_\theta)$ is upper-semicontinuous in γ and $\gamma \in [0,1]$ (compact set).

Claim 1: If $\rho_A \rho_B > 0$, if $F_B(B) \overset{\text{FOSD}}{\succ} F'_B(B)$ the optimal contract under F'_B implies lower losses then the optimal contract under F_B.

(Step 1) If $\rho_A \rho_B > 0$. The optimal contract design is equivalent to pick an optimal $\tilde{B} \in [0,1]$ and set

$$\kappa_i(B) = \begin{cases} 0 & B \leq \tilde{B} \\ 1 & B > \tilde{B} \end{cases}$$

If $\rho_A, \rho_B > 0$, then $F_{A|B}(A|b) \overset{\text{FOSD}}{\succ} F_{A|B}(A|b')$ when $b > b'$. Recall the profitability index

$$\phi(b,\gamma) = \int_{A_1}^{A_0} F_{A|B}(A|b) dA$$

Therefore the profitability index ranking is independent of γ: $\phi(b,\gamma) < \phi(b',\gamma)$ for all $\gamma \in [0,1)$.

(Step 2) If $F_B(B) \overset{\text{FOSD}}{\succ} F'_B(B)$, the following properties are true:

- $F_{B|A}(B|a) \overset{\text{FOSD}}{\succ} F'_{B|A}(B|a)$ for all $a \in \mathcal{A}$:

  $$F_{B|A}(b|a) = \Pr(U_B \leq F_B(b) | U_A = u_a) = \Phi\left(\frac{\Phi^{-1}(F_B(b)) - \rho\Phi^{-1}(u_a)}{\sqrt{1-\rho^2}}\right)$$

  where $\rho = \rho_A \rho_B$. As $F_B(b)$ decreases point-wise, $F_{B|A}(b|a)$ decreases point-wise.

- $F'_{A|B}(A|b) \overset{\text{FOSD}}{\succ} F_{A|B}(A|b)$ for all $b \in \mathcal{B}$:

  $$F_{A|B}(a|b) = \Pr(U_A \leq u_a | U_B = F_B(b)) = \Phi\left(\frac{\Phi^{-1}(u_a) - \rho\Phi^{-1}(F_B(b))}{\sqrt{1-\rho^2}}\right)$$

  as $F_B(b)$ decreases point-wise, $F(a|b)$ increases point-wise.

(Step 3) Putting everything together:

$$\max_{\tilde{B}\in[0,1]} \int_{\Delta_\theta} Z_\theta(A,B)dF(A,B)$$

Consider the cases in which the global maximum is interior and characterized by the first order condition

$$-\left(\int_0^{\tilde{B}}\int_{\underline{A}}^{A_1} f(A,B)dAdB + \int_{\tilde{B}}^1\int_{\underline{A}}^{A_0} f(A,B)dAdB\right) + \int_{A_1}^{A_0} F_{A|B}(A|\tilde{B})dA = 0$$
$$-\int_{A_1}^{A_0} F_{B|A}(\tilde{B}|A)dF_A(A) - F_A(A_1) + \int_{A_1}^{A_0} F_{A|B}(A|\tilde{B})dA = 0$$

using the conditions we derived above $F'_{B|A}(\tilde{B}|A) > F_{B|A}(\tilde{B}|A)$ and $F'_{A|B}(A|\tilde{B}) < F_{A|B}(A|\tilde{B})$. Therefore under F'_B the optimal $\tilde{B}$ is lower, which means that the optimal contract implies lower losses.

B Additional comparative statics

B.1 Stringency of capital requirements

To conduct comparative statics on the stringency of capital requirements, I begin by introducing a useful property.

Global ranking property. *(Definition)* A distribution function $F(A,B)$ and the set of parameters $(\bar{x}, y)$ satisfy the global ranking property if there exists a strict total order $\succ$ on $\mathcal{B}$ such that

$$b \succ b' \quad \Leftrightarrow \quad \phi(b;\gamma) > \phi(b';\gamma) \quad \forall\gamma \in [0,1].$$

This means that the relative order of the profitability indices depend only b and not on γ. One sufficient condition to ensure global ranking is that the families of conditional distributions $\{F_{A|B}(\cdot|b)\}_{b\in\mathcal{B}}$ can be ranked over B in terms of first order stochastic dominance. This property streamlines the analysis and enables meaningful comparative statics.

Recall the capital requirement rule: an asset that returns $K \sim F_K$ requires a capital ratio equal to

$$\gamma_K = \min\left\{\xi\int_{\underline{K}}^1 (1-K)dF_K(K), 1\right\}$$

in this section, I study the effect on increasing capital requirements strictness ξ. The first straightforward observation is that the bank is worse off: by increasing capital requirements the regulator is limiting the

ability of the bank to extract rents. Let us first consider the case in which the increase in capital requirements concerns just the underlying portfolio but not the rest of the balance sheet. Stricter capital rules imply that it is more costly for the bank to set $\kappa_i(B) = 0$ in terms of capital requirements, however as the bank becomes more capitalized the spread between capital and deposit is lower, hence capital is relatively less costly. To see this analytically, assume the global ranking property and without loss of generality assume that the ordering is the reverse natural order of $\mathcal{B}$, low Bs are the most profitable to set to zero. The optimal contract problem then just consist of picking a threshold $\tilde{B}$ such that

$$\kappa_i(B) = \begin{cases} 0 & \text{if } B \leq \tilde{B} \\ 1 & \text{if } B > \tilde{B} \end{cases}$$

Capital requirement will be equal to $\gamma_\theta = \xi F(\tilde{B})$.

$$\max_{\tilde{B}\in[0,1]} \int_0^{\tilde{B}} \int_{\underline{A}}^{A_0} \Big((1-\gamma_A - A)y + (1-\xi F(\tilde{B}))\bar{x}\Big)\, dF(A,B) + \int_{\tilde{B}}^{1} \int_{\underline{A}}^{A_1} \Big((1-\gamma_A - A)y - \xi F(\tilde{B})\bar{x}\Big)\, dF(A,B)$$

Assume parameters such that the solution is interior. The FOC:

$$\phi(\tilde{B}; \xi F(\tilde{B})) - \xi \bar{x} \Pr(\Delta_\theta) = 0$$

Applying the implicit function theorem, the sign of $\frac{d\tilde{B}^*}{d\xi}$ is given by:

$$-F(\tilde{B}) \Big(F(A_0|\tilde{B}) - F(A_1|\tilde{B})\Big) - \Pr(\Delta_\theta) + \xi F(\tilde{B}) \frac{\bar{x}}{y} \Pr(\text{//}_\theta) \tag{2}$$

where //$_\theta$ is the default boundary, i.e. //$_\theta = \{(A,B) : Z_\theta(A,B) = 0\}$. If we assume that the size of the contract is smaller than the rest of the balance sheet ($\bar{x}/y < 1$), the sign of 2 is negative as $\xi F(\tilde{B}) = \gamma < 1$, and //$_\theta \subset \Delta_\theta$. This means that the bank chooses a contract that implies lower expected losses.