WORKING PAPERS

N° 1676

October 2025

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Abstract

Firms often choose between concentrated, renegotiable bank claims and dispersed, arm's-length market debt. I develop a tractable adverse-selection model in which *both* financiers can take collateral, but they differ in *enforcement and coordination efficiency* at default. The single primitive wedge—a higher effective liquidation rate for concentrated creditors—is sufficient to generate coexistence, a sharp cutoff in the bank–bond partition, and distinctive comparative statics. A marginal improvement in bankruptcy/insolvency efficiency or bondholder coordination reallocates issuance toward bonds, compresses loan–bond pricing gaps for safe types, and shifts default incidence and collateral intensity in predictable ways. The welfare decomposition clarifies when strengthening bank enforcement reduces deadweight liquidation losses (by moving marginal types into monitored finance) versus when improving market-side coordination dominates (by accelerating dispersed-creditor resolution). The model delivers stability-relevant predictions for default rates, recovery, covenant stringency, and issuance composition around reforms that move liquidation efficiency on either side, and it provides a disciplined mapping to empirical proxies (recoveries, covenant strength, creditor dispersion).

Keywords: Bank–bond choice; Collateral and enforcement; Liquidation efficiency; Creditor coordination; Adverse selection; Financial stability.
JEL: G21, G32, G33, D82, K22.

1 Introduction

A central question for financial stability is how institutional differences in creditor control and coordination shape firms' debt structure *at the margin*. When both banks and bond

*Earlier versions circulated under the title "Collateral, Liquidation Costs, and the Choice between Direct and Intermediated Debt." I am grateful for insightful comments and conversations from Christian Hellwig, Natalia Kovaleva, Eric Mengus, Harry Pei, Guillaume Plantin, Alp Simsek, Tong Su, Jean Tirole, and Takuro Yamashita. Any remaining errors are my own.

investors can pledge collateral, the relevant distinction is not access to security per se, but the *efficiency* with which collateral is enforced and investor coordination is achieved in distress. I develop a microfounded comparison of bank and bond finance under adverse selection in which the only primitive wedge is higher effective liquidation efficiency for concentrated creditors. This parsimonious friction nests covenant enforcement, amendment speed, and coordination among dispersed claimholders without imposing ad hoc instrument bans.

This paper makes three contributions. First, the model delivers coexistence with selection: competitive banks implement borrower-optimal zero-profit menus that screen intermediate types, while the bond market prices a pooling contract that attracts the safest tail; the cutoff pivots with the enforcement/coordination wedge. Second, the framework yields stability-relevant comparative statics: improving bankruptcy efficiency or bondholder coordination reallocates issuance toward bonds, shifts default incidence and recovery in predictable directions across segments, and compresses loan–bond spread gaps for safe types. Third, a transparent welfare decomposition clarifies when strengthening bank enforcement reduces deadweight liquidation losses versus when improving market-side coordination dominates.

The theory maps cleanly to observable proxies. On the bank side, monitoring intensity and amendment frequency summarize enforcement; on the market side, creditor dispersion and covenant strength index coordination. These inputs explain: (i) the direction of issuance shifts around institutional reforms; (ii) movements in collateral intensity and covenant tightness across segments; and (iii) cross-sectional default and recovery patterns at the cutoff. The results organize recent evidence on covenant weakening, the rise of nonbank/direct-lender credit with bond-like control, and coordination technologies in public-debt restructurings, and provide testable implications for policy evaluations targeting insolvency and resolution frictions.

2 Related Literature

This paper connects to classic theories of financial intermediation, collateral, and the architecture of financing, and to a recent empirical literature that documents how enforcement, renegotiation, and creditor coordination shape the loan–bond margin. On the theory side, delegated monitoring and intermediation provide the organizing background for why concentrated creditors differ from diffuse investors in resolving frictions (Holmström and Tirole, 1997; Allen and Gale, 2004; Gorton and Winton, 2003). In asymmetric-information credit markets, collateral, covenants, and screening jointly determine who is financed and on what terms (Stiglitz and Weiss, 1981; Besanko and Thakor, 1987a,b; Chan and Thakor, 1987). Reputation and migration from banks to public markets when information asymmetry falls are also central (Diamond, 1991). I adopt this backbone but make two discipline choices that address common realism concerns raised in prior reports: both banks and markets can pledge collateral, and the bank is profit-maximizing under competition rather than benevolent; the only primitive wedge is more efficient liquidation/enforcement by banks than by dispersed bondholders. This keeps the contract set realistic while delivering sharp selection and welfare results.

A large empirical literature documents differences in control rights, renegotiation, and covenant technology across loans and bonds. Private loans feature tighter, more frequently amended covenants and creditor control in response to information updates (Roberts and Sufi, 2009; Nini et al., 2009, 2012; Gârleanu and Zwiebel, 2009). Over the last decade, contractual weakness on the loan side has risen with the growth of nonbank participation: Ivashina and Vallée (2024) quantify the "weakening" of negative covenants through carveouts and baskets; Badoer et al. (2024) show reputational capital mitigates covenant-lite terms. On the bond/high-yield margin, Bräuning et al. (2023) find that incurrence covenants have real effects on investment even without formal transfers of control. These patterns match the modeling choice of a bank–market wedge in effective enforcement/coordination rather than an outright ban on collateral in bonds.

Recent work ties the pricing and composition of debt directly to the interaction of loans and bonds. Schwert (2020) shows that, even after aligning seniority, loans are often expensive relative to bond-implied spreads, consistent with borrowers paying for monitoring and renegotiation flexibility. Bond access in turn disciplines bank pricing: Thia and Kong (2025) estimate that recent bond issuance lowers subsequent loan spreads, while Weston and Yimfor (2023) show that the addition of bank debt raises yields on outstanding bonds via priority and conflict channels. These findings echo classic evidence on sorting by credit quality and opacity (Denis and Mihov, 2003) and align with our mechanism in which pooled bond pricing attracts very safe types, competitive banks design menus for intermediate types, and the partition pivots with the liquidation wedge.

Enforcement and creditor coordination frictions are first-order in distress resolution and map directly into the paper's liquidation technology. Cross-country evidence links stronger creditor rights and enforcement to greater reliance on arm's-length finance (Djankov et al., 2008). Zooming in on mechanisms, Dou et al. (2021) decompose bankruptcy frictions and conclude that excess delay—coordination among dispersed creditors—is a dominant source of inefficiency, exactly the channel that raises market-side effective liquidation losses in our setting. Outside Chapter 11, exchange offers and consent solicitations provide a coordination technology for public debt restructuring (Fan et al., 2025), which we interpret as raising λ_m and shifting the partition toward bonds in the model.

The rise of nonbank/private-credit lenders changes the landscape without overturning the core bank–market distinction emphasized here. Regulatory constraints and borrower characteristics push riskier or negative-EBITDA issuers toward nonbanks, often at higher spreads and with weaker protections (Chernenko et al., 2022); direct-lender capital substitutes for traditional lending in the middle market (Davydiuk et al., 2024). These loans frequently carry bond-like covenant structures and more dispersed control, reinforcing the idea that the economically relevant wedge is enforcement/renegotiation efficiency rather than the legal label of the claim. Relatedly, priority design and spreading across instruments create predictable conflicts and pricing effects (Badoer et al., 2020), consistent with the welfare decomposition we derive when marginal types switch financiers as the liquidation gap changes.

On the collateral and liquidation side, classic evidence shows that higher liquidation values tighten secured contracting and shift terms (Benmelech et al., 2005), while collateral capacity, risk management, and debt choice co-move over the cycle (Rampini and Viswanathan, 2010). Our comparative statics translate these facts into the bank–bond partition via a single, observable wedge $\Delta = \lambda_b - \lambda_m$: increases in recovery or coordination efficiency on the market side (higher λ_m) tilt issuance toward bonds and compress loan–bond spread gaps for safe types; increases on the bank side (higher λ_b) move the cutoff in favor of bank finance and lower default among marginal switchers.

Two additional strands are complementary. First, dynamic renegotiation with asymmetric information provides microfoundations for why contracts load on state-contingent control (Roberts, 2015), which in our static environment is summarized parsimoniously by the liquidation-efficiency wedge. Second, recent theory nests screening costs and intermediation under adverse selection (Biswas, 2023); our approach is in the same spirit but focuses on a disciplined bank–market comparison when both can pledge collateral yet differ in liquidation efficiency. For completeness, we note that cooperative/mutual intermediation remains important in some systems (McKillop and Wilson, 2020); we keep this interpretation in an appendix benchmark to preserve a competitive, profit-maximizing core in the main text.

In sum, recent evidence on contracting, coordination, and the structure of credit markets supports modeling banks and markets as sharing access to collateral while differing in enforcement and liquidation. The paper's selection, coexistence, and welfare results provide a compact positive framework that matches these facts and yields testable predictions about issuance composition, pricing, covenant intensity, and default around policy or institutional shifts that move λ_b and λ_m.

The remainder of the paper is organized as follows. Section 3 presents the environment and primitives. Section 4 analyzes the competitive bank benchmark. Section 5 introduces the bond market and derives the borrower self-selection equilibrium. Section 6 provides welfare results and comparative statics. Section 7 discusses empirical implications and extensions. Section 8 concludes.

3 Environment and Primitives

There is a unit mass of risk-neutral entrepreneurs indexed by type $\theta \in \Theta := [\underline{\theta}, \overline{\theta}]$ with continuously differentiable cdf F and density $f > 0$ on Θ. Type θ is privately observed by the entrepreneur. Each entrepreneur requires one unit of external finance to undertake an indivisible project that yields a random cash flow $X \in \mathbb{R}_+$ at date 1. The outside option is not to invest (normalized value 0). Time is $t \in \{0, 1\}$; all agents are risk-neutral and the risk-free rate is normalized to zero.

Each entrepreneur is endowed with a collateralizable asset $a \in [0, \bar{a}]$, observable and verifiable, which can be pledged up to an amount $m \in [0, a]$. Collateral is valued at one by the entrepreneur. The distribution of X conditional on type θ is $F_X(\cdot \mid \theta)$ with survivor function $G(\cdot \mid \theta) := 1 - F_X(\cdot \mid \theta)$ and conditional upper-tail mean $\mu_+(d, \theta) := \mathbb{E}[X \mid X \geq d, \theta]$; we write $\mu(\theta) := \mathbb{E}[X \mid \theta]$.

There are two sources of external finance. A competitive banking sector (the "bank") can post a menu of secured loan contracts. A competitive bond market (the "market") offers a secured bond contract. Both forms of finance can take collateral.[1] The only primitive difference between bank and market is their liquidation/enforcement technology in distress. Let $\lambda_i \in (0, 1]$ denote the fraction of pledged collateral that financier $i \in \{b, m\}$ can realize

[1]Many public bonds are unsecured in practice. Allowing unsecured market debt is the special case $m = 0$ on the market side; none of the selection or welfare results depend on requiring $m > 0$ for bonds.

net of deadweight costs if the borrower defaults; the bank is strictly more efficient: $\lambda_b > \lambda_m$. Define the liquidation gap $\Delta := \lambda_b - \lambda_m > 0$. In default, the financier realizes $\lambda_i m$ and the remaining $(1 - \lambda_i)m$ is dissipated. The borrower forfeits the full m in default. Project cash flows are fully dissipated in default (the financier does not recover X beyond collateral);[2] this can be relaxed without affecting the main comparative statics.

A (secured) debt contract for financier i is a pair (d, m) where $d \geq 0$ is the face value due at date 1 and $m \in [0, a]$ is the pledged collateral. If $X \geq d$ the borrower repays d and keeps $X - d$; otherwise she defaults, the financier seizes collateral and realizes $\lambda_i m$, and the borrower loses m. Limited liability rules out transfers beyond d and m. All objects are scaled so that the required investment equals one.

The borrower's expected payoff from contract (d, m) offered by financier i given type θ is

$$U_i(\theta; d, m) \;=\; \mathbb{E}\Big[(X - d)\,\mathbf{1}\{X \geq d\} \mid \theta\Big] \;-\; m\,\Pr[X < d \mid \theta].$$

The financier's expected (gross) revenue is $d\,\Pr[X \geq d \mid \theta] + \lambda_i m\,\Pr[X < d \mid \theta]$. With competitive pricing and free entry, financiers earn zero expected profit on the pool of borrowers they serve. Social surplus from financing a type-θ project with financier i under (d, m) is

$$W_i(\theta; d, m) \;=\; \mu(\theta) \;-\; (1 - \lambda_i)m\,\Pr[X < d \mid \theta] \;-\; 1,$$

where the second term is the expected deadweight loss from liquidation.

Contracts must satisfy feasibility: $d \geq 0$ and $m \in [0, a]$. The individual rationality (IR) constraint is $U_i(\theta; d, m) \geq 0$. Incentive compatibility (IC) constraints appear when the bank posts a menu (defined below). Zero-profit (ZP) constraints equate expected revenue to the unit investment for the realized pool.

The timing is as follows. At $t = 0$, the bank posts a menu $\mathcal{M}_b \subset \mathbb{R}_+ \times [0, \bar{a}]$ of secured contracts. The market posts a secured bond contract (d_m, m_m). At $t = 0^+$, each entrepreneur privately observes θ (if not already known), chooses either a contract from $\mathcal{M}_b$, or the market contract, or does not borrow. At $t = 1$, X realizes, repayments/default occur, and collateral is enforced according to the financier's technology.

We impose standard regularity so that self-selection is well-behaved.

Assumption 1. *$F_X(\cdot \mid \theta)$ satisfies first-order stochastic dominance in θ and the monotone likelihood ratio property (MLRP).*[3] *In particular, the repayment probability $G(d \mid \theta)$ is strictly increasing in θ for any fixed d, and the mapping $(d, m) \mapsto U_i(\theta; d, m)$ satisfies single-crossing in d relative to θ.*

Assumption 2. *Entrepreneurs draw a from a distribution on $[0, \bar{a}]$ independent of θ (or with support-wide overlap). Results extend to type-dependent a under a standard monotone regression property.*

[2] Allowing partial recovery of X shifts levels but not the selection logic; it is equivalent to scaling the effective λ_i in the zero-profit conditions.

[3] These conditions are satisfied by standard log-concave families with mean shifts (e.g., Normal with type-dependent mean, Gamma with shape shifts), which is why the results travel beyond the parametric example in Appendix D.

Assumption 3. *Both the bank and market are competitive and risk-neutral. The bank faces free entry (zero profits in equilibrium) and can commit to a menu $\mathcal{M}_b$. The market sets (d_m, m_m) competitively given beliefs about the types who select into the market contract, and earns zero expected profit on that pool in equilibrium.*

Assumption 4. *Liquidation efficiencies satisfy $\lambda_b \in (0,1]$, $\lambda_m \in (0,\lambda_b)$, constant across contracts. The wedge $\Delta = \lambda_b - \lambda_m > 0$ captures enforcement/coordination advantages of banks over dispersed bondholders.*

The bank's menu $\mathcal{M}_b$ is a (possibly continuum) set of pairs (d,m). Let $\mathcal{C}_m := \{(d_m, m_m)\}$ denote the market's contract. Given $(\mathcal{M}_b, \mathcal{C}_m)$ and a tie-breaking rule, a measurable selection function $\sigma : \Theta \to \mathcal{M}_b \cup \mathcal{C}_m \cup \{\varnothing\}$ assigns to each type either a bank contract, the market contract, or no financing. Beliefs about the composition of borrowers served by each financier are induced by σ and used to price contracts competitively.

The relevant constraints can be written compactly. For any candidate pool $S \subseteq \Theta$ that selects a bank contract $(d,m) \in \mathcal{M}_b$, the bank's zero-profit condition is

$$\int_S \Big[d\, G(d \mid \theta) + \lambda_b m \,(1 - G(d \mid \theta)) \Big] \,\mathrm{d}F(\theta) \;=\; \int_S 1 \,\mathrm{d}F(\theta).$$

For the market's contract (d_m, m_m) with pool $T \subseteq \Theta$,

$$\int_T \Big[d_m\, G(d_m \mid \theta) + \lambda_m m_m \,(1 - G(d_m \mid \theta)) \Big] \,\mathrm{d}F(\theta) \;=\; \int_T 1 \,\mathrm{d}F(\theta).$$

For any $(d,m) \in \mathcal{M}_b$ and type $\theta \in S$, IR requires $U_b(\theta; d, m) \geq 0$, and IC requires $U_b(\theta; d, m) \geq U_b(\theta; d', m')$ for all $(d', m') \in \mathcal{M}_b$. For the market, IR requires $U_m(\theta; d_m, m_m) \geq 0$ for $\theta \in T$. When both a bank menu option and the market contract are feasible at zero profit, types choose the option that maximizes U_i; we adopt a minimal tie-breaking rule (e.g., prefer the bank) to select among equal-utility options.[4]

We are interested in equilibria with bank–market coexistence, pure dominance by one source, or (measure-zero) exclusion. Under Assumption 1, the bank's menu can be represented as a monotone allocation in debt face value and collateral. In particular, there exist cutoffs such that higher types face weakly lower d and (weakly) lower expected default, while collateral schedules are monotone in the sense that θ with lower repayment probability is asked to post weakly higher m. The liquidation gap Δ shifts the locus of contracts that satisfy zero profit, which in turn shapes the self-selection partition between bank and market. Section 4 characterizes the competitive bank benchmark. Section 5 introduces the market contract and derives existence and uniqueness of the borrower self-selection equilibrium with comparative statics in $(\Delta, \bar{a})$ and the dispersion of $F_X(\cdot \mid \theta)$.

4 Competitive Bank Benchmark

This section characterizes the allocation that a competitive banking sector implements in isolation. The purpose is twofold. First, it delivers a disciplined benchmark in which collateral

[4] Any fixed, measurable tie-breaking convention delivers the same comparative statics; results stated below are robust to alternative conventions.

and repayment are chosen to screen borrower types under zero profits.[5] Second, it provides the objects and comparative statics we will take to the mixed bank–market environment in Section 5.

Fix the bank's liquidation efficiency $\lambda_b \in (0,1]$ and a borrower of type θ with collateral endowment a. Because banks are competitive with free entry, any contract chosen in equilibrium must yield zero expected profit on the set of types that select it. Under a separating outcome, each type is (weakly) indifferent across all zero-profit contracts that are feasible for that type and strictly prefers the one that maximizes her expected surplus. Hence, in the bank-only environment, each type solves the borrower problem of maximizing $U_b(\theta; d, m)$ subject to the bank's zero-profit constraint and the collateral bound $m \le a$:

$$\max_{d\ge 0,\ 0\le m\le a} \quad U_b(\theta; d, m) \quad \text{s.t.} \quad d\,G(d \mid \theta) + \lambda_b\, m\,[1 - G(d \mid \theta)] = 1.$$

This is the standard Rothschild–Stiglitz logic adapted to secured debt with liquidation losses: competition drives markups to zero on the marginal type served by a given contract.

The borrower's indifference curves in (d, m) space satisfy

$$\left.\frac{\mathrm{d}m}{\mathrm{d}d}\right|_{U_b=\text{const}} = -\frac{G(d \mid \theta)}{1 - G(d \mid \theta)},$$

whereas the zero-profit locus for a given θ has slope

$$\left.\frac{\mathrm{d}m}{\mathrm{d}d}\right|_{\Pi_b=0} = -\frac{G(d \mid \theta) - d\,g(d \mid \theta)}{\lambda_b\,[1 - G(d \mid \theta)]},$$

with $g(d \mid \theta)$ the density of X at d conditional on θ. Interior optima equate these slopes. When the collateral constraint does not bind, tangency pins down the optimal repayment threshold $d^*(\theta)$, and $m^*(\theta)$ follows from zero profit.

Proposition 1. *Suppose Assumptions 1–4 hold and that $F_X(\cdot \mid \theta)$ has a continuous, positive density at all relevant thresholds. In the bank-only environment, there exists a monotone separating equilibrium in which a measure $\Theta_S \subseteq \Theta$ of types is financed and each financed type $\theta \in \Theta_S$ is offered a unique contract $(d^*(\theta), m^*(\theta))$ that maximizes $U_b(\theta; \cdot)$ subject to zero profit and $m \le a$.*

(i) If the collateral constraint is slack, $(d^*(\theta), m^*(\theta))$ solves the tangency condition

$$d^*(\theta)\, g(d^*(\theta) \mid \theta) \;=\; \Big(1 - \lambda_b\Big)\, G(d^*(\theta) \mid \theta)\,,$$

and

$$m^*(\theta) \;=\; \frac{1 - d^*(\theta)\, G(d^*(\theta) \mid \theta)}{\lambda_b\,[1 - G(d^*(\theta) \mid \theta)]}.$$

(ii) If the collateral constraint binds, $m^*(\theta) = a$ and $d^*(\theta)$ is the unique solution to

$$d\,G(d \mid \theta) + \lambda_b\, a\,[1 - G(d \mid \theta)] = 1.$$

(iii) The allocation is monotone. Under the monotone hazard rate property (in addition to Assumption 1), $d^*(\theta)$ and $m^*(\theta)$ are weakly decreasing in θ on Θ_S; safer types obtain weakly lower repayment thresholds and pledge weakly less collateral.

[5] Allowing modest bank market power leaves the sorting and coexistence logic intact and mainly reallocates surplus; the zero-profit benchmark sharpens welfare comparisons without changing the positive predictions.

The intuition is simple. Along the bank's zero-profit locus, a marginal increase in the face value d must be offset by a reduction in collateral m scaled by λ_b, reflecting the bank's expected liquidation proceeds in default. The borrower is willing to trade collateral for a lower d at a rate given by the odds of default relative to repayment. Equating these substitution rates yields the repayment threshold condition in Proposition 1. The right-hand side is proportional to the deadweight component of liquidation, $(1-\lambda_b)$, so more efficient liquidation rotates the zero-profit schedule in a way that lowers the optimal d and m jointly (when interior) and reduces default.

The marginal type is determined by individual rationality. Let $\underline{\theta}_b$ denote the unique type for which $U_b(\underline{\theta}_b; d^*(\underline{\theta}_b), m^*(\underline{\theta}_b)) = 0$ under the borrower-optimal zero-profit choice; all types $\theta \geq \underline{\theta}_b$ are strictly served in equilibrium, while types below the cutoff decline to invest. When collateral binds for some range of types, the cutoff may shift because pledging capacity relaxes zero profit.

Corollary 1. *Fix $\theta \in \Theta_S$.*

(a) If the solution is interior, $d^*(\theta)$ is strictly decreasing in λ_b and $m^*(\theta)$ is strictly decreasing in λ_b. The default probability $1 - G(d^*(\theta) \mid \theta)$ is strictly decreasing in λ_b.

(b) If the collateral constraint binds at $m = a$, then an increase in a strictly decreases $d^*(\theta)$, strictly lowers default probability, and weakly increases borrower surplus. If the solution is interior, small changes in a do not affect $(d^*(\theta), m^*(\theta))$.

(c) Under the monotone hazard rate property, the IR cutoff $\underline{\theta}_b$ is weakly decreasing in λ_b and weakly decreasing in a; more efficient liquidation and greater pledging capacity expand bank finance.

These results recover standard qualitative patterns in a compact form. With competition and free entry, the bank implements borrower-optimal zero-profit contracts. More efficient liquidation shifts out feasible sets, producing lower spreads and less collateral, along with lower default and deadweight loss. Greater collateral endowment helps precisely when the constraint binds; otherwise it is irrelevant at the margin. Monotonicity ensures that safer types face softer terms, which we will use to establish single-crossing selection when the bond market is introduced.

A useful way to visualize the benchmark is in (d, m) space. For a fixed θ, borrower indifference curves are downward-sloping with slope $-G/(1-G)$, and the bank's zero-profit schedule is also downward-sloping with slope $-[G - dg]/[\lambda_b(1-G)]$. The interior solution is at their tangency, provided the implied collateral does not exceed a. If it does, the solution occurs at $m = a$ with d pinned down by zero profit. In either case, the allocation is pinned down by primitives $(F_X(\cdot \mid \theta), \lambda_b, a)$ and does not rely on ad hoc benevolence.

The bank benchmark provides two immediate objects needed below. First, it delivers borrower utilities under bank finance, $U_b(\theta) := U_b(\theta; d^*(\theta), m^*(\theta))$, which determine the outside option when we introduce the bond contract. Second, it yields the default probabilities and pledged collateral by type, which allow a transparent comparison of expected deadweight losses across financiers once the market contract is added. In Section 5 we place the bank menu next to a competitively priced secured bond and derive the self-selection partition between bank and market, prove existence, and characterize the comparative statics in the liquidation gap $\Delta = \lambda_b - \lambda_m$.

5 Adding the Bond Market and Self-Selection

I now introduce a competitively priced, secured bond contract offered by the market and derive the borrower self-selection equilibrium between the bank's menu and the market's single contract. Both financiers can take collateral; the bank has the more efficient liquidation technology. The market's contract must break even on the pool of types it attracts, given beliefs that are consistent with borrowers' choices.

The market offers a secured pair (d_m, m_m) and prices it competitively on the pool $T \subseteq \Theta$ of borrowers who select it. Let $\mathbb{E}_T[\cdot]$ denote the expectation with respect to the cross-section of types in T (i.e., conditional on selecting the market). The market's zero-profit condition requires

$$d_m \, \mathbb{E}_T\Big[G(d_m \mid \theta) \Big] + \lambda_m \, m_m \, \mathbb{E}_T\Big[1 - G(d_m \mid \theta) \Big] \;=\; 1. \tag{1}$$

Borrowers who take (d_m, m_m) receive

$$U_m(\theta; d_m, m_m) \;=\; \mathbb{E}\Big[(X - d_m) \, \mathbf{1}\{X \geq d_m\} \mid \theta \Big] - m_m \, \Pr[X < d_m \mid \theta].$$

For the bank, the borrower-optimal zero-profit contract $(d^*(\theta), m^*(\theta))$ from Section 4 remains feasible for any type; competition and free entry imply that, on any set of types the bank serves in equilibrium, the bank can profitably deviate to offer those borrower-optimal zero-profit contracts. It is therefore without loss to restrict attention to bank menus that coincide with $\{(d^*(\theta), m^*(\theta)) : \theta \in \Theta_S\}$ on their domain of use.

An equilibrium consists of a bank menu $\mathcal{M}_b$ (taken w.l.o.g. to be $\{(d^*(\theta), m^*(\theta))\}$ on the served set), a market contract (d_m, m_m), a measurable selection rule $\sigma : \Theta \to \mathcal{M}_b \cup \{(d_m, m_m)\} \cup \{\varnothing\}$, and beliefs about the composition of the market pool T and bank pool S, such that (i) borrowers best respond given $(\mathcal{M}_b, (d_m, m_m))$, (ii) the market's contract satisfies (1) at T, (iii) the bank earns zero expected profit on each contract it offers, and (iv) beliefs are consistent with σ.

Under Assumption 1 and the monotone hazard rate property, single-crossing in (d, m) implies that both $U_b(\theta) := U_b(\theta; d^*(\theta), m^*(\theta))$ and $U_m(\theta; d_m, m_m)$ are strictly increasing in θ at fixed contracts. It is therefore natural to look for monotone, threshold allocations in which the market attracts the safer types.

Definition 1. *A BME with monotone selection is a triple $(\theta^*, (d_m, m_m), \mathcal{M}_b)$ and a cutoff $\underline{\theta}_b$ such that:*

(i) Types $\theta < \underline{\theta}_b$ do not borrow; types $\theta \in [\underline{\theta}_b, \theta^*)$ choose the bank contract $(d^*(\theta), m^*(\theta))$; types $\theta \geq \theta^*$ choose the market contract (d_m, m_m).

(ii) Beliefs assign $S = [\underline{\theta}_b, \theta^*)$ to the bank and $T = [\theta^*, \overline{\theta}]$ to the market; the market's contract (d_m, m_m) satisfies (1) with $T = [\theta^*, \overline{\theta}]$.

(iii) The cutoff $\underline{\theta}_b$ is the unique type with $U_b(\underline{\theta}_b) = 0$; the cutoff θ^* satisfies the indifference condition

$$U_b(\theta^*) \;=\; U_m(\theta^*; d_m, m_m), \tag{2}$$

and the induced choices are strict on either side of θ^*.

The market's best response to any conjectured pool $T = [\theta^*, \overline{\theta}]$ solves a borrower-utility maximization problem under zero profit. When the collateral constraint does not bind for the market, first-order conditions at an interior solution deliver the pool-averaged repayment threshold condition

$$d_m \, \mathbb{E}_T\Big[g(d_m \mid \theta)\Big] \; = \; \Big(1 - \lambda_m\Big) \, \mathbb{E}_T\Big[G(d_m \mid \theta)\Big], \tag{3}$$

with m_m then determined uniquely by (1). When a collateral cap binds at $m_m = \bar{a}$ (or at any exogenously imposed limit), d_m is pinned down by zero profit.

Proposition 2. *Suppose Assumptions 1–4 hold and $F_X(\cdot \mid \theta)$ admits a continuous, positive density. Then there exists a BME with monotone selection and a unique cutoff $\theta^* \in [\underline{\theta}_b, \overline{\theta}]$ satisfying* (2) *in which the market serves the safer types, $T = [\theta^*, \overline{\theta}]$, and the bank serves the intermediate types, $S = [\underline{\theta}_b, \theta^*)$. The market's contract (d_m, m_m) solves* (3)*–*(1) *at T. If the interior condition fails due to a binding collateral limit for the market, (d_m, m_m) is uniquely determined by zero profit at the boundary. The cutoff θ^* is unique under single-crossing of $U_b(\theta)$ and $U_m(\theta; d_m, m_m)$.*

The intuition mirrors competitive screening with an outside option. The market posts a single pooling contract priced on the distribution of types it expects to attract. Because the bank implements type-specific zero-profit contracts with better liquidation technology, it dominates for sufficiently risky types who would default with higher probability under any given d. Conversely, very safe types value the lower collateral and face value implicit in the market's pooled pricing and migrate to bonds. The intersection of $U_b(\theta)$ and $U_m(\theta; d_m, m_m)$ determines the unique cutoff.

Comparative statics are transparent when stated in terms of the liquidation gap $\Delta = \lambda_b - \lambda_m > 0$ and collateral endowment.

Corollary 2. *Let $\theta^*(\Delta, \bar{a})$ be the equilibrium cutoff.*

(a) θ^* is strictly decreasing in Δ: a larger bank–market liquidation gap expands the range of types served by the bank and shrinks the range served by the market.

(b) If collateral constraints bind on a positive-measure set of bank types, θ^* is weakly decreasing in $\bar{a}$: greater pledging capacity expands bank finance. If constraints are slack throughout the relevant range, small changes in $\bar{a}$ leave θ^* unchanged.

(c) As $\Delta \to 0$, $\theta^* \downarrow \underline{\theta}_b$: with no advantage in liquidation, the market serves all financed types at the pooled zero-profit contract. As $\Delta \to 1 - \lambda_m$ (maximal bank advantage), $\theta^* \uparrow \overline{\theta}$: the bank serves nearly all financed types.

The corollary formalizes the usual "cream-skimming with a twist." When the bank's liquidation advantage is small, the market's pooled pricing is attractive to nearly all safe types, and competition pushes the bank to the margin. As the advantage grows, bank contracts become strictly better for increasingly safe types because the expected deadweight loss in distress falls more for bank finance than for bond finance; the bank consequently captures a larger segment of the type distribution. Collateral moves the cutoff only when it relaxes a binding constraint.

Two further observations will be useful for welfare. First, the expected deadweight loss per financed borrower is lower under bank finance holding default probabilities fixed because $(1 - \lambda_b) < (1 - \lambda_m)$. Second, default probabilities themselves differ across financiers in equilibrium due to the endogenous choice of d and m. In the interior region, both d_m and

m_m satisfy the pool-averaged analogue of the bank's tangency condition with λ_m replacing λ_b, so default under the market contract is weakly higher for any given type than under the bank contract targeted to that type. The welfare section will aggregate these differences to compare a bank-only allocation, a market-only allocation, and the coexistence equilibrium.

Finally, while the main text assumes exclusive contracting for clarity, the equilibrium partition and its comparative statics survive in a nonexclusive environment under standard "no-arbitrage with splits" conditions.[6] Allowing borrowers to combine a bank loan with a small bond issue generally leaves the cutoff characterization intact while slightly attenuating rents at the top; the appendix provides details and a sufficient condition under which the same monotone cutoff obtains.

6 Welfare and Comparative Statics

This section compares aggregate surplus across three regimes: bank-only, market-only, and coexistence. The benchmark for welfare is the ex-ante social surplus net of the unit investment cost, integrating over the set of financed types in each regime. Because all agents are risk-neutral and the risk-free rate is zero, private and social values differ only through liquidation deadweight losses.[7]

For a type θ financed by financier $i \in \{b, m\}$ under contract (d_i, m_i), social surplus equals

$$W_i(\theta; d_i, m_i) \;=\; \mu(\theta) \;-\; (1-\lambda_i)\, m_i \;\Pr[X < d_i \mid \theta] \;-\; 1.$$

Let $q_i(\theta) := 1 - G(d_i \mid \theta)$ denote the default probability under i's contract. In the bank-only regime, denote the equilibrium served set by $S^B = [\underline{\theta}_b^B, \overline{\theta}]$ and the type-specific contracts by $(d_b^B(\theta), m_b^B(\theta))$. In the market-only regime, the unique pooling contract is (d_m^M, m_m^M) priced on $[\underline{\theta}_m^M, \overline{\theta}]$. In the coexistence regime, denote the bank and market pools by $S^{BM} = [\underline{\theta}_b^{BM}, \theta^*]$ and $T^{BM} = [\theta^*, \overline{\theta}]$, with $(d_b^{BM}(\theta), m_b^{BM}(\theta))$ on S^{BM} and (d_m^{BM}, m_m^{BM}) on T^{BM}.

Aggregate welfare under regime $\mathcal{R} \in \{B, M, BM\}$ is

$$\mathcal{W}(\mathcal{R}) \;=\; \int_{\Theta_\mathcal{R}} \Big(\mu(\theta) - 1\Big)\, \mathrm{d}F(\theta) \;-\; \int_{\Theta_\mathcal{R}} (1 - \lambda_{i(\theta)})\, m_{i(\theta)}(\theta)\, q_{i(\theta)}(\theta)\, \mathrm{d}F(\theta),$$

where $\Theta_B = S^B$, $\Theta_M = [\underline{\theta}_m^M, \overline{\theta}]$, and $\Theta_{BM} = S^{BM} \cup T^{BM}$; the map $i(\theta)$ picks the relevant financier in each regime. The first integral depends only on the extensive margin (which types invest). The second collects expected liquidation losses and captures the intensive margin of contract choice.

Two forces drive the comparison between bank-only and coexistence. Moving safe types from bank contracts to a pooled market contract reduces screening distortions that were present in the bank-only menu, but it raises the deadweight cost of liquidation because $\lambda_m < \lambda_b$. The net effect depends on the liquidation gap $\Delta = \lambda_b - \lambda_m$ and on how strongly the bank-only menu distorts the top of the type distribution.

[6] With nonexclusive contracting, mixing arises only for marginal types when the liquidation wedge is small; the monotone cutoff and comparative statics survive (Appendix B.1).

[7] This normalization isolates liquidation losses as the only wedge between private and social value. Introducing taxes or risk premia would add level effects without altering the selection logic.

Proposition 3. *Assume the conditions of Propositions 1 and 2. Let $H := [\theta^*, \overline{\theta}]$ denote the set of types served by the market under coexistence, with (d_m^{BM}, m_m^{BM}) priced on H. Then*

$$\mathcal{W}(BM) - \mathcal{W}(B) = \underbrace{\int_H \Big[(1-\lambda_b)\, m_b^B(\theta)\, q_b^B(\theta) - (1-\lambda_m)\, m_m^{BM}\, q_m^{BM}(\theta)\Big] \mathrm{d}F(\theta)}_{\textit{liquidation penalty } (\le 0) \textit{ if contracts unchanged}}$$

$$+ \underbrace{\Delta_{screen}}_{\textit{screening-relief } (\ge 0)} + \underbrace{\Delta_{ext}}_{\textit{extensive-margin}} .$$

The liquidation term compares deadweight losses for types that switch from bank to market. The screening-relief term collects utility-improving changes in (d, m) induced on H by replacing type-specific bank contracts with a pooled market contract that relaxes bank-side incentive constraints at the top. The extensive-margin term captures any change in the lower cutoff, $\underline{\theta}_b^{BM}$ vs. $\underline{\theta}_b^B$.

The decomposition isolates the mechanism. Holding contracts fixed, switching a given type from bank to market only raises deadweight loss because $\lambda_m < \lambda_b$. Coexistence improves welfare only to the extent that replacing the top of the bank menu with a pooled market contract relaxes screening distortions enough to offset the higher liquidation loss, or because the extensive margin changes which types invest. This is the familiar competition-with-outside-option logic in a liquidation-friction environment.

Corollary 3. *Suppose the coexistence equilibrium is interior on H and collateral constraints are slack for all $\theta \in H$. Then there exists $\bar{\Delta} > 0$ such that for all $\Delta \in (0, \bar{\Delta})$,*

$$\mathcal{W}(BM) > \mathcal{W}(B).$$

Moreover, $\bar{\Delta}$ is weakly increasing in the dispersion of types at the top of the distribution (which raises the value of pooling among safe borrowers) and weakly decreasing in the sensitivity of default probabilities to d at the relevant thresholds (which raises liquidation losses under the market contract).

When the bank's liquidation advantage is small, the market's pooled pricing among very safe types removes screening wedges that the bank-only menu would otherwise impose to deter mimicry by slightly riskier types. Pooling eliminates those wedges without attracting the riskier borrowers because the pooled price embeds their higher default probability. If the liquidation advantage becomes large, the bank dominates because it can offer nearly first-best contracts type by type while preserving low deadweight loss in distress.

A related comparison shows that market-only is generally dominated unless the liquidation gap is negligible and the type distribution is extremely concentrated near the top.

Proposition 4. *If collateral constraints are slack on $[\underline{\theta}_b^B, \overline{\theta}]$ and the monotone hazard rate property holds, then $\mathcal{W}(B) \ge \mathcal{W}(M)$, with strict inequality for any $\Delta > 0$. If collateral binds for a positive-measure set near the bank's lower cutoff, market-only can finance a larger set than bank-only, but the intensive-margin loss from $\lambda_m < \lambda_b$ must then be weighed against the extensive gain; a sufficient condition for $\mathcal{W}(B) > \mathcal{W}(M)$ is*

$$\int_{\underline{\theta}_m^M}^{\underline{\theta}_b^B} \Big(\mu(\theta) - 1\Big)\, \mathrm{d}F(\theta) \;<\; \int_{\underline{\theta}_b^B}^{\overline{\theta}} \Big[(1-\lambda_m)\, m_m^M\, q_m^M(\theta) - (1-\lambda_b)\, m_b^B(\theta)\, q_b^B(\theta)\Big]\, \mathrm{d}F(\theta).$$

The proposition formalizes the idea that, absent collateral scarcity, a bank with better liquidation can replicate any market allocation with weakly lower deadweight loss, up to incentive constraints. Market-only becomes appealing only when it substantially expands the extensive margin by reaching collateral-poor but safe types that the bank cannot profitably serve at zero profit.

Comparative statics with respect to primitives follow directly.

Corollary 4. *(i) Fix the set of financed types in a given regime. Aggregate welfare is strictly increasing in λ_i for the active financier(s) through a reduction in expected liquidation losses. In coexistence, $\partial\mathcal{W}(BM)/\partial\Delta > 0$ holding (S^{BM}, T^{BM}) fixed.*

(ii) Allow the equilibrium partition to adjust. The cutoff θ^* is strictly decreasing in Δ (Corollary 2), and the induced change in $\mathcal{W}(BM)$ is the sum of a direct liquidation effect (positive) and a reallocation effect from H to S^{BM} (ambiguous in general, positive if screening wedges at the top are small).

(iii) If collateral constraints bind on a positive-measure set for the bank, an increase in the collateral endowment $\bar{a}$ weakly raises $\mathcal{W}(B)$ and $\mathcal{W}(BM)$ by relaxing zero-profit constraints and lowering default. If constraints are slack throughout, small changes in $\bar{a}$ have no first-order welfare effect.

The upshot is a simple testable mapping. In cross sections where observed recovery rates and covenant intensity favor banks (a large Δ), the allocation should tilt toward bank finance and the welfare ranking should favor bank-only relative to market-only, with coexistence adding little beyond the extensive margin. In settings where recovery differences are modest and the upper tail of types is thick, coexistence should be strictly welfare-improving because it removes screening wedges for safe borrowers at a small liquidation cost penalty.

Section 7 translates these results into empirical implications for issuance composition, collateralization, and observed recovery, and sketches two robustness extensions including nonexclusive contracting and a cooperative-banking appendix benchmark. Proofs of the propositions and corollaries in this section are provided in the appendix.

7 Empirical Implications and Extensions

The model yields a set of cross-sectional and time-series predictions that map directly into observable quantities: recovery rates, covenant intensity, collateral usage, and the composition of external finance between bank loans and bonds. The central primitive is the liquidation gap $\Delta = \lambda_b - \lambda_m > 0$; larger Δ raises the relative efficiency of bank finance in distress and shifts the borrower self-selection cutoff in favor of banks.[8]

Empirical implications are most transparent when stated conditionally on observables that proxy for type θ (e.g., profitability, volatility, size) and collateral endowment a (e.g., tangibility).

[8] In practice, Δ can be proxied by loan-vs-bond recoveries instrumented by restructuring congestion, by bondholder dispersion and covenant strength indices, or by the incidence of covenant-lite terms.

Debt composition and pricing

First, the bank share of external finance is increasing in Δ. In cross section,

$$\text{BankShare}_{f,t} \uparrow \text{ with } \Delta_{r,t},$$

where $\Delta_{r,t}$ is measured at region/industry level r using observable proxies for liquidation efficiency and creditor coordination. Second, holding observable risk constant, bank loan spreads relative to matched bond yields fall with Δ for marginal borrowers near the cutoff, reflecting both lower expected deadweight loss and reduced screening wedges on the bank menu. Third, improvements in market-side enforcement (higher λ_m) tilt issuance toward bonds and compress the spread wedge, with the strongest effects among safe borrowers.

Collateral usage and default patterns

Among bank borrowers, interior solutions imply that higher λ_b reduce both d and m, so the average collateralization of bank loans declines when bank-side liquidation becomes more efficient. Composition, however, moves additional types from the market into the bank pool as Δ rises; the net effect on average m in bank loans is therefore ambiguous a priori. Two conditional predictions follow. Within-firm or within-industry changes in bank-side enforcement that leave the pool composition fixed reduce pledged collateral per loan. Across firms, increases in Δ raise the fraction of collateralized bank loans due to selection, especially where a is large.

Default probabilities exhibit the same structure. For a given type, default is weakly lower under bank contracts than under the market contract because the bank chooses lower d at comparable or lower m when $\lambda_b > \lambda_m$. Near the cutoff, event-study variation in Δ moves marginal firms from the market to the bank and reduces their default frequency ex post even when observables are held fixed.

Collateral endowments and interaction effects

Greater pledging capacity expands bank finance only when collateral constraints bind. Hence, the effect of Δ on issuance composition is stronger in collateral-rich sectors (high tangibility) and weaker in collateral-poor sectors. Formally, interaction terms between proxies for a and Δ should be positive in bank-share regressions and negative in bond-share regressions. The same interaction sharpens predictions for spread wedges and default differences around the cutoff.

Natural experiments and identification

Several sources of plausibly exogenous variation can identify the causal effects implied by the model. Legal or procedural changes that alter recovery rates or creditor coordination costs shift λ_b or λ_m (or both). Court congestion, reorganization practice, or secured transactions reforms generate discrete movements in expected liquidation losses and covenant enforceability. For market-side changes, shifts in covenant technology and investor dispersion in public bonds move λ_m by altering coordination frictions. Within the loan market, swings toward covenant-lite contracting attenuate effective control rights, reducing λ_b and pushing marginal borrowers toward bonds.

These changes suggest standard designs: difference-in-differences when reforms are staggered across jurisdictions or industries with heterogeneous ex-ante exposure, event studies around sharp policy onsets, and triple differences that interact reforms with asset tangibility. Judge or court-district fixed effects, time-varying legal indices, and pre-trends help separate selection from treatment effects.

Measurement and baseline specifications

Let $\text{BankShare}_{f,t}$ denote the fraction of new external debt raised as bank loans by firm f at time t; define $\text{SpreadGap}_{f,t}$ as the matched loan–bond spread difference on the narrowest window around issuance; and let $\text{Default}_{f,t+\tau}$ be an indicator for failure within horizon τ. Construct $\Delta_{r,t}$ using recovery-based proxies (e.g., instrumented recoveries on comparable defaults for loans versus bonds within region/industry r) or coordination-based proxies (e.g., covenant indices, investor dispersion).

A baseline specification for composition is

$$\text{BankShare}_{f,t} \;=\; \alpha + \beta_1\,\Delta_{r,t} + \beta_2\,\text{Tangibility}_{f,t} + \beta_3\,\Delta_{r,t}\times\text{Tangibility}_{f,t} + \gamma' X_{f,t} + \mu_{i\times t} + \varepsilon_{f,t},$$

with $X_{f,t}$ a standard risk and information set (size, profitability, volatility, age), and $\mu_{i\times t}$ industry-by-time fixed effects. The model predicts $\beta_1 > 0$ and $\beta_3 > 0$. For pricing near the cutoff,

$$\text{SpreadGap}_{f,t} \;=\; \eta \;+\; \kappa_1\,\Delta_{r,t} \;+\; \kappa_2\,\Delta_{r,t}\times\mathbb{1}\{\text{NearCutoff}_{f,t}\} \;+\; \phi' X_{f,t} \;+\; \mu_{i\times t} \;+\; u_{f,t},$$

with $\kappa_2 < 0$ when banks' advantage lowers borrower cost for marginal types. For default outcomes,

$$\Pr\Big(\text{Default}_{f,t+\tau} = 1\Big) \;=\; \Lambda\Big(\rho + \delta_1\mathbb{1}\{\text{Bank}_{f,t}\} + \delta_2\,\Delta_{r,t} + \delta_3\mathbb{1}\{\text{Bank}_{f,t}\}\times\Delta_{r,t} + \psi' X_{f,t} + \mu_{i\times t}\Big),$$

and the model predicts $\delta_3 < 0$ for marginal borrowers.

Additional predictions and falsification

Three additional patterns are sharp. First, the fraction of firms simultaneously using both a loan and a bond rises when Δ is small and falls when Δ is large, consistent with limited gains from mixing when one financier has a strong liquidation advantage. Second, the sensitivity of loan covenants to observable risk declines with Δ because part of the bank's control comes from liquidation efficiency rather than ex-ante covenant tightness. Third, near-policy discontinuities that raise λ_m disproportionately shift safe issuers to bonds with little change in their subsequent investment sensitivity to cash flow, indicating substitution rather than a change in underlying type.

Extensions and robustness

Nonexclusive contracting can be accommodated by allowing borrowers to split financing between the bank and the market. Under standard no-arbitrage conditions, the monotone cutoff in the main text remains, with limited splitting for marginal types when Δ is small. A cooperative or mutual-bank benchmark can be microfounded via membership fees and internal risk sharing without altering the positive selection predictions; it primarily affects surplus division and the treatment of low types close to the financing margin. Heterogeneous liquidation technologies across industries or asset classes sharpen identification and generate cross-sectional tilts in composition consistent with observable redeployability. Endogenous investment scale is a natural extension; in a version with convex costs, safer types increase scale more when migrating to bonds after market-side enforcement improves, magnifying issuance shifts. Finally, a maturity margin is complementary: longer-maturity bank loans become more attractive when liquidation efficiency increases, while bonds extend in response to stronger market enforcement.

These implications can guide future empirical work.

8 Conclusion

This paper develops a compact comparison of bank and bond finance under adverse selection when both can take collateral but differ in enforcement and liquidation efficiency. Banks are profit-maximizing and compete with free entry; the only primitive asymmetry is a lower deadweight loss in liquidation for banks than for dispersed bondholders. Within this disciplined environment I derive the borrower self-selection equilibrium, characterize when bank and market finance coexist and how the partition shifts with the liquidation gap and collateral, and compare welfare across bank-only, market-only, and coexistence regimes.

Two messages emerge. First, giving collateral to both financiers while allowing a bank–market wedge in liquidation efficiency is enough to rationalize realistic segmentation and coexistence without relying on ad hoc benevolence or restricted contract sets. Second, the welfare ranking turns on a transparent trade-off: pooling safe types into a market contract relaxes screening wedges but raises expected liquidation losses. Coexistence strictly improves welfare when the bank's advantage is modest and the upper tail is sufficiently thick; bank dominance emerges when liquidation differences are large or collateral constraints are slack.

The theory delivers testable implications that line up with observable objects. A larger liquidation gap predicts a higher bank share of new borrowing, lower spreads and default for marginal borrowers moving from bonds to loans, and stronger effects in collateral-rich sectors. Improvements in market-side enforcement tilt issuance toward bonds and compress loan–bond spread differences, especially for safe issuers. These predictions suggest straightforward empirical designs exploiting legal or contractual shocks to recovery and creditor coordination.

The framework also points to policy trade-offs. Reforms that raise recovery on the market side deepen bond finance but may reallocate rather than expand total surplus if the bank's advantage is sizeable; conversely, weakening loan contract enforceability (for example via widespread covenant-lite adoption) can shift marginal borrowers toward bonds and increase default risk on the margin. Because the objects are observables—recoveries, covenant intensity, collateralization—the model can be brought to data with minimal institutional overfitting.

Several limitations are deliberate and open avenues for further work. Liquidation efficiencies are taken as exogenous; endogenizing them through creditor bargaining, court congestion, or covenant technology would allow richer policy counterfactuals. Maturity is suppressed; introducing a maturity choice would connect liquidation efficiency to term structure and rollover risk. Nonexclusive contracting is treated in robustness; embedding full mixing and secondary-market trading is a natural extension. Finally, a dynamic version with information production and reputation would let firms migrate systematically across financiers over time and deliver richer investment responses to enforcement shocks.

Overall, the contribution is a tractable, microfounded map from enforcement and collateral to the composition of external finance, selection, and welfare. The map is simple enough to calibrate and rich enough to generate sharp empirical tests, making it a useful benchmark for interpreting changes in creditor rights, covenant practice, and the evolving boundary between banks and markets.

Appendix A. Proofs

This appendix contains proofs for Propositions 1, 2, 3 and their corollaries. Throughout, $G(d \mid \theta) = \Pr[X \geq d \mid \theta]$ is continuously differentiable in d with density $g(d \mid \theta) := -\partial G/\partial d > 0$, and Assumptions 1–4 hold. All integrals are well defined and Fubini/Tonelli conditions are met.

A.1 Preliminaries

For a financier $i \in \{b, m\}$, a contract (d, m) yields borrower expected utility

$$U_i(\theta; d, m) = \mathbb{E}\Big[(X - d)\mathbf{1}\{X \geq d\} \mid \theta\Big] - m\,(1 - G(d \mid \theta)).$$

Envelope calculations give the partial derivatives (holding type fixed):

$$\frac{\partial U_i}{\partial d}(\theta; d, m) = -G(d \mid \theta), \qquad \frac{\partial U_i}{\partial m}(\theta; d, m) = -(1 - G(d \mid \theta)).$$

Hence indifference curves in (d, m) space satisfy

$$\left.\frac{\mathrm{d}m}{\mathrm{d}d}\right|_{U_i=\text{const}} = -\frac{G(d \mid \theta)}{1 - G(d \mid \theta)} < 0.$$

Financier i's zero-profit condition on a type-θ contract is

$$\Pi_i(\theta; d, m) := d\,G(d \mid \theta) + \lambda_i m\,[1 - G(d \mid \theta)] - 1 = 0,$$

with partial derivatives

$$\frac{\partial \Pi_i}{\partial d}(\theta; d, m) = G(d \mid \theta) - d\,g(d \mid \theta) + \lambda_i m\,g(d \mid \theta), \qquad \frac{\partial \Pi_i}{\partial m}(\theta; d, m) = \lambda_i\,[1 - G(d \mid \theta)].$$

Thus the zero-profit locus has slope

$$\left.\frac{\mathrm{d}m}{\mathrm{d}d}\right|_{\Pi_i=0} = -\frac{G(d \mid \theta) - d\,g(d \mid \theta) + \lambda_i m\,g(d \mid \theta)}{\lambda_i\,[1 - G(d \mid \theta)]}.$$

Under Assumption 1, single-crossing of U_i in d relative to θ holds.

A.2 Proof of Proposition 1

Fix θ and a. In a bank-only environment with free entry, any contract chosen in equilibrium must satisfy $\Pi_b(\theta; d, m) = 0$; otherwise a competitor offering the borrower-optimal zero-profit contract would attract the type. The borrower solves

$$\max_{d\geq 0,\ 0\leq m\leq a} U_b(\theta; d, m) \quad \text{s.t.} \quad \Pi_b(\theta; d, m) = 0.$$

Interior solutions equate the slopes of the borrower indifference and the bank zero-profit loci, yielding the tangency condition

$$\frac{G(d \mid \theta)}{1 - G(d \mid \theta)} = \frac{G(d \mid \theta) - d\,g(d \mid \theta) + \lambda_b m\,g(d \mid \theta)}{\lambda_b\,[1 - G(d \mid \theta)]}. \tag{4}$$

Together with $\Pi_b(\theta; d, m) = 0$, this system implicitly defines $(d^*(\theta), m^*(\theta))$ provided $m^*(\theta) < a$. If the implied m exceeds a, the collateral constraint binds and $(d^*(\theta), m^*(\theta))$ is pinned down by $\Pi_b(\theta; d, a) = 0$.

Existence and uniqueness of the borrower-optimal zero-profit point follow from continuity and strict quasi-concavity of U_b along the zero-profit locus. Along $\Pi_b = 0$, m is an implicit function of d: $m(d) = [1 - d\,G(d \mid \theta)]/[\lambda_b(1 - G(d \mid \theta))]$, which is continuous on the relevant compact set; $U_b(\theta; d, m(d))$ is continuously differentiable with derivative $-G(d \mid \theta) + (\partial U_b/\partial m)\, m'(d)$. Standard arguments show a unique interior maximizer unless the boundary constraint binds, in which case uniqueness of d on $m = a$ follows from strict monotonicity of Π_b in d.

Monotonicity in θ uses Assumption 1 and the monotone hazard rate property. Single-crossing implies that if $\theta' > \theta$ then, at any (d, m), $U_b(\theta'; d, m) - U_b(\theta; d, m)$ is strictly increasing in d. Hence the set of optimal d along zero profit is weakly decreasing in θ; $m^*(\theta)$ is weakly decreasing via the zero-profit mapping. The lower IR cutoff $\underline{\theta}_b$ is unique because $U_b(\theta; d^*(\theta), m^*(\theta))$ is strictly increasing in θ by single-crossing and the continuity of (d^*, m^*) in θ. This proves the existence, uniqueness, and monotonicity claims.

A.3 Proof of Corollary 1

For interior types, the solution is characterized by (4) and $\Pi_b = 0$. Apply the implicit function theorem to the system in (d, m) with parameters (λ_b, a). Increasing λ_b rotates the zero-profit locus outward (for given d) and lowers the slope magnitude $|\mathrm{d}m/\mathrm{d}d|$ at the tangency; the unique maximizer therefore has strictly lower d^* and m^*. Default probability $1 - G(d^* \mid \theta)$ falls strictly with d^*. If $m = a$ binds, differentiating $\Pi_b(\theta; d, a) = 0$ yields $\partial d^*/\partial a < 0$. The IR cutoff $\underline{\theta}_b$ shifts down when either λ_b or a increases, because $U_b(\theta; d^*, m^*)$ increases pointwise in these parameters and is strictly increasing in θ.

A.4 Proof of Proposition 2

Fix a cutoff candidate $\vartheta \in [\underline{\theta}_b, \overline{\theta}]$ and suppose the market expects pool $T = [\vartheta, \overline{\theta}]$. For that pool, the market chooses (d_m, m_m) to maximize borrower utility subject to zero profit:

$$\max_{d \geq 0,\ 0 \leq m \leq \bar{a}} \ \mathbb{E}_T\Big[(X - d)\mathbf{1}\{X \geq d\}\Big] - m\,\mathbb{E}_T[1 - G(d \mid \theta)]$$

subject to

$$d\,\mathbb{E}_T[G(d \mid \theta)] + \lambda_m m\,\mathbb{E}_T[1 - G(d \mid \theta)] = 1.$$

Interior solutions satisfy the pool-averaged tangency and zero-profit conditions

$$\frac{\mathbb{E}_T[G(d \mid \theta)]}{\mathbb{E}_T[1 - G(d \mid \theta)]} = \frac{\mathbb{E}_T[G(d \mid \theta) - d\,g(d \mid \theta) + \lambda_m m\,g(d \mid \theta)]}{\lambda_m\,\mathbb{E}_T[1 - G(d \mid \theta)]}, \tag{5}$$

$$d\,\mathbb{E}_T[G(d \mid \theta)] + \lambda_m m\,\mathbb{E}_T[1 - G(d \mid \theta)] = 1. \tag{6}$$

If the collateral bound binds at $m = \bar{a}$, (6) pins down d.

Given $(d_m(\vartheta), m_m(\vartheta))$ that solve (5)–(6), define the difference in borrower utilities

$$\Phi(\theta; \vartheta) := U_b(\theta; d^*(\theta), m^*(\theta)) - U_m(\theta; d_m(\vartheta), m_m(\vartheta)).$$

By Assumption 1 and the continuity of (d^*, m^*), $\Phi(\cdot; \vartheta)$ is continuous and strictly increasing in θ (single-crossing). For fixed ϑ, existence and uniqueness of a type θ solving $\Phi(\theta; \vartheta) = 0$ follow from intermediate value and monotonicity, provided the signs at the endpoints differ. At $\theta = \underline{\theta}_b$, $U_b = 0 \geq U_m$ because the market contract priced on $[\vartheta, \overline{\theta}]$ is unattractive to low types; at $\theta = \overline{\theta}$, $U_m \geq U_b$ for sufficiently small $\Delta > 0$ (when interior) or generically by continuity otherwise. Thus there exists a unique $\theta^*(\vartheta)$ solving $\Phi(\theta^*(\vartheta); \vartheta) = 0$. The candidate equilibrium cutoff must satisfy the fixed-point condition $\theta^*(\vartheta) = \vartheta$. Define $\Gamma(\vartheta) := \theta^*(\vartheta) - \vartheta$. Continuity of Γ and sign changes at endpoints imply a unique fixed point by the intermediate value theorem; this fixed point is the equilibrium cutoff. The induced pools are $S = [\underline{\theta}_b, \theta^*)$ and $T = [\theta^*, \overline{\theta}]$. Uniqueness follows from single-crossing of U_b and U_m in θ.

A.5 Proof of Corollary 2

Let $\theta^*(\Delta, \bar{a})$ denote the unique fixed point. Totally differentiate the indifference condition $U_b(\theta^*) = U_m(\theta^*; d_m(\theta^*), m_m(\theta^*))$ with respect to $\Delta = \lambda_b - \lambda_m$, using the envelope theorem on the bank side and the implicit function theorem on the market side. Because $\partial U_b/\partial \lambda_b > 0$ at the borrower-optimal bank contract and $\partial U_m/\partial \lambda_m > 0$ at the market optimum, while $\partial U_m/\partial \lambda_b = 0 = \partial U_b/\partial \lambda_m$, one obtains

$$\frac{\mathrm{d}\theta^*}{\mathrm{d}\Delta} = -\,\frac{\partial U_b/\partial \lambda_b + \partial U_m/\partial \lambda_m}{\partial U_b/\partial \theta - \partial U_m/\partial \theta} \ < \ 0,$$

since the denominator is strictly positive by single-crossing. The collateral comparative static is analogous. If the collateral constraint binds for the bank on a positive-measure set, then $\partial U_b/\partial \bar{a} > 0$ near the constraint, shifting the indifference in favor of the bank and lowering θ^*; otherwise the derivative is zero.

A.6 Proof of Proposition 3

Write aggregate welfare as

$$\mathcal{W}(\mathcal{R}) = \int_{\Theta_{\mathcal{R}}} \Big(\mu(\theta) - 1\Big)\, \mathrm{d}F(\theta) - \int_{\Theta_{\mathcal{R}}} (1 - \lambda_{i(\theta)})\, m_{i(\theta)}(\theta)\, q_{i(\theta)}(\theta)\, \mathrm{d}F(\theta).$$

Subtract $\mathcal{W}(B)$ from $\mathcal{W}(BM)$. The set difference occurs only on $H = [\theta^*, \overline{\theta}]$ for intensive-margin contracts and around the lower cutoff for the extensive margin. Add and subtract the bank-only deadweight losses evaluated for the types in H to obtain

$$\mathcal{W}(BM) - \mathcal{W}(B) = \int_H \Big[(1-\lambda_b) m_b^B q_b^B - (1-\lambda_m) m_m^{BM} q_m^{BM}\Big] \mathrm{d}F \; + \; \Delta_{\text{screen}} \; + \; \Delta_{\text{ext}}.$$

The first bracket is weakly nonpositive holding contracts fixed because $\lambda_b > \lambda_m$ and bank-only contracts minimize deadweight loss for each type given zero profit. Δ_{screen} captures the utility-improving relaxation of screening wedges among the safe types when replacing a menu with a pooled contract at zero profit on H; by revealed preference at equal cost, it is weakly nonnegative. Δ_{ext} is the change in the measure of financed types (lower cutoff). This yields the stated decomposition.

A.7 Proof of Corollaries 3 and 4

For Corollary 3, suppose the coexistence equilibrium is interior on H with slack collateral constraints. As $\Delta \downarrow 0$, the liquidation penalty term is of order $O(\Delta)$, while the screening-relief term is first order in the dispersion of top types because the pooled market contract removes menu-induced wedges among nearby types. Hence there exists $\bar{\Delta} > 0$ such that for all $\Delta \in (0, \bar{\Delta})$ the screening gain dominates.

For Corollary 4, fix the partition and differentiate $\mathcal{W}$ with respect to λ_i. The derivative equals minus the integral of $m_i q_i$ over the relevant pool, which is strictly negative; thus welfare rises with λ_i. Allowing the partition to move, apply the envelope theorem and the cutoff comparative statics to decompose the total derivative into a direct liquidation effect and a reallocation effect; signs follow from Corollary 2 and the decomposition in Proposition 3.

Appendix B. Robustness and Extensions

This section sketches robustness checks referenced in the main text.

B.1 Nonexclusive contracting

Allow borrowers to split financing between bank and market, taking (d_b, m_b) and (d_m, m_m) subject to two zero-profit constraints. Under standard no-arbitrage and convexity, the borrower's problem is jointly convex and the solution either coincides with the exclusive outcome or features a small amount of splitting for marginal types when Δ is small. Monotone selection with a unique cutoff survives because single-crossing in θ is preserved and the joint budget set is convex with a supporting hyperplane at the margin. Details are available on request and can be added as a formal lemma if needed.

B.2 Cooperative/mutual bank benchmark

A cooperative intermediary can be microfounded by introducing a membership fee ϕ and redistributing profits to members so that the per-type objective is $U_b(\theta; d, m) + \phi$ subject to a break-even constraint on the coalition. Under independent and identically distributed membership draws and a large-membership law of large numbers, the coalition's budget constraint pins down ϕ; the individual FOCs mirror those in the competitive case with a constant shift in IR. Positive selection and the coexistence cutoff are unaffected; only surplus division changes.

B.3 Heterogeneous liquidation technologies

Let $\lambda_b(z)$ and $\lambda_m(z)$ vary by industry or collateral class z. All proofs carry through with $\Delta(z)$ replacing Δ. The cutoff becomes $\theta^*(z)$ with $\partial\theta^*(z)/\partial\Delta(z) < 0$. Cross-sectional predictions in Section 7 follow directly.

B.4 Endogenous investment scale

Allow project scale k with cost k and payoff kX. The borrower's problem scales linearly except for default probabilities, which depend on d/k. In the bank-only benchmark, k is undistorted when the interior tangency holds; with coexistence, marginal safe types increase k upon moving to the market after an improvement in λ_m, amplifying issuance shifts. The main comparative statics are unchanged.

B.5 Maturity

Let debt maturity T enter via $G_T(d \mid \theta)$, with G_T increasing in T at fixed d for safer types. The tangency and zero-profit conditions generalize by replacing G and g with G_T and $g_T = \partial G_T/\partial d$. If longer maturities raise default risk for risky types more than for safe types, the cutoff shifts toward the bank as T increases when Δ is large, and toward the market when Δ is small.

Appendix C. Notation and Additional Derivations

For convenience, here are two identities used repeatedly. First,

$$\frac{\partial U_i}{\partial d}(\theta; d, m) = -G(d \mid \theta) \quad \text{and} \quad \frac{\partial U_i}{\partial m}(\theta; d, m) = -(1 - G(d \mid \theta)).$$

Second, along zero profit with $i \in \{b, m\}$,

$$m(d) = \frac{1 - d\,G(d \mid \theta)}{\lambda_i\,[1 - G(d \mid \theta)]}, \qquad \frac{\mathrm{d}m}{\mathrm{d}d}\bigg|_{\Pi_i=0} = -\,\frac{G(d \mid \theta) - d\,g(d \mid \theta) + \lambda_i m(d)\,g(d \mid \theta)}{\lambda_i\,[1 - G(d \mid \theta)]}.$$

These expressions are sufficient for reproducing the tangency conditions and all comparative statics used in the proofs above without imposing functional-form restrictions on $F_X(\cdot \mid \theta)$.

Appendix D. Parametric Example

This appendix specializes the model to a tractable case that delivers closed-form objects suitable for diagrams or quick calibration.[9]

D.1 Primitives and type distribution

Project payoffs are uniform conditional on type. For each entrepreneur with type $\theta > 0$,

$$X \mid \theta \sim \text{Uniform}[0, \theta], \qquad G(d \mid \theta) = \frac{\theta - d}{\theta} \text{ for } 0 \leq d \leq \theta, \quad g(d \mid \theta) = \frac{1}{\theta}.$$

This family satisfies MLRP and a monotone hazard rate. The investment cost is 1, the safe rate is zero, and all agents are risk neutral.

Types are Pareto on $[\theta_0, \infty)$ with tail index $\alpha > 0$:

$$F(\theta) = 1 - \left(\frac{\theta_0}{\theta}\right)^{\alpha}, \qquad \theta \geq \theta_0,$$

with $\mathbb{E}[1/\theta \mid \theta \geq \vartheta] = (\alpha/(\alpha+1))\,\vartheta^{-1} \equiv c/\vartheta$. Collateral endowment is $a > 0$.

D.2 Competitive bank benchmark (closed form)

For financier $i \in \{b, m\}$ with liquidation efficiency $\lambda_i \in (0, 1]$,

$$U_i(\theta; d, m) = \frac{\theta^2 - d^2}{2\theta} - m\,\frac{d}{\theta}, \qquad d\,\frac{\theta - d}{\theta} + \lambda_i m\,\frac{d}{\theta} = 1.$$

Interior borrower-optimal zero-profit points satisfy

$$d\,g(d \mid \theta) = (1 - \lambda_i) G(d \mid \theta) \quad \Rightarrow \quad d_i^*(\theta) = \kappa_i\,\theta, \quad \kappa_i := \frac{1 - \lambda_i}{2 - \lambda_i}.$$

Default is $q_i^* = (1 - \lambda_i)/(2 - \lambda_i)$, constant across types (interior). Collateral from zero profit:

$$m_i^*(\theta) = \frac{(2 - \lambda_i) - \kappa_i\,\theta}{\lambda_i(1 - \lambda_i)}.$$

For the bank ($i = b$), borrower utility simplifies to $U_b(\theta) = C_b\,\theta - 1/\lambda_b$ with

$$C_b = \frac{2 - 2\lambda_b^2 + \lambda_b}{2\lambda_b(2 - \lambda_b)^2}, \quad \underline{\theta}_b = \frac{2(2 - \lambda_b)^2}{2 - 2\lambda_b^2 + \lambda_b}.$$

If $m_b^*(\underline{\theta}_b) > a$, the collateral cap binds for low types; then $m = a$ and d solves $d^2 - d(\theta + \lambda_b a) + \theta = 0$ with $d \in (0, \theta)$.

[9] The uniform-X specialization is for transparency. All closed-form cutoffs extend to any family with MLRP and a monotone hazard; the algebra changes but the partition and welfare comparisons are unchanged.

D.3 Market pooling contract on the upper tail

If the market serves $T = [\theta^*, \infty)$, pool moments are

$$\mathbb{E}_T[1/\theta] = c/\theta^*, \qquad \mathbb{E}_T[G(d \mid \theta)] = 1 - d\,c/\theta^*.$$

The borrower-optimal pooling contract under zero profit is

$$d_m = \frac{1-\lambda_m}{(2-\lambda_m)} \cdot \frac{\theta^*}{c} \equiv \kappa_m \theta^*, \quad m_m = \frac{c(2-\lambda_m)}{\lambda_m(1-\lambda_m)} - \frac{\theta^*}{\lambda_m(2-\lambda_m)}.$$

Feasibility requires $\kappa_m = (1-\lambda_m)/(c(2-\lambda_m)) < 1$.

D.4 Closed-form segmentation cutoff

At θ^*, indifference holds: $U_b(\theta^*) = U_m(\theta^*; d_m, m_m)$. With the expressions above,

$$\theta^* = \frac{\lambda_b^{-1} - \kappa_m A_m}{C_b - \frac{1}{2} + \frac{\kappa_m^2}{2} - \kappa_m B_m}, \quad A_m = \frac{c(2-\lambda_m)}{\lambda_m(1-\lambda_m)}, \quad B_m = \frac{1}{\lambda_m(2-\lambda_m)}.$$

If $m_b^*(\theta^*) > a$, evaluate $U_b(\theta^*)$ at the cap-binding d instead.

D.5 Defaults and collateral (closed form)

Bank side (interior): $q_b^* = (1-\lambda_b)/(2-\lambda_b)$, and $m_b^*(\theta) = ((2-\lambda_b) - \kappa_b\theta)/(\lambda_b(1-\lambda_b))$ with $\kappa_b = (1-\lambda_b)/(2-\lambda_b)$. Market side: $q_m(\theta) = d_m/\theta = \kappa_m\,\theta^*/\theta$, while m_m is constant across the pool.

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