Bankruptcy Procedures, Debt Capacity, and Aggregate Fragility*

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Abstract

Much corporate debt is backed by firms' going concern value rather than the liquidation value of their assets. Such borrowing exposes firms to rollover risk, since what creditors recover depends on the firm continuing to operate. I study how bankruptcy procedures shape firms' debt capacity and aggregate fragility in a heterogeneous-firm general-equilibrium model with defaultable short-term debt and rollover risk. Reorganization raises creditor recoveries in default, expanding the amount of debt that is safe from runs, but weakens repayment incentives when creditors have limited bargaining power. In the calibrated U.S. economy, the first force dominates: easier reorganization raises debt capacity, productivity, and welfare. These gains can reverse when rollover risk is sufficiently low. Yet such economies are also the most fragile, as firms self-insure less and take on more refinancing exposure. Reorganization therefore provides greater protection against credit market disruptions precisely where it may reduce steady-state welfare.

JEL Codes: G33, G32, E44, E32

Keywords: Bankruptcy, Reorganization, Rollover Risk, Debt Capacity, Creditor Coordination, Firm Dynamics, Aggregate Fragility, Liquidation Value, going concern Value.

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1 Introduction

Corporate leverage and financial constraints have long been recognized as important sources of macroeconomic fluctuations (Bernanke, 1983; Kiyotaki and Moore, 1997). A traditional view holds that firms' borrowing capacity is determined by the liquidation value of their assets (Shleifer and Vishny, 1992; Hart and Moore, 1994). This view has recently been challenged. Lian and Ma (2021) document that 80% of U.S. nonfinancial corporate debt by value is based on cash flows from continuing operations, and Kermani and Ma (2023) show that many large firms borrow well beyond the liquidation value of their assets: for much of the corporate sector, debt capacity rests on the firm's going concern value, the value of the cash flows it generates as an operating business. Such debt, however, is not backed by assets that creditors can seize, which exposes firms to rollover risk: creditors may refuse to refinance maturing debt simply because they expect other creditors to do the same (Calvo, 1988; Cole and Kehoe, 2000). When refinancing breaks down, otherwise viable firms can be forced into default

Bankruptcy institutions are therefore central to this problem: by governing how value is allocated in default, and in particular whether going concern value is preserved or destroyed, they shape both creditors' incentives to provide financing and firms' incentives to repay. Reorganization raises creditors' recovery when refinancing fails and thereby reduces their incentive to run. By making default less costly for the firm, however, it also weakens repayment incentives. The existing literature has studied these two margins in isolation: Corbae and D'Erasmo (2021) emphasize the repayment margin, while Guntin (2023) emphasizes reorganization as a resolution of coordination failures once a run has occurred. Because the two forces push in opposite directions, the effects of bankruptcy design on debt capacity and aggregate outcomes depend on which one dominates, a question that remains open.

In this paper, I study how these two forces jointly shape firms' debt capacity and aggregate fragility. I develop a heterogeneous-firm general-equilibrium model in which firms finance investment with defaultable short-term debt that must be refinanced before production, and distressed firms are resolved through liquidation or reorganization. Because a firm cannot repay maturing debt without new financing, creditors' refusal to refinance forces it into default. Whether such refusals can be self-fulfilling depends on what creditors recover in default. If maturing debt is fully recovered, each creditor is willing to roll over regardless of what others do, and the firm is safe from runs. If not, refinancing decisions become strategic complements, and runs can occur even when the firm would repay in full after a successful refinancing. By determining recoveries when refinancing fails, bankruptcy procedures therefore determine how much debt is rollover-safe. Moreover, since creditors are never repaid in full when the firm

chooses to default, every state of strategic default is also exposed to rollover risk. As in Corbae and D'Erasmo (2021), strategic default can be interpreted as an attempt to renegotiate with creditors. Since in practice it is difficult to verify whether a firm has made every effort to raise funding, the terms of debt resolution cannot condition on why the firm defaulted,[1] and any change in bankruptcy procedures affects both repayment and coordination incentives.

To isolate the mechanism, I first study a tractable three-period model. Under liquidation, borrowing beyond the liquidation value of assets exposes the firm's continuation surplus to a run. Firms therefore trade off the larger scale that additional borrowing allows against the risk of losing this surplus, and firms with high continuation value may optimally borrow no more than their liquidation value even when they could borrow more. Reorganization relaxes this trade-off: by preserving going concern value in default, it expands the set of debt levels that are safe from runs and allows firms hit by a run to continue operating. Whether these benefits outweigh weaker repayment incentives depends on the distribution of firms across states.

I then embed these forces in an infinite-horizon heterogeneous-firm model with endogenous debt choices, default, entry, and exit. Although rollover failure occurs with an exogenous probability conditional on exposure, firms choose how much debt to issue, so their exposure to rollover risk is endogenous. As a result, rare defaults can coexist with economically important rollover risk: higher rollover risk induces firms to deleverage, which can lower the equilibrium default rate rather than raise it. The calibrated model matches both the low incidence of business failures in the U.S. (about 0.96% per year in Dun & Bradstreet data over 1984-1997) and realistic young-firm survival dynamics, a discipline emphasized by Khan et al. (2024). It also reproduces an untargeted pattern documented by Lian and Ma (2021): smaller firms' borrowing is more closely tied to liquidation value, whereas larger firms rely more on going concern value.

I use the calibrated model to ask which force dominates in the U.S. economy. At the benchmark, the coordination benefit dominates: lowering reorganization costs raises leverage, productivity, and welfare. This occurs even though the bankruptcy rate rises and the share of reorganizations triggered by runs falls, as firms take on more exposure and default becomes more attractive. These patterns are consistent with the experience following the Bankruptcy Reform Act of 1978, which made reorganization more accessible and shifted bargaining power from creditors to firms, and after which both the business failure rate and the share of reorga-

[1] U.S. bankruptcy law reflects this difficulty: a firm need not be insolvent to file a voluntary Chapter 11 petition. Courts may dismiss petitions not filed in good faith, which typically requires evidence of some financial distress (see In re SGL Carbon Corp., 1999; In re Integrated Telecom Express, Inc., 2004), but this standard falls well short of verifying that the firm could not have serviced its debt. In the model, strategic default occurs only in states where the firm is exposed to rollover risk, so strategic defaulters would also meet this standard.

nizations increased.

These gains, however, depend on the financing environment. In economies where the probability of a coordination failure is substantially lower than in the U.S. benchmark, lowering reorganization costs reduces leverage, productivity, and welfare, even though rollover risk remains positive. With little scope to prevent runs, the main effect of easier reorganization is to make default less costly, which, when creditors have limited bargaining power, weakens firms' repayment commitment and reduces the share of continuation value they can pledge.

Finally, steady-state welfare and resilience to credit market disruptions need not align. When coordination failures are unlikely in normal times, firms self-insure less and take on more refinancing exposure, leaving the economy more vulnerable to an unexpected rise in rollover risk. It is in these economies that reorganization stabilizes the most, since more continuation-backed debt remains rollover-safe and going concern value is preserved when refinancing fails. Reorganization is thus more valuable as a stabilizer precisely where it may reduce steady-state welfare.

1.1 Literature Review

This paper contributes to three strands of literature.

Self-fulfilling debt crises and rollover risk A classic literature shows how creditor expectations can generate self-fulfilling debt crises, either by raising borrowing costs (Calvo, 1988) or by preventing the rollover of maturing debt (Cole and Kehoe, 2000). Subsequent work on sovereign debt quantifies these mechanisms and studies their interaction with debt maturity and issuance (Bocola and Dovis, 2019; Aguiar et al., 2022), as well as the ex ante effects of debt restructuring and reprofiling (Fernández and Martin, 2014; Hatchondo et al., 2014, 2025). In corporate finance, a theoretical literature studies how creditor coordination shapes debt pricing, maturity structure, and creditor concentration (Morris and Shin, 2004; He and Xiong, 2012a,b; Cheng and Milbradt, 2012; Zhong, 2021).

Most closely related, Guntin (2023) develops a heterogeneous-firm model with rollover crises and alternative bankruptcy procedures. In his framework, exposure to coordination failures stems from short-term liquidity shortfalls: firms with sufficient internal resources can meet maturing obligations without new financing, and restructuring allows distressed firms to obtain financing and continue operating once a run has occurred. I instead abstract from liquidity shortfalls and emphasize a complementary margin based on recovery: bankruptcy procedures shift the boundary of rollover-safe debt ex ante, not only the resolution of runs ex post, and

firms choose whether to borrow beyond that boundary.

Asset- and Earnings-Based Financing Building on the evidence of Lian and Ma (2021) and Kermani and Ma (2023) that much corporate borrowing is based on cash flows rather than liquidation values, especially among large firms,[2] a growing quantitative literature incorporates earnings-based borrowing constraints to study investment and aggregate outcomes (Drechsel, 2023; Öztürk, 2024; Drechsel and Kim, 2024; Li, 2022; di Giovanni et al., 2026). Closer to this paper, several studies examine how default, creditor control, and distress resolution shape cash-flow-based financing. Ebsim et al. (2026) show that when covenant violations transfer control rights to creditors, who then choose firm policies rather than mechanically enforce deleveraging, the financial accelerator generated by hard borrowing constraints is substantially weakened. Hartman-Glaser et al. (2025) jointly derive financing capacity and distress resolution in a dynamic contracting model in which anticipated continuation supports cash-flow-based financing, which in turn sustains continuation. Szekely (2025) studies how the likelihood of liquidation affects the relative cost of asset-based and cash-flow-based debt. I contribute by showing how bankruptcy procedures and rollover risk determine firms' ability to borrow beyond the liquidation value of their assets, and how this debt capacity shapes both steady-state welfare and resilience to credit market disruptions.

Macroeconomic models with defaultable corporate lending A quantitative literature embeds defaultable corporate debt in heterogeneous-firm models, so that loan prices and borrowing respond to firm-level default risk (Arellano et al., 2019; Gomes and Schmid, 2021; Ottonello and Winberry, 2020; Khan et al., 2021, 2024). These models typically resolve default through liquidation and exit; I add reorganization as an alternative procedure. A smaller literature models liquidation and reorganization explicitly. Corbae and D'Erasmo (2021) provide a benchmark quantitative framework in which distressed firms choose between Chapter 7 liquidation and Chapter 11 reorganization, and reorganization weakens repayment incentives by allowing equityholders to retain value after default. By contrast, Guntin (2023) abstracts from

[2]For small private firm data, however, unsecured borrowing does not, by itself, establish that their borrowing capacity under corporate limited liability exceeds the liquidation value of their assets. In U.S. supervisory data, Caglio et al. (2024) find that collateralization is associated with smaller loans and higher spreads for public firms, but larger loans and lower spreads for private firms. Relatedly, Ivashina et al. (2022) document in Spanish credit-registry data that cash-flow borrowing is more prevalent among lower-leverage firms. Also, using Spanish credit-registry data, González and Sy (2026) document widespread use of personal guarantees among small private firms; classifying personally guaranteed loans as collateralized roughly halves the measured unsecured-debt share among the smallest firms. These findings point to two additional margins in private firm borrowing: contractual debt types do not, by themselves, indicate whether firms can borrow beyond the liquidation value of their assets, and owner recourse can extend creditor recovery beyond corporate limited liability.

strategic reorganization, and Szekely (2025) rules it out by setting the firm's default value to zero under both procedures. My framework features both strategic and run-induced reorganization.

Paper Organization The remainder of the paper proceeds as follows. Section 2 develops an analytical model that illustrates how bankruptcy procedures affect debt capacity through creditors' rollover incentives. Section 3 embeds this mechanism in a quantitative heterogeneous-firm generalequilibrium model. Section 4 characterizes the equilibrium, describes the calibration, and discusses the model's properties. Section 5 studies the aggregate implications of bankruptcy design and rollover risk, including steady-state counterfactuals and dynamic responses to rollover-risk shocks. Section 6 concludes.

2 An Analytical Model

This section develops a tractable three-period model to isolate how bankruptcy resolution changes firms' exposure to rollover risk. The model is not intended to quantify aggregate effects. Instead, it derives the firm-level mechanisms governing financing capacity and default incentives.

Time is indexed by $t = 0, 1, 2$. Productivity is deterministic and given by z_1 and z_2 in periods 1 and 2, respectively. Output is produced using capital stock k according to an increasing and concave production function,

$$y = zk^{\alpha},$$

where $\alpha \in (0, 1)$. To simplify the environment, we assume that the gross interest rate is equal to one; equivalently, the net risk-free interest rate is $r_f = 0$. The depreciation rate is $\delta \in (0, 1)$. The price of capital is normalized to one in period $t = 0$, is given by $p_k \in (0, 1)$ in period $t = 1$, and is zero in period $t = 2$.

There are two types of agents: firms and creditors. At the beginning of period 0, a firm with initial endowment e_0 issues one-period defaultable debt d_0 and invests

$$k_1 = e_0 + d_0.$$

The debt is priced according to $Q(k_1, b_1)$, where b_1 denotes the face value of debt that the firm must repay in period 1. Hence,

$$d_0 = b_1 Q(k_1, b_1).$$

In period 1, maturing debt comes due before production and must be refinanced with intra-period debt l_1. Since intra-period lenders are junior in bankruptcy as new creditors, they are repaid in default only after maturing creditors have been fully repaid. They are atomistic, so no individual creditor can refinance the firm's maturing debt on its own. As a result, a creditor's willingness to roll over the debt depends not only on the firm's ability to repay, but also on whether other creditors are willing to roll over their claims. That's how we incorporate potential coordination failure in our specific context, which we motivate from the standard rollover risk literature, as in Cole and Kehoe (2000) and Guntin (2023). After production, the firm issues inter-period debt d_1, repays l_1, and chooses investment k_2. In period 2, the firm produces, repays its outstanding debt, and exits.

2.1 Frictionless Economy

We first consider a frictionless economy as a benchmark. Since there is no uncertainty or financial friction, the model can be solved by backward induction. In period 2, the firm value is

$$V_2(z_2, k_2, b_2) = z_2 k_2^{\alpha} - b_2. \tag{1}$$

In period 1, the firm chooses next-period capital k_2 and its value is

$$V_1^F(z_1, k_1, b_1) = z_1 k_1^{\alpha} + p_k(1-\delta)k_1 - b_1 + \bar{V}, \tag{2}$$

where

$$\bar{V} = -p_k k_2^* + z_2 (k_2^*)^{\alpha} \tag{3}$$

$$k_2^* = \left(\frac{\alpha z_2}{p_k}\right)^{\frac{1}{1-\alpha}} \tag{4}$$

Going back to period 0, the firm chooses initial investment k_1 taking into account that $b_1 = d_0$. The optimal capital choice in the frictionless economy is therefore

$$k_1^* = \left(\frac{\alpha z_1}{1 - p_k(1-\delta)}\right)^{\frac{1}{1-\alpha}}. \tag{5}$$

2.2 Rollover Risk and Bankruptcy Regimes

We now consider the economy with rollover risk under alternative bankruptcy regimes. The model is again solved by backward induction. Since rollover risk affects only the refinancing stage in period 1, the period-2 problem is unchanged relative to the frictionless benchmark.

In period 1, if rollover succeeds, production takes place as in the frictionless economy. Because productivity is deterministic, the firm's value in the no-run state coincides with the frictionless value in (2):

$$V_1^N(z_1, k_1, b_1) = V_1^F(z_1, k_1, b_1). \tag{6}$$

The key departure from the benchmark is the possibility of rollover failure at period 1, together with the way different bankruptcy regimes allocate surplus between the firm and its creditors.

At period 1, if the firm enters default, there are two possible resolution regimes: liquidation and reorganization:

1. Liquidation: The firm liquidates its assets at price $\chi \in (0, p_k(1-\delta))$, repays its debt and exits. The firm receives the remaining $max\{0, \chi k_1 - b_1\}$.

2. Reorganization: The firm pays a fixed cost $\eta \geq 0$ to restructure.[3] If the firm and its creditors agree to reorganize, the firm obtains intra-period financing with certainty. The firm and its creditors maximize the joint value of the firm and split the resulting surplus through Nash bargaining. The firm's bargaining power is $\theta \in [0, 1]$.

Under liquidation, the firm's equity value is

$$V^L(z_1, k_1, b_1) = \max\{0, \chi k_1 - b_1\}. \tag{7}$$

Since we assume $p_k(1-\delta) \geq \chi$ and productivity is deterministic, liquidation is dominated by

[3]Empirical evidence is consistent with a substantial non-proportional component of bankruptcy costs. Lawless et al. (1994) document economically large direct costs among small-firm bankruptcies. Bris et al. (2006) provide particularly direct evidence of a scale effect: average court-reported fees relative to pre-bankruptcy assets decline sharply with firm size, from over 30 percent among the smallest cases to roughly 1 percent among firms with more than $10 million in assets. Estimates for larger public firms are generally much lower, and prepackaged reorganizations typically involve direct costs below 3 percent of pre-filing assets (Weiss, 1990; Tashjian et al., 1996). More broadly, Altman (1984), Opler and Titman (1994), and Andrade and Kaplan (1998) show that observable professional and administrative expenses capture only part of the economic burden associated with financial distress. These studies do not separately identify a fixed reorganization cost, however, and some measured losses occur before filing or may reflect underlying economic distress. Accordingly, η should be interpreted as a reduced-form incremental procedural and implementation friction, not as all losses associated with financial distress.

continuation whenever the firm can secure financing. Therefore, liquidation arises only as the fallback resolution when refinancing fails or when reorganization cannot be agreed upon.

Alternatively, the firm may reorganize by paying a fixed cost $\eta \geq 0$. Reorganization eliminates rollover failure and allows the firm to continue operating. During reorganization, creditors agree to write down part of the maturing debt, so that the firm repays only a fraction $\phi \in (0, 1]$ of b_1. The recovery rate ϕ is determined by Nash bargaining between the firm and its creditors.

Let the value of the firm before debt repayment and reorganization costs be

$$W(z_1, k_1) \equiv z_1 k_1^{\alpha} + p_k(1-\delta)k_1 + \bar{V}. \tag{8}$$

Given a recovery rate ϕ, the firm's value under reorganization is

$$V^R(z_1, k_1, b_1) = W(z_1, k_1) - \phi b_1 - \eta. \tag{9}$$

The recovery rate ϕ solves the following Nash bargaining problem:

$$\phi \in \arg\max_{\varphi \in [0,1]} \underbrace{(W - \varphi b_1 - \eta)^{\theta}}_{\text{Firm}} \underbrace{(\varphi b_1 - \chi k_1)^{1-\theta}}_{\text{Creditors}} \tag{10}$$

$$\text{subject to: } \chi k_1 \leq \varphi b_1 \leq W - \eta \tag{11}$$

The constraint requires that the firm obtains a non-negative surplus from reorganization, and creditors weakly prefer reorganization to liquidation. Therefore, reorganization is feasible only if the joint surplus relative to liquidation is non-negative.

Solving the Nash bargaining problem yields the following recovery value for creditors. Creditors could recover $min\{b_1, R^R(z_1, k_1)\}$ from reorganization:

$$R^R(z_1, k_1) = (1-\theta) \underbrace{[W(z_1, k_1) - \eta - \chi k_1]}_{\text{Surplus}} + \underbrace{\chi k_1}_{\text{Outside option}} \tag{12}$$

For $b_1 \geq R^R(z_1, k_1)$, the firm's reorganization value is:

$$V^R(z_1, k_1, b_1) = \theta \underbrace{\big(W(z_1, k_1) - \chi k_1 - \eta\big)}_{\text{Surplus}} + \underbrace{0}_{\text{Outside option}} \tag{13}$$

The boundary of default is defined by: $V^N \geq V^R$

$$b_1 \leq W(z_1, k_1) - \underbrace{\theta\left(W(z_1, k_1) - \eta - \chi k_1\right)}_{\text{strategic default rent}=V^R(z_1,k_1,b_1)} = R^R(z_1, k_1) + \eta \tag{14}$$

Liquidation gives equity holders a lower bound of zero as their outside option. Therefore, whenever the reorganization value is positive, the firm strictly prefers reorganization to liquidation as the bankruptcy resolution. Otherwise, the firm chooses liquidation. This feasibility condition directly leads to Proposition 1.

Proposition 1 (Bankruptcy regimes)**.** *The reorganization cost η partitions the economy into three exhaustive regimes:*

1. *If $\eta > W(z_1, k^*) - \chi k^*$, reorganization is never chosen.*
2. *If $\eta \leq \bar{V}$, reorganization is chosen for all possible $k_1 \in (0, k^*]$.*
3. *If $\eta \in (\bar{V}, W(z_1, k^*) - \chi k^*]$, reorganization is chosen only for some $k_1 \in (0, k^*]$.*

Having characterized the payoffs under alternative bankruptcy regimes, we now turn to the rollover problem. At the beginning of period 1, the firm's state (z_1, k_1, b_1) is publicly observable. Hence, all agents know the firm's reorganization value $V^R(z_1, k_1, b_1)$ and therefore the relevant bankruptcy resolution.

The firm must issue intra-period debt to repay the maturing debt b_1 before production takes place. Since production has not yet occurred, an individual atomistic creditor cannot provide enough financing to prevent default if other creditors refuse to roll over. Therefore, even when the firm is fundamentally solvent, a coordination failure among creditors may force the firm into default.

The key point is that new intra-period lenders are junior to maturing creditors in bankruptcy. Thus, a new creditor is willing to roll over only if, in the event of default, the bankruptcy outcome generates enough recovery to fully repay the maturing debt. If maturing creditors can be fully repaid, then a creditor who rolls over is effectively protected, and she can still be repaid in default. By contrast, if the bankruptcy recovery is insufficient to fully repay maturing creditors, then a new creditor anticipates a loss whenever other creditors refuse to roll over. This creates the possibility of coordination failure.

We consider the two cases separately.

1. **Liquidation is the relevant bankruptcy resolution:** $V^R(z_1, k_1, b_1) \leq 0$.

   Under liquidation, the recovery value available to creditors is χk_1.

(a) If $b_1 \leq \chi k_1$: Liquidation generates enough resources to fully repay maturing creditors. In this case, a new creditor has no reason to panic: even if all other creditors refuse to roll over and the firm defaults, the liquidation value is sufficient to cover the maturing debt.

(b) If $b_1 > \chi k_1$: Liquidation value cannot fully repay maturing creditors. Since new intra-period lenders are junior to maturing creditors, a creditor who rolls over expects to suffer a loss if other creditors do not roll over and the firm defaults. Therefore, rollover risk arises.

2. **Reorganization is the relevant bankruptcy resolution:** $V^R(z_1, k_1, b_1) > 0$.

   Under reorganization, creditors recover at most $R^R(z_1, k_1)$, where $R^R(z_1, k_1)$ is determined by the Nash bargaining problem in equation (12). The same logic applies.

   (a) If $b_1 \leq R^R(z_1, k_1)$: Reorganization generates enough recovery to fully repay maturing creditors. In this case, new creditors do not have an incentive to panic, because even if a coordination failure occurs, the bankruptcy outcome protects them from losses.

   (b) If $b_1 > R^R(z_1, k_1)$: Reorganization does not provide full repayment to maturing creditors. Since new creditors are junior to maturing creditors, they anticipate losses in the event of default when other creditors refuse to roll over. Hence, rollover risk can arise even when reorganization is available.

Therefore, the bankruptcy regime affects rollover risk through its effect on the recovery value available in default. We summarize this effect in Proposition 2.

Proposition 2 (Safe debt and rollover exposure)**.** *A firm is not exposed to rollover risk if its outstanding debt can be fully repaid in the event of default. Formally, given state* (z_1, k_1, b_1)*, the firm is in the safe region if either*

$$\chi k_1 \geq b_1, \tag{15}$$

or

$$S^R(z_1, k_1) \geq 0 \quad \textit{and} \quad \phi(z_1, k_1, b_1) = 1. \tag{16}$$

where $S^R(z_1, k_1) \equiv W(z_1, k_1) - \chi k_1 - \eta$

Otherwise, the firm is exposed to rollover risk.

Corollary 1. *Suppose that $S^R(z_1, k_1) > 0$. For any $\theta < 1$, the safe borrowing region under reorganization strictly contains the safe borrowing region under liquidation.*

The strict inclusion arises because reorganization makes part of the firm's going concern value pledgeable to creditors. As a result, debt positions that would be exposed to rollover risk under liquidation can remain rollover-safe under reorganization.

However, Equation 14 shows that reorganization also imposes an endogenous borrowing limit. Because the firm can retain value through reorganization, firms can pledge only the portion of continuation value that remains outside the firm's default payoff. Maximum debt capacity is therefore given by $W(z_1, k_1) - V^R(z_1, k_1, b_1)$. At the borrowing limit, this pledgeable value equals the value creditors recover in reorganization plus the reorganization cost, $\phi b_1 + \eta$. Any larger promised repayment would make strategic default privately optimal for the firm.

So far, we have fully characterized the firm's payoff in period 1. We now turn to the firm's period-0 financing and investment problem. Proposition 1 shows that the reorganization cost η partitions the economy into three exhaustive regimes.

In the main text, we focus on the two polar cases, since the purpose of the analytical model is to isolate the main economic forces. When reorganization is never available, the model isolates the scale–rollover-exposure trade-off generated by liquidation. When reorganization is available at every feasible scale, the model isolates how reorganization shifts the creditor-coordination boundary and changes debt capacity. Both mechanisms carry directly into the quantitative model. We characterize the intermediate regime, in which access to reorganization depends on the firm's endogenous scale, in Appendix A.2.

2.2.1 Case 1: No Reorganization Option $\eta > W(z_1, k^*) - \chi k^*$

If the reorganization surplus is negative even at the efficient investment level k^*, then reorganization is infeasible for all feasible choices of k_1. In this case, the firm cannot access reorganization through its investment decision. Proposition 7 in the Appendix shows formally that the firm does not overinvest to gain access to reorganization.

Given that liquidation is the only outside option, we can characterize the firm's problem when it borrows risky debt in period 0. Risky debt arises when the firm's borrowing exceeds the liquidation value of its assets in period 1.

For $e_0 < k^* - \chi k^*$, the firm may choose to issue risky debt. Its problem is

$$V(e_0) = \max_{d_0} (1 - \xi) \left[z_1 (e_0 + d_0)^\alpha + p_k (1 - \delta)(e_0 + d_0) - b_1 + \bar{V} \right] \tag{17}$$

subject to

$$b_1 = d_0 R(e_0, d_0), \tag{18}$$

$$d_0 = \xi\chi(e_0 + d_0) + (1-\xi)b_1. \tag{19}$$

Here, d_0 is the present value of debt issued in period 0, while b_1 is the face value due in period 1. The function $R(e_0, d_0)$ denotes the gross promised return on risky debt, and ξ is the probability of coordination failure. The debt-pricing equation reflects that, in the event of coordination failure, creditors recover only the liquidation value $\chi(e_0 + d_0)$, whereas in the no-run state they are repaid the promised face value b_1.

Solving the problem yields:

$$e_0 + d_0 = \left(\frac{(1-\xi)z_1\alpha}{1-(1-\xi)p_k(1-\delta)-\xi\chi}\right)^{\frac{1}{1-\alpha}} \equiv k^{L*} \tag{20}$$

The borrowing capacity can be decomposed as follows:

$$\bar{d}_0^{L*} = \underbrace{(1-\xi)W\Big(z_1, \overbrace{k^{L*}}^{\text{investment distortion}}\Big)}_{\text{continuation-value component}} + \underbrace{\xi\chi k^{L*}}_{\text{liquidation-value component}} \tag{21}$$

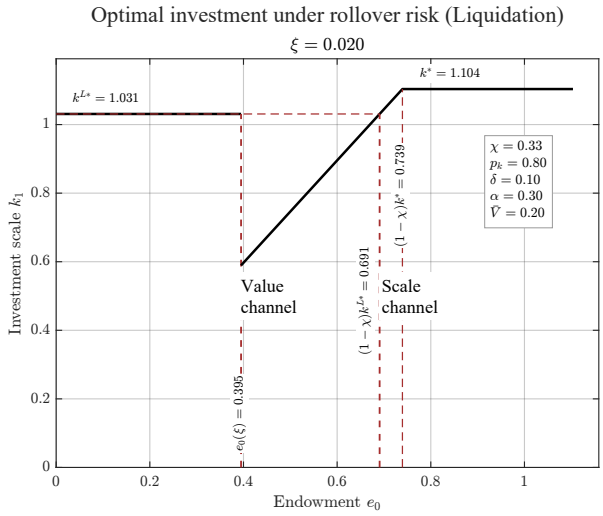
Unless rollover risk occurs with certainty ($\xi = 1$), a firm's borrowing capacity is a weighted average of its continuation value and liquidation value. Formally, we can show:

Proposition 3 (Borrowing capacity under liquidation)**.** *Under liquidation, for any $\xi \in (0,1)$, liquidation value is not a hard borrowing constraint. That is, the firm can issue risky debt and borrow beyond the liquidation value of its assets.*

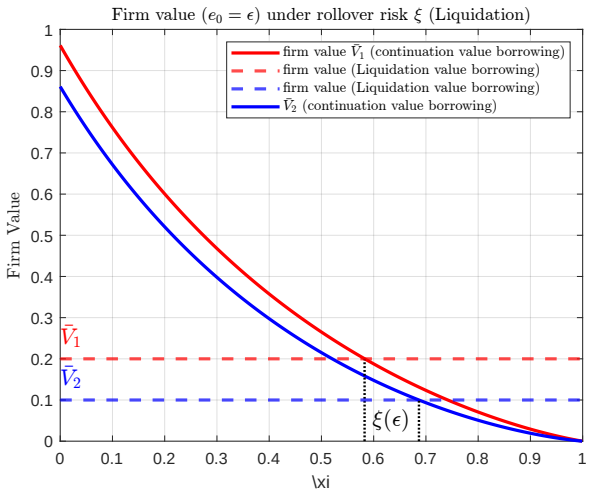
Although risky debt allows the firm to borrow beyond its liquidation value, liquidation value still constrains the firm through two distinct channels: a scale channel, operating through debt pricing, and a value channel, operating through the firm's exposure to liquidation losses. Figure 1a shows that, when rollover risk is low, the value channel is the dominant force.

1. **Scale channel (debt-pricing margin).** The optimal scale under risky debt is below the first-best investment scale:

$$k^{L*} < k^*, \qquad \text{for } \xi > 0. \tag{22}$$



(a) Optimal scale



(b) Firm value under liquidation

Figure 1: Firm decisions under liquidation regimes

This scale distortion arises because borrowing beyond liquidation value exposes the firm to rollover risk. Creditors require compensation for this risk, which raises the promised return on debt and therefore increases the firm's effective cost of external finance. With decreasing returns to scale, a higher cost of funds reduces the firm's optimal investment scale. As a result, firms with initial endowment $e_0 \in \big((1-\chi)k^{L*},\, (1-\chi)k^*\big)$ can finance a higher scale than k^{L*} using only risk-free debt backed by liquidation value, but cannot reach the first-best scale k^*. In this sense, even though liquidation value is not a hard borrowing constraint, it still limits firm scale indirectly.

2. **Value channel (exposure margin).** Risky debt allows a larger current scale, but puts firm value at risk. When the firm borrows beyond its liquidation value, it becomes exposed to rollover failure with probability ξ. In the run state, production does not take place and the firm is liquidated. Therefore, risky debt lowers expected firm value not only through a higher promised repayment, but also through the loss of continuation value when coordination failure occurs.

   Therefore, the firm's willingness to enter the risky region depends on two distinct forces. First, a higher initial endowment makes the firm less willing to take rollover risk. Holding future continuation value fixed, firms that choose risky borrowing have the same optimal investment scale k^{L*}. A high-endowment firm, however, has more of its own current value at stake. If rollover fails and the firm is liquidated, it loses a larger amount of internally financed value. A higher initial endowment therefore increases the loss associated with rollover failure without increasing the return to risky borrowing, making the firm more

likely to remain in the safe borrowing region.

Second, holding the initial endowment fixed, a higher future continuation value makes rollover failure more costly. To see this, consider two firms that differ only in their period-2 continuation value, with $\bar{V}_2 < \bar{V}_1$, as in Figure 1b. The firm with higher continuation value loses more surplus if refinancing fails and liquidation occurs. It therefore has a stronger incentive to remain in the safe borrowing region, whereas a firm with lower continuation value is more willing to accept rollover risk in exchange for a larger current scale.

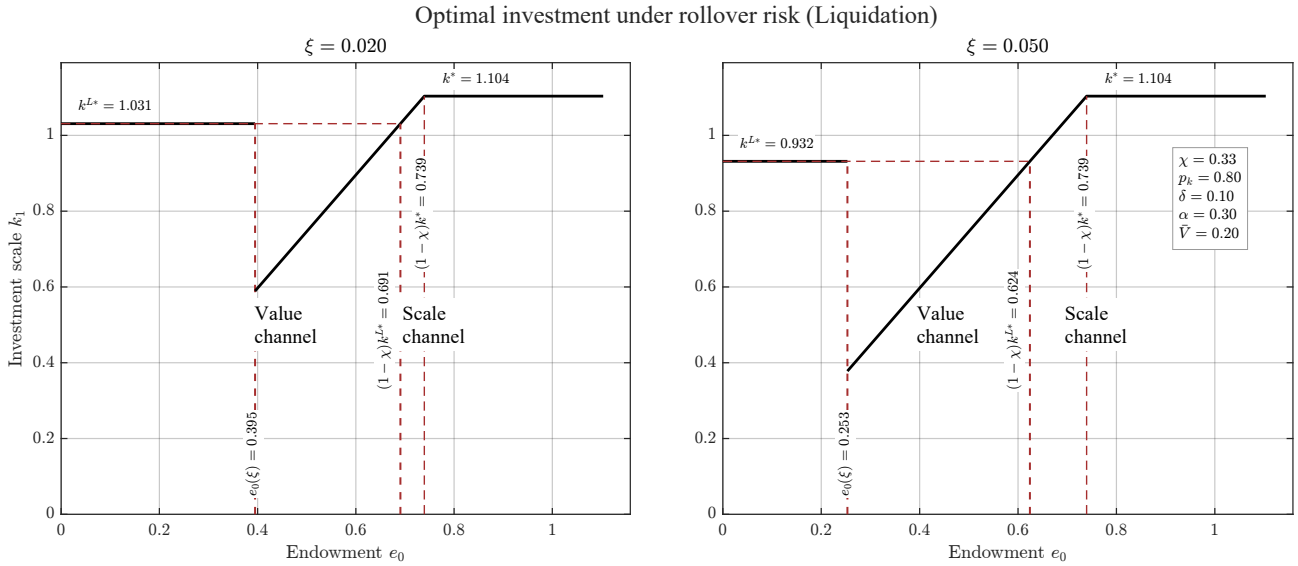


Figure 2: Firm investment policy functions under liquidation regimes.

Taken together, these results characterize the firm's policy function rather than the observed cross-sectional size distribution directly. As Figure 1 illustrates, liquidation value can nevertheless act as an endogenous borrowing boundary even when rollover failure is not certain.

2.2.2 Case 2: Reorganization is feasible for any possible value of k_1: $\eta \leq \bar{V}$

We now consider the other extreme case, in which the reorganization surplus is positive for all feasible investment levels $k_1 \in [0, k^*]$. Equivalently, this corresponds to the case with $\eta \leq \bar{V}$. In this regime, reorganization is always a feasible outside option in default.

We can characterize the firm's problem when it issues risky debt in period 0. Risky debt arises when the firm's debt is not fully protected by the recovery value under reorganization. The recovery value is given by equation (12). By contrast, when debt is risk-free, rollover risk is absent and the firm reaches the efficient investment level k^* provided its financing capacity

is sufficient.

$$V(e_0) = \max_{d_0}(1-\xi)\Big(W(z_1,(e_0+d_0)) - b_1\Big) + \xi\underbrace{\theta\Big(W(z_1,(e_0+d_0)) - \chi(e_0+d_0) - \eta\Big)}_{\text{Reorganization value}=V^R(z_1,(e_0+d_0),b_1)} \tag{23}$$

subject to

$$R^R(e_0+d_0) = (1-\theta)\big[W(z_1,(e_0+d_0)) - \eta - \chi(e_0+d_0)\big] + \chi(e_0+d_0) \tag{24}$$

$$R^N(e_0+d_0) = R^R(e_0+d_0) + \eta \tag{25}$$

$$b_1 = d_0 R(e_0,d_0) \leq R^N(e_0+d_0) \tag{26}$$

$$d_0 = \xi\Big(R^R(e_0+d_0)\Big) + (1-\xi)b_1 \tag{27}$$

$$W(z_1,e_0+d_0) = z_1(e_0+d_0)^\alpha + p_k(1-\delta)(e_0+d_0) + \bar{V}. \tag{28}$$

We use the same notation as in Case 1. The debt-pricing equation reflects the creditors' expected repayment. $R^R(e_0+d_0)$ represents the repayment to creditors under reorganization, while $R^N(e_0+d_0)$ denotes the maximum repayment when rollover risk does not materialize. This repayment imposes a limit because reorganization gives rise to strategic default. Anticipating this, creditors take the possibility of strategic default into account and set the maximum debt capacity accordingly, as shown in Equation 14.

In the event of coordination failure, default is resolved through reorganization, and creditors recover $\phi(z_1,k_1,b_1)b_1$. In the no-run state, the firm repays the promised face value b_1.

Solving the firm's problem yields:

$$e_0 + d_0 = \left(\frac{\alpha z_1}{1-p_k(1-\delta)}\right)^{\frac{1}{1-\alpha}} \equiv k^*. \tag{29}$$

$$V(e_0) = W(z_1,k^*) - d_0 - \xi\eta \tag{30}$$

$$\bar{d} = (1-\theta)W(z_1,k^*) + (\theta-\xi)\eta + \theta\chi k^* \tag{31}$$

Proposition 4. *Conditional on borrowing risky debt, the firm's unconstrained optimal scale is k^*, regardless of the level of rollover risk. Moreover, for any $\theta < 1$, reorganization creates a strictly positive amount of debt capacity beyond liquidation value that is free of rollover risk.*

Notice that if $e_0 > k^* - R^R(k^*)$, the firm is unconstrained and can attain the efficient scale k^*. If $e_0 \in (k^* - \bar{d}, k^* - R^R(k^*)]$, the firm can attain the efficient scale k^* with risky debt, but may

optimally choose not to do so because of the value channel, as in Case 1. Since the effects of bargaining power and reorganization costs on risk-free borrowing capacity are straightforward, we focus on risky borrowing. Conditional on choosing risky debt, a higher reorganization cost lowers expected firm value with risky debt linearly, since the cost is incurred only when coordination failure occurs. Moreover, holding scale fixed at k^*, debt capacity declines linearly with the probability of rollover failure:

$$\frac{\partial V}{\partial \eta} = -\xi, \tag{32}$$

$$\frac{\partial \bar{d}}{\partial \xi} = -\eta. \tag{33}$$

Figure 3 illustrates this mechanism. In the figure, we use the special case in which $\bar{d} = k^*$ at $\xi = 0$ as an illustrative example. The liquidation value always defines a safe borrowing region. In addition, reorganization creates an extra safe region when the firm's bargaining power satisfies $\theta < 1$, because creditors receive part of the continuation surplus in reorganization. This allows firms to borrow beyond liquidation value without being exposed to rollover risk.

Hence, firms with $e_0 \in (k^* - R^R(k^*), k^*]$ can reach the efficient investment level k^* using risk-free debt. The red region in Figure 3 corresponds to firms for which the efficient scale k^* is feasible only under risky debt. As shown in equation (30), k^* is optimal conditional on risky borrowing. However, they could still choose risk-free borrowing. The range of endowments for which k^* is feasible shrinks linearly with rollover risk, as shown in equation (33). As the red region shrinks, firms in the gray region become constrained and can no longer reach k^*.

Conditional on risky borrowing, rollover risk no longer directly distorts marginal investment decisions, since repayment in reorganization is tied to continuation value. Instead, it reduces debt capacity and may also induce firms to choose a smaller but rollover-safe scale.

If $\bar{d} < k^*$, some firms are constrained. In particular, firms with $e_0 \in [0, k^* - \bar{d})$ cannot reach the efficient investment level k^*. These firms correspond to the gray region in Figure 3. If they borrow risky debt, they will borrow up to the maximum debt capacity, denoted by $d_0^{Rs}(e_0)$, which satisfies:

$$\begin{aligned} d_0^{Rs}(e_0) = (1-\xi)\Big(W(z_1, e_0 + d_0^{Rs}(e_0)) - \overbrace{\theta\big(W(z_1, e_0 + d_0^{Rs}(e_0)) - \eta - \chi(e_0 + d_0^{Rs}(e_0))\big)}^{\text{Strategic default}}\Big) \\ + \xi\Big(\underbrace{(1-\theta)(W(z_1, (e_0 + d_0^{Rs}(e_0))) - \eta)}_{\text{Cash flow saving}} + \theta\chi(e_0 + d_0^{Rs}(e_0))\Big) \end{aligned} \tag{34}$$

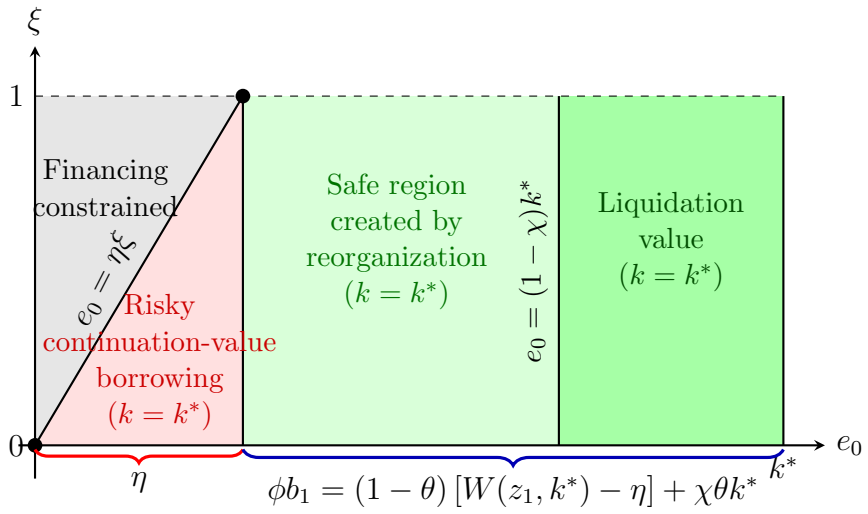


Figure 3: Borrowing regimes as a function of initial equity and rollover risk.

Equation 34 shows that reorganization introduces two opposing forces. On the one hand, when rollover failure occurs, reorganization preserves firm cash flow and raises creditors' recovery relative to liquidation. This recovery effect tends to relax borrowing constraints. On the other hand, reorganization also creates the possibility of strategic default in the no-run state: even when rollover succeeds, the firm may use reorganization to renegotiate its debt. This strategic-default effect lowers creditors' expected repayment and tends to tighten borrowing constraints.

As a result, the effect of making reorganization easier is ambiguous. Lemma 1 in the Appendix characterizes how the reorganization cost affects both debt capacity and firm value:

$$\frac{\partial d_0^{Rs}(e_0)}{\partial \eta} \propto \theta - \xi, \tag{35}$$

$$\frac{\partial V}{\partial \eta} = \underbrace{\frac{\partial d_0^{Rs}(e_0)}{\partial \eta}\left(\frac{\partial W}{\partial k} - 1\right)}_{\text{financial-constraint effect}} - \underbrace{\xi}_{\text{expected reorganization-cost effect}} \tag{36}$$

Equation (35) shows that the effect of reorganization on debt capacity depends on which force dominates. If $\theta > \xi$, the strategic-default effect dominates the cash-flow preservation effect. In this case, reducing the reorganization cost η lowers debt capacity. By contrast, if $\theta < \xi$, the cash-flow preservation effect dominates, and making reorganization easier relaxes borrowing constraints.

Equation (36) shows that the effect on firm value is also ambiguous. A lower reorganization cost affects firm value through two channels. First, it changes debt capacity, which affects

investment through the financial-constraint effect. Second, it changes the expected cost paid in the event of rollover failure. The net effect therefore depends on the interaction between borrowing constraints and expected reorganization costs.

We summarize this ambiguity in the following proposition.

Proposition 5 (Ambiguous effects of bankruptcy reform)**.** *A reduction in the reorganization cost η does not necessarily relax borrowing constraints or increase firm value. Its effect depends on the interaction between rollover risk ξ, bargaining power θ, and firms' initial endowment e_0.*

Therefore, the effect of bankruptcy reform is theoretically ambiguous. The analytical model identifies the forces governing this ambiguity, but it does not determine their quantitative importance once firms differ in productivity, size, leverage, and exposure to rollover risk. We therefore turn to a heterogeneous-firm quantitative model, disciplined by the U.S. institutional setting, to evaluate how bankruptcy procedures shape firm financing, default, and aggregate outcomes in equilibrium.

3 Quantitative Model

I embed these mechanisms in a canonical infinite-horizon heterogeneous firm general equilibrium model based on Corbae and D'Erasmo (2021). In every period, firms can choose to repay or default. There are two ways to resolve default: Chapter 7 Liquidation and Chapter 11 Reorganization. The central feature is that defaultable, short-term maturing debt must be refinanced by dispersed intra-period debt creditors before production. At the time of repayment, nothing has been produced yet. The firm can repay its maturing debt only by obtaining refinancing from intra-period lenders. As a result, even if a firm wants to repay, a refinancing failure will cause the firm to default. The court cannot determine whether the default was caused by a refinancing failure. Hence, a firm may exercise its option to default, rather than meet its repayment obligations. Competitive inter-period lenders must attempt to predict default decisions of the firms and rollover decisions of the future intra-period lenders when pricing the debt. There is a representative household that consumes, saves and works, and owns the firms in the economy.

3.1 Incumbent firm problem

3.1.1 Firms and technology

Firms operate a Cobb–Douglas production technology with decreasing returns to scale,

$$F(z_t, k_t, l_t) = z_t \left(k_t^{\alpha} l_t^{1-\alpha}\right)^{v}, \qquad v < 1, \tag{37}$$

where k_t and l_t denote capital and labor, respectively. Firm-level productivity z_t is idiosyncratic and independent across firms, and evolves according to a first-order Markov process,

$$\log z_{t+1} = \rho_z \log z_t + \epsilon_{t+1}, \qquad \epsilon_{t+1} \sim \mathcal{N}(0, \sigma_z^2). \tag{38}$$

Conditional on operating, a firm's period-t operating profit is

$$\pi(z_t, k_t; w_t) = \max_{l_t} \left\{ z_t \left(k_t^{\alpha} l_t^{1-\alpha}\right)^{v} - w_t l_t - c_f \right\}, \tag{39}$$

where w_t is the wage and c_f is a fixed operating cost that must be paid in every period in which the firm operates.

Capital is partially irreversible: firms purchase capital at a unit price normalized to one, but can sell installed capital only at a price $\theta_k \in [0, 1]$. Net investment is defined as

$$I_t = k_{t+1} - (1 - \delta) k_t, \tag{40}$$

where $\delta \in (0, 1)$ is the depreciation rate. The effective price of investment is therefore

$$P_k = \begin{cases} 1, & I_t > 0, \\ \theta_k, & I_t \leq 0. \end{cases} \tag{41}$$

Thus, positive investment is purchased at unit cost, whereas disinvestment yields only θ_k units of consumption goods per unit of installed capital sold.

Apart from partial irreversibility, the firm also faces a convex capital adjustment cost and corporate income tax.

$$AC(k_{t+1}, k_t) = \frac{\psi}{2} \left(\frac{I_t}{k_t}\right)^2 k_t, \tag{42}$$

where $\psi \geq 0$ governs the strength of the adjustment friction.

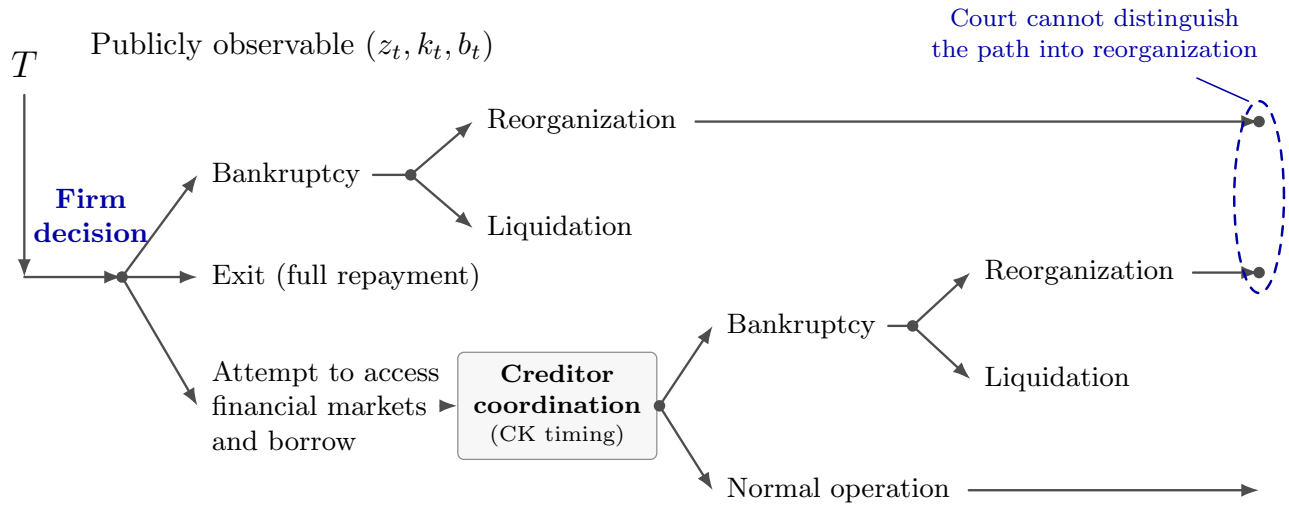


Figure 4: Within-period timing.

Corporate income taxes are given by

$$T_t^c = \mathbf{1}_{\{\Gamma_t \geq 0\}} \tau_c \Gamma_t, \tag{43}$$

where τ_c is the corporate income tax rate and taxable income is

$$\Gamma_t = \pi_t(z_t, k_t) - \delta k_t - \left(\frac{1}{Q(z_t, k_{t+1}, b_{t+1})} - 1 \right) \frac{b_{t+1}}{1+r}. \tag{44}$$

b_{t+1} denotes the face value of debt due in the next period, and $Q(z_t, k_{t+1}, b_{t+1})$ denotes the associated debt price conditional on current productivity and the firm's investment and borrowing decisions. Incumbent firms are precluded from issuing equity.

3.1.2 Timing and firm options

At the beginning of period, each firm's productivity z_t is realized. A firm's maturing debt b_t comes due immediately after its state (z_t, k_t, b_t) becomes publicly observable and before production takes place. At the time of repayment, nothing has been produced yet. The firm can repay its maturing debt only by obtaining refinancing from intra-period lenders. A firm may default immediately, exit with full repayment of its maturing debt by selling the assets, or attempt to refinance its maturing liabilities by raising new funding and continue operating.

A firm that does attempt to access the financial market will seek intraperiod financing b_t^l and issue one-period defaultable debt with face value b_{t+1} through a single round of finance. If the

firm attempts to refinance, new creditors decide whether to provide funding. Only intraperiod debt b_t^l is available before repayment of b_t and it is due at the end of period t. The firm's settlement funds are collected in a lender-controlled account and used to repay intraperiod debt before funds are released for new capital purchases or dividends. No further shocks occur and no new information arrives before end-of-period settlement. Under this settlement arrangement, intra-period debt is automatically repaid in full with no separate default option at the end of the period. Interperiod debt b_{t+1} is disbursed at the end of the period conditional on successful intra-period refinancing, and it matures at the beginning of period $t+1$. Hence, it is not exposed to contemporaneous default risk.

Following Cole and Kehoe (2000) and Guntin (2023), I assume that creditors are atomistic and perfectly competitive, and new creditors are junior to legacy debt creditors. Since intra-period lenders are atomistic, no individual lender can provide enough financing to roll over the firm's maturing debt. Moreover, at the time of repayment, nothing has been produced yet. If all other intra-period lenders refuse to refinance the debt, no individual lender can prevent the firm from defaulting by lending on its own. This gives rise to the possibility of multiple self-fulfilling equilibria: if intra-period lenders expect the others to refinance the firm, they are willing to lend and the firm continues operating; if they expect the others not to refinance, they refuse to lend and the firm defaults. When multiple equilibria exist, rollover fails with probability $\xi \in (0,1)$. Our analysis examines how bankruptcy procedures shape the region of the state space in which firms are exposed to rollover risk, how firms endogenously choose their exposure to the risk, and how creditors price debt in response.

Conditional on successfully rolling over its debt and continuing operations, the firm's dividend is

$$d_t(z_t, k_t, b_t) = \pi_t(z_t, k_t) - b_t - P_k I_t + Q(z_t, k_{t+1}, b_{t+1}) b_{t+1} - AC(k_{t+1}, k_t) - T_t^c. \tag{45}$$

The funding from intra-period debt b_t^l and its end-of-period repayment cancel in the period budget constraint, since the intra-period debt carries no interest. The value of a firm in state (z_t, k_t, b_t) conditional on successful refinancing is:

$$V^N(z_t, k_t, b_t) = \max_{k_{t+1}, b_{t+1}} d_t(z_t, k_t, b_t) + \frac{1}{1+r} E_t(V_{t+1}(z_{t+1}, k_{t+1}, b_{t+1})) \tag{46}$$

subject to:

$$d_t \geq 0$$

If refinancing fails, or the firm voluntarily files for bankruptcy before production, all outstanding liability claims enter bankruptcy together. We assume that newly issued debt is junior to maturing debt in bankruptcy. Two bankruptcy procedures are available following default: liquidation (Chapter 7) and reorganization (Chapter 11).

1. **Liquidation.** Under liquidation, debt is repaid out of the liquidation value of the firm's assets.

2. **Reorganization.** Under reorganization, creditors receive a recovery determined through Nash bargaining over the firm's continuation value. The reorganization plan includes the financing arrangements necessary for the firm to continue operating.

If a firm defaults and enters Chapter 7 liquidation, its assets are liquidated and creditors are repaid from the liquidation proceeds. The equity value under liquidation is

$$V^L(z_t, k_t, b_t) = \max\{\chi k_t - b_t,\, 0\}, \tag{47}$$

where χ denotes the liquidation value of installed capital.

If a firm defaults and files for Chapter 11 reorganization, it continues operating after restructuring its maturing debt. However, reorganization is costly. It entails both direct costs borne by the firm and losses in firm value. I capture this overall burden using two reduced-form components: a fixed component, η, and a component proportional to installed capital, γk_t. Both components may reflect direct costs or losses in value arising during reorganization.

Relative to Corbae and D'Erasmo (2021), I formulate creditor recovery in reorganization in units of value, allowing the negotiated transfer to be delivered through cash or value-equivalent claims.[4] Under this assumption, firms have no need for intra-period borrowing during reorganization. A reorganized firm that continues as a going concern can access inter-period debt financing, since inter-period debt b_{t+1} is disbursed at the end of the period and it does not have contemporaneous default risk.

[4]In the benchmark formulation of Corbae and D'Erasmo (2021), the negotiated repayment φb_t enters the firm's current resource constraint and must therefore be financed out of contemporaneous resources. Here, φb_t instead denotes the value transferred to maturing creditors under the reorganization agreement. This treatment is consistent with the fact that Chapter 11 recoveries need not be delivered entirely in contemporaneous cash: reorganization plans may modify existing debt claims or distribute new debt, equity, or other securities to creditors. The abstraction also substantially reduces the computational burden while preserving the central object of the bargaining problem—the division of going concern surplus between equity holders and maturing creditors.

Let the value of reorganization to equity holders be

$$V^R(z_t, k_t, b_t) = \max_{k_{t+1}, b_{t+1}} \{W(z_t, k_t, 0) - \varphi(z_t, k_t, b_t) b_t\}, \tag{48}$$

where

$$W(z_t, k_t, 0) = d_t(z_t, k_t, 0) - \eta - \gamma_k k_t + \beta \mathbb{E}_t \left[V_{t+1}(z_{t+1}, k_{t+1}, b_{t+1})\right]. \tag{49}$$

subject to:

$$d_t(z_t, k_t, 0) - \eta - \gamma_k k_t \geq 0$$

The recovery rate $\varphi(z_t, k_t, b_t)$ denotes the value transferred to maturing creditors under the reorganization agreement. It is determined through Nash bargaining between equity holders and creditors:

$$\phi(z_t, k_t, b_t) \equiv \arg \max_{\varphi \in [0,1]} [W^R(z_t, k_t, b_t; \varphi)]^\theta [W^L(z_t, k_t, b_t; \varphi)]^{1-\theta} \tag{50}$$

s.t.

$$W^R(z_t, k_t, b_t; \varphi) = V^R(z_t, k_t, b_t; \varphi) \geq 0 \tag{51}$$

$$W^L(z_t, k_t, b_t; \varphi) = \varphi(z_t, k_t, b_t) b_t - min\{b_t, \chi k_t\} \geq 0 \tag{52}$$

where $\theta \in [0, 1]$ denotes the bargaining weight of equity holders. The disagreement outcome is Chapter 7 liquidation, so creditors require at least the recovery they would obtain under liquidation.

Alternatively, at the beginning of period, a firm may choose to exit voluntarily rather than enter bankruptcy or seek refinancing. It sells its assets and repays its creditors in full. The value of voluntary exit in state (z_t, k_t, b_t) is therefore

$$V^X(z_t, k_t, b_t) = s_x k_t - b_t, \tag{53}$$

where s_x denotes the resale value of capital upon voluntary exit.

3.1.3 Firm values

Given these payoffs under different options, I now characterize the firm's value function. I begin by examining the conditions under which refinancing is immune to coordination failure among

creditors.

As in the three-period model, the firm must refinance its maturing debt, b_t, before production takes place. No individual atomistic creditor can provide sufficient financing to prevent default if other creditors refuse to roll over. Hence, even a fundamentally solvent firm may be forced into default if its creditors refuse to rollover its debt.

New (Intra-period) lenders are junior to the holders of maturing debt but senior to equity holders. They can be repaid in full in the event of default only if the holders of maturing debt are repaid in full. Hence, if bankruptcy recovery is sufficient to cover the firm's maturing debt, each individual lender can recover its infinitesimal claim in full even if all other lenders refuse to refinance. A lender's refinancing decision is therefore independent of the other lenders' decisions, eliminating rollover risk. However, if bankruptcy recovery is insufficient to cover the firm's maturing debt, each new creditor anticipates a loss when other creditors refuse to refinance. This creates the possibility of a self-fulfilling rollover failure.

This observation yields the following rollover-safety condition.

Proposition 6 (Rollover-safe financing)**.** *A firm in state (z_t, k_t, b_t) is free from rollover risk if either*

$$\chi k_t \geq b_t, \tag{54}$$

or

$$V^R(z_t, k_t, b_t) \geq V^L(z_t, k_t, b_t) \qquad \textit{and} \qquad \phi(z_t, k_t, b_t) = 1. \tag{55}$$

The first condition guarantees full repayment through liquidation. The second guarantees that reorganization is chosen following default and that maturing creditors are repaid in full under the reorganization agreement.

We are now ready to characterize the value of an incumbent firm. Let $s_t \equiv (z_t, k_t, b_t)$ denote the firm's state. At the beginning of period, an incumbent firm chooses among voluntary exit, immediate liquidation, immediate reorganization, and attempting to refinance its maturing debt. Its value is therefore:

$$V(s_t) = \max\left\{V^L(s_t), V^R(s_t), V^X(s_t), V^{ref}(s_t)\right\}. \tag{56}$$

If a firm attempts to refinance its maturing debt, intra-period lenders decide whether they want to roll over the debt. If maturing debt cannot get fully repaid in the event of default, a

firm is exposed to the rollover risk. The value of attempting to refinance is

$$V^{ref}(s_t) = I_L(s_t)\left[\xi V^L(s_t) + (1-\xi)V^N(s_t)\right] + I_R(s_t)\left[\xi V^R(s_t) + (1-\xi)V^N(s_t)\right] + I_S(s_t)V^N(s_t), \tag{57}$$

where ξ denotes the probability of a coordination failure conditional on the firm being exposed to rollover risk, and

$$I_L(s_t) = \mathbf{1}_{\{\chi k_t < b_t\}}\mathbf{1}_{\{V^R(s_t) < V^L(s_t)\}}, \tag{58}$$

$$I_R(s_t) = \mathbf{1}_{\{V^R(s_t) \geq V^L(s_t)\}}\mathbf{1}_{\{\phi(s_t) < 1\}}, \tag{59}$$

$$I_S(s_t) = \big(1 - I_L(s_t)\big)\big(1 - I_R(s_t)\big). \tag{60}$$

The indicator $I_L(s_t)$ identifies states in which the firm is exposed to rollover risk and liquidation follows a failed rollover, whereas $I_R(s_t)$ identifies states in which the firm is exposed to rollover risk but reorganization follows a failed rollover. The remaining states, captured by $I_S(s_t)$, are rollover-safe, so refinancing succeeds independently of creditor coordination.

3.2 Lenders' Problem

Given the firm's refinancing problem, I next characterize the pricing of its next-period financial position. Competitive atomistic lenders price debt taking into account both the firm's future default decision and creditors' refinancing incentives.

Let $k' \equiv k_{t+1}$, $b' \equiv b_{t+1}$, and define

$$s' \equiv (z_{t+1}, k', b'), \qquad \phi' \equiv \phi(s').$$

The price schedule is

$$Q(z_t, k', b') = \begin{cases} \dfrac{1}{1+r-\kappa_s}, & b' < 0, \\ \dfrac{1}{1+r+\kappa_b}, & 0 \leq b' \leq \chi k', \\ \dfrac{1}{(1+r+\kappa_b)b'}\mathbb{E}_t[R(s')], & b' > \chi k'. \end{cases} \tag{61}$$

For $b' < 0$, the firm holds liquid financial assets, with $\kappa_s > 0$ capturing a small cost of carrying liquidity. For $b' > 0$, $\kappa_b > 0$ captures a small borrowing wedge. When positive

debt does not exceed the liquidation value of installed capital, repayment is fully covered by liquidation proceeds and the debt is therefore risk free.

For $b' > \chi k'$, creditor repayment depends on the firm's subsequent default and refinancing outcomes. The total payoff to creditors is

$$R(s') = \begin{cases} \chi k', & V^R(s') < V^L(s'), \quad \Lambda(s') = \text{Liq}, \\ (1-\xi)b' + \xi\chi k', & V^R(s') < V^L(s'), \quad \Lambda(s') = \text{Cont}, \\ \phi' b', & V^R(s') \geq V^L(s'), \quad \Lambda(s') = \text{Reorg}, \\ b', & \Lambda(s') = \text{Exit}, \\ b', & V^R(s') \geq V^L(s'), \quad \Lambda(s') = \text{Cont}, \quad \phi' = 1, \\ (1-\xi)b' + \xi\phi' b', & V^R(s') \geq V^L(s'), \quad \Lambda(s') = \text{Cont}, \quad \phi' < 1. \end{cases} \tag{62}$$

Here, $\Lambda(s')$ denotes the firm's optimal action in the following period. The second and final cases correspond to rollover-exposed continuation states: with probability $1-\xi$, refinancing succeeds and creditors are repaid in full, whereas with probability ξ, refinancing fails and creditors receive the recovery implied by the relevant bankruptcy procedure. When $\phi' = 1$, reorganization guarantees full recovery even following a failed rollover, so the position is rollover safe.

Small balance-sheet wedges. I introduce small wedges on both borrowing and liquid-asset holdings. These wedges have both an economic and a numerical motivation. Issuing and adjusting debt entails underwriting, intermediation, and other transaction costs, while corporate liquid assets are costly to manage and generally earn less than the firm's opportunity cost of funds. Consistent with this evidence (Fischer et al., 1989; Altinkilic and Hansen, 2000; Leary and Roberts, 2005; Azar et al., 2016), I set κ_b and κ_s to small positive values and interpret these wedges as financial intermediation spreads. Firms face borrowing costs above the return received by households and earn a return on liquid assets below the return on household saving. Although financial intermediaries are not modeled explicitly, the resulting spread income is rebated lump-sum to the representative household. Thus, the wedges affect firms' balance sheet incentives but do not constitute aggregate resource losses. The magnitudes used in the baseline are deliberately tiny and should be interpreted primarily as tie-breaking wedges rather than as additional quantitative financial frictions.

Numerically, the wedges uniquely pin down the firm's balance-sheet policy throughout the state space. When taxable income is positive, the interest tax shield generally provides a marginal incentive that helps determine the optimal debt position. When taxable income is negative, however, this tax advantage disappears, so corporate income taxation alone may fail to select a unique debt position. The small balance-sheet wedges eliminate these local ties and deliver a unique debt choice at every state.[5]

3.3 Entering firm problem

Potential entrants are initially uncertain about their project-specific productivity. However, they need to choose their financing scale before observing their productivity draw. To access the entry opportunity, a potential entrant raises external equity e, incurs an equity issuance cost $E(e)$, and pays a fixed entry cost κ. The amount of equity raised determines the entrant's potential scale of operation. After completing the financing stage, the entrant observes its initial productivity draw z_t. The productivity of entering firms, z_t, is idiosyncratic and independent across firms, and evolves according to the same first-order Markov process as the productivity of incumbent firms.

After observing z_t, the entrant decides whether to proceed with the project. If productivity is sufficiently low, the entrant abandons the project and returns the unused funds to investors; both the equity issuance cost and the fixed entry cost are sunk. If productivity is sufficiently high, the entrant invests at the predetermined scale, $k_{t+1} = e$, and becomes an incumbent firm in the following period.

$$\text{Potential entrant} \;\rightarrow\; \begin{array}{c}\text{raise equity } e \\ \text{and pay } E(e) \\ \text{pay } \kappa\end{array} \;\rightarrow\; \begin{array}{c}\text{observe} \\ z_t\end{array} \;\rightarrow\; \begin{cases}\text{return residual funds and exit,} & \text{if } z_t \text{ is low,} \\ \text{invest } k_{t+1},\ \text{enter,} & \text{if } z_t \text{ is high.}\end{cases}$$

Figure 5: Timing of entry decisions.

[5]These policy indifferences are essentially innocuous for steady-state firm values and aggregate allocations, but they are potentially problematic for transition dynamics. One could impose an explicit tie-breaking rule—for example, selecting the highest-debt policy among nearly indifferent choices. Such rules, however, are not numerically robust when the objective is locally flat. Arbitrarily small rounding, interpolation, or convergence errors can change which grid point is classified as optimal and therefore cause the selected debt policy to jump across otherwise payoff-equivalent positions. Whether such policy switching is quantitatively innocuous in transition is not known a priori. This is particularly important in the present model because capital and maturing debt are separate state variables and rollover risk depends on the composition of the balance sheet rather than on net worth alone. I therefore introduce the small wedges to remove the underlying indifference rather than resolving it through an arbitrary numerical selection rule.

The potential entrant chooses how much equity to raise before observing their productivity. The value of the entry opportunity is:

$$V^E = \max_{e \geq 0} \{-E(e) - \kappa + \sum_z W^E(z, e)\bar{G}(z)\} \tag{63}$$

where the equity issuance cost is given by

$$E(e) = \lambda e^3. \tag{64}$$

$W^E(z_t, e)$ is the post-signal entering firm value after it has raised equity (e) and observed its productivity realization z_t. At this stage, the firm chooses whether to enter at the predetermined scale or abandon the project and refund investors. The post-signal entering firm value is therefore:

$$W^E(z_t, e) = \max\{0, -e + \frac{1}{1+r} E(V_{t+1}(z_{t+1}, k_{t+1}, b_{t+1}))\}, \tag{65}$$

subject to

$$k_{t+1} = e \tag{66}$$

$$b_{t+1} = 0 \tag{67}$$

3.4 Household Problem

The representative household owns firms and financial intermediaries. In period t, it chooses consumption C_t, labor supply L_t, firm shares $S_{j,t+1}$, and risk-free bond holdings. The government levies proportional and lump-sum taxes on corporations and the household, and its budget must balance every period.

$$\max_{\{C_t, L_t, S_{j,t+1}, B_{t+1}\}_{t \geq 0}} \quad E_0 \left[\sum_{t=0}^{\infty} \beta^t U(C_t, L_t) \right] \tag{68}$$

subject to

$$U(C_t, L_t) = \log C_t - \Phi L_t \tag{69}$$

$$C_t + \int p_{jt} S_{j,t+1} \, dj + q_t^B B_{t+1} = w_t L_t + \int (p_{jt} + d_{jt}) S_{jt} \, dj + B_t + T_t + \Pi_t^{FI} \tag{70}$$

where p_{jt} is the ex-dividend stock price of firm j, d_{jt} is its dividend, q_t^B is the price of the risk-free discount bond, T_t is a lump-sum transfer, and Π_t^{FI} is financial intermediaries' spread income, which is rebated lump-sum to the household. Φ is the labor disutility parameter.

I use the same model environment for two exercises. Section 5.1 and 5.2 study the stationary equilibrium, which provides the main framework for the long-run welfare analysis. Section 5.3 studies business-cycle dynamics around the calibrated steady state. The individual firm problems are identical across the two exercises; only the equilibrium closure of the labor market and entry margin differs.

4 Equilibrium and Calibration

4.1 Stationary Equilibrium

I first characterize the stationary equilibrium used for calibration and long-run counterfactual analysis. Let $\mu(s)$ denote the stationary measure of incumbent firms over states $s = (z, k, b)$, and let M denote the mass of potential entrants that access the financing stage.

Definition 1 (Stationary Competitive Equilibrium)**.** *Given household preferences and model parameters, a stationary competitive equilibrium consists of a wage w, aggregate consumption C, aggregate labor L, an entrant mass M, a financial-price schedule $Q(z, k', b')$, firm value functions and policy rules, and a stationary measure μ such that:*

1. ***Incumbent optimization.*** *Given w and Q, incumbent firms solve the dynamic problem characterized in Section 3.*

2. ***Bankruptcy resolution.*** *Conditional on reorganization, the recovery rate solves the Nash bargaining problem described above.*

3. ***Lender break-even.*** *Competitive atomistic lenders earn zero expected profits, and $Q(z, k', b')$ satisfies the lenders' pricing condition for every feasible balance-sheet choice.*

4. ***Entrant optimization and free entry.*** *Potential entrants optimally choose their financing scale and post-signal entry decisions, and whenever entry is positive, the free-entering condition $V^E = 0$ holds.*

5. ***Stationary distribution.*** *The distribution of incumbent firms is invariant under the optimal policy rules, productivity transitions, endogenous exit and default, and the inflow*

of successful entrants:

$$\mu = \mathcal{T}(\mu) + M^* \mu^E, \tag{71}$$

where μ^E denotes the distribution of successful entrants generated by the entrant problem and M^* is the associated entering mass.

6. ***Household optimality.*** *The intratemporal labor-supply condition satisfies*

$$w = \Phi C. \tag{72}$$

7. ***Labor-market clearing.*** *Aggregate labor supplied by the household equals aggregate labor demand:*

$$L = \int l(s)\, d\mu(s). \tag{73}$$

8. ***Taxes / transfers satisfy government budget balance.***

9. ***Goods-market clearing.*** *Aggregate consumption satisfies the economy's resource constraint.*

This equilibrium definition applies to both the calibrated benchmark and the counterfactual steady states. The distinction lies in which equilibrium conditions are used for calibration and which variables are allowed to adjust.

4.2 Transition Equilibrium

To study aggregate dynamics, I consider MIT transitions starting from a stationary equilibrium. Conditional on an unexpected change in rollover risk, agents have perfect foresight over the subsequent path of aggregate prices and rollover risk. The transition equilibrium is defined analogously to the stationary equilibrium, except that prices, firm policies, and the cross-sectional measure of firms are time varying. The household stochastic discount factor is therefore

$$m_{t,t+1} = \beta \frac{C_t}{C_{t+1}}, \tag{74}$$

and the firm distribution evolves according to the equilibrium policies, productivity transitions, entry, ordinary exit, rollover failures, and bankruptcy outcomes.

Along the transition, I hold fixed only the flow of potential entrants at its steady-state level. In each period, a mass M^{SS} of potential entrants arrives, but entrants reoptimize their initial scale and financing choices given current equilibrium conditions and the equity-issuance cost

they face. They may also choose not to operate, so both the scale of entering firms and realized entry remain endogenous. Successful entrants join the incumbent distribution in the following period. Importantly, the measure of firms is not normalized along the transition: aggregate firm mass evolves endogenously through entry, exit, default, liquidation, reorganization, and rollover failures. Appendix B.1 provides the formal definition of the transition equilibrium.

4.3 Calibration

I calibrate the model to a stationary equilibrium representing the U.S. economy. Before describing the parameter choices, I first explain the normalization and equilibrium closure used to construct the benchmark.

Benchmark normalization. For the calibrated U.S. benchmark, I normalize the steady-state wage to $w^{US} = 1$ and target aggregate labor at $L^{US} = 1/3$. Given the benchmark wage, labor-market clearing determines the entrant mass M^{US}. The resource constraint then determines benchmark consumption C^{US}, and the household labor-disutility parameter is calibrated from

$$\Phi = \frac{w^{US}}{C^{US}}. \tag{75}$$

The benchmark calibration also satisfies the free-entry condition $V^E = 0$.

I divide the parameterization into two groups. The first group of parameters is assigned externally using standard values from the literature or direct empirical counterparts. The second group of parameters is chosen jointly to match moments governing firm financing, entry and exit, and bankruptcy resolution. For exposition, I discuss the moments that are particularly informative about individual parameters, although all internally calibrated parameters are determined jointly in equilibrium.

Table 1 summarizes the parameters assigned outside the model. First, because the model in Corbae and D'Erasmo (2021) serves as a nature benchmark for this paper, I set the production related parameters, including the capital share α, the returns-to-scale parameter v, and the parameters governing the productivity process, namely ρ_z and σ_z, to the values reported in their study. Second, I set the household discount factor, β, to 0.96 following Khan et al. (2024), which implies an average real interest rate of 4 percent. Then, I take the annual depreciation rate δ and the corporate income tax rate τ_c from Winberry (2021) and Corbae and D'Erasmo (2021) respectively. These parameter values are standard and widely used in the literature. For the capital irreversibility parameter θ_k, I follow the calibration in Khan and

Thomas (2013), a well-established benchmark in the partial-irreversibility literature. Khan and Thomas (2013) calibrates this parameter to match both the serial correlation and the lumpiness of establishment-level investment. Third, I discipline the liquidation value of the asset χ and the capital loss in reorganization γ_k, using estimates from the empirical literature. I set the liquidation value of the asset, χ, to 0.35, based on Kermani and Ma (2023), who estimates that the orderly liquidation value of property, plant, and equipment averages 35% of its net book value across industries. For the capital loss in reorganization γ_k, I follow Bris et al. (2006), who reports the median decline in reported asset value during Chapter 11 proceedings is 13.1%. Finally, I set the cash-management wedge κ_s and the debt-servicing wedge κ_b deliberately small, as discussed in the previous section.

Table 1: Externally Assigned Parameters

Parameter	Value	Description	Source
β	0.96	Annual discount factor	Khan et al. (2024)
δ	0.10	Annual depreciation rate	Winberry (2021)
τ_c	0.30	Corporate tax rate	Corbae and D'Erasmo (2021)
α	0.33	Capital share	Corbae and D'Erasmo (2021)
v	0.85	Returns to scale	Corbae and D'Erasmo (2021)
ρ_z	0.657	Persistence of firm productivity	Corbae and D'Erasmo (2021)
σ_z	0.199	Std. dev. of productivity innovations	Corbae and D'Erasmo (2021)
χ	0.35	Liquidation value per unit of capital	Kermani and Ma (2023)
θ_k	0.954	Partial irreversibility	Khan and Thomas (2013)
γ_k	0.131	Capital loss in reorganization	Bris et al. (2006)
κ_s	0.10%	Cash-management wedge	–
κ_b	0.01%	Debt-servicing wedge	–

The remaining parameters are determined using a combination of equilibrium restrictions and targeted moments. As described above, I normalize the benchmark steady-state wage to $w^{US} = 1$ and target aggregate labor at $L^{US} = 1/3$. Given the resulting steady-state allocation, the household labor-disutility parameter Φ follows directly from the household first-order condition. Hence, Φ is implied by the benchmark wage normalization and the labor-supply target rather than disciplined by an additional moment.

The parameters governing entrant financing are disciplined by the entry conditions. The entrant-to-incumbent employment ratio pins down the curvature of the entrant equity-issuance cost, which determines the scale at which new firms enter. Conditional on this choice, the remaining entry-cost parameter is set so that the free-entry condition, $V^E = 0$, holds. Thus, the

Table 2: Internally Calibrated Parameters

Parameter	Value	Description
Panel A. Incumbent firm		
ψ	0.02	Convex capital adjustment cost
c_f	0.08255	Fixed cost of production
s_x	0.37	Resale price of capital in exit
ξ	0.03	Rollover risk probability
θ	0.65	Firm bargaining power
η	0.95	Reorganization cost
Panel B. Entering firm and GE		
κ	0.0339	Entry cost
λ	4.6875	Cubic equity issuance cost
Φ	2.4517	Labor disutility

Table 3: Targeted Moments

Moment	Data	Model	Data source
Panel A. Cross-sectional moments			
Aggregate debt-to-asset ratio	37.2%	38.92%	Flow of Funds; Khan et al. (2024)
Entrant-to-incumbent employment ratio	28.50%	27.98%	BDS; Khan et al. (2024)
Share of firms with positive debt	0.81 [§]	0.69	Crouzet and Mehrotra (2020)
Average investment rate	0.12	0.15	Cooper and Haltiwanger (2006)
Panel B. Exit and default moments			
Exit rate (annual)	8.65%	8.82%	BDS; Khan et al. (2024)
Default rate (annual)	0.959%	0.952%	D&B business-failure 1984-1997
Share of bankrupt firms reorganized	25.00%	28.26%	U.S. Courts[†]
Average recovery rate in reorganization	69.40%	63.19%	Corbae and D'Erasmo (2021)
Panel C. Life-cycle moments			
Cohort survival rate through age 3	57.42%	58.32 %	BDS, see Khan et al. (2024)
Cohort survival rate through age 5	45.61%	38.23%	BDS, see Khan et al. (2024)

Notes: [§] Because the model is calibrated to aggregate U.S. moments, the ideal empirical counterpart would be an economy-wide measure of the share of firms with positive debt. Following Ottonello and Winberry (2020), we report 0.81 as the benchmark implied by Crouzet and Mehrotra (2020), based on the QFR sample, which is representative of U.S. manufacturing firms with more than $250,000 in assets. This coverage therefore excludes many of the smallest firms in the economy. For comparison, the 2025 Federal Reserve Small Business Credit Survey reports that 69% of U.S. employer firms with 1–499 employees have positive outstanding debt, while the corresponding share among nonemployer firms is 49%.
[†] U.S. Courts business bankruptcy filings for the year ending December 2013, as reported by Corbae and D'Erasmo (2021). This statistic is not a calibration target in Corbae and D'Erasmo (2021).

entry block uses one empirical size moment together with the free-entry equilibrium restriction, rather than a separate empirical target for each entry parameter.

Parameters governing exit and bankruptcy have relatively direct empirical counterparts. Following the logic of Corbae and D'Erasmo (2021), the resale value of capital upon voluntary exit, s_x, is chosen primarily to reproduce the relative frequency of voluntary exit and bankruptcy. The corresponding empirical moments are an annual exit rate of 8.65%, and an annual default rate of 0.959%. Conditional on this margin, the cost of reorganization, η, is disciplined primarily by the share of bankrupt firms that reorganize rather than liquidate. This mapping is particularly tight in the calibrated model because η directly shifts the relative value of the two bankruptcy procedures. The firm's bargaining power in reorganization is jointly disciplined by aggregate leverage and creditor recovery in reorganization. Recovery rates place a relatively tight restriction on bargaining power, while leverage provides additional discipline because bargaining outcomes affect the amount of continuation value that can be pledged to creditors.

The remaining parameters are more tightly connected and are therefore calibrated jointly. The fixed operating cost is primarily disciplined by the aggregate exit rate. Although exit also responds to rollover risk and capital adjustment costs, the fixed operating cost is quantitatively the dominant determinant of the steady-state exit margin and therefore provides the natural benchmark for matching aggregate exit.

Both rollover risk and convex capital adjustment costs affect firms' financing choices and the survival of young firms. Higher rollover risk acts directly as a financing friction: firms respond by limiting their debt exposure. Higher adjustment costs can generate a similar within-firm force by slowing firms' movement toward their preferred scale and prolonging the period over which financing constraints bind. At the aggregate level, however, the effects of adjustment costs also interact with endogenous entry and selection and therefore need not be monotonic.

Additional discipline comes from the non-monotonic effect of capital adjustment costs on equilibrium leverage. At low levels of ψ, a higher adjustment cost strengthens selection among active firms, raising the average productivity of the surviving firm population. Since more productive firms tend to operate with higher leverage, this composition effect raises aggregate leverage. As ψ becomes sufficiently large, however, the direct distortion to capital adjustment dominates the selection effect, and equilibrium leverage declines.

This non-monotonic response helps distinguish adjustment costs from rollover risk. Higher rollover risk operates more directly through firms' incentives to reduce debt exposure, whereas changes in ψ also alter selection and the composition of firms. Very high adjustment costs are

additionally inconsistent with bankruptcy outcomes: they generate substantially lower leverage among reorganizing firms and consequently unrealistically high recovery rates in reorganization.

The observed default rate provides a further restriction on rollover risk. When rollover risk becomes sufficiently high, firms have a strong incentive to self-insure by sharply reducing leverage and their exposure to refinancing failures. This endogenous adjustment can reduce the equilibrium incidence of default substantially and, at sufficiently high values of rollover risk, drive it close to zero. Parameter values in this region are therefore inconsistent with the observed incidence of business failure. I therefore use investment, leverage, firm survival and bankruptcy-recovery moments jointly to discipline convex adjustment cost ψ and rollover risk ξ.

Before turning to these validation exercises, I briefly describe the equilibrium closure used whenever I solve an alternative stationary environment. This is needed for any steady-state counterfactual exercises studied later.

Counterfactual stationary equilibria. In counterfactual economies, I hold the household preference parameter Φ fixed at its benchmark value. The free-entry condition

$$V^E(w) = 0 \tag{76}$$

determines the counterfactual wage. Household optimality then implies

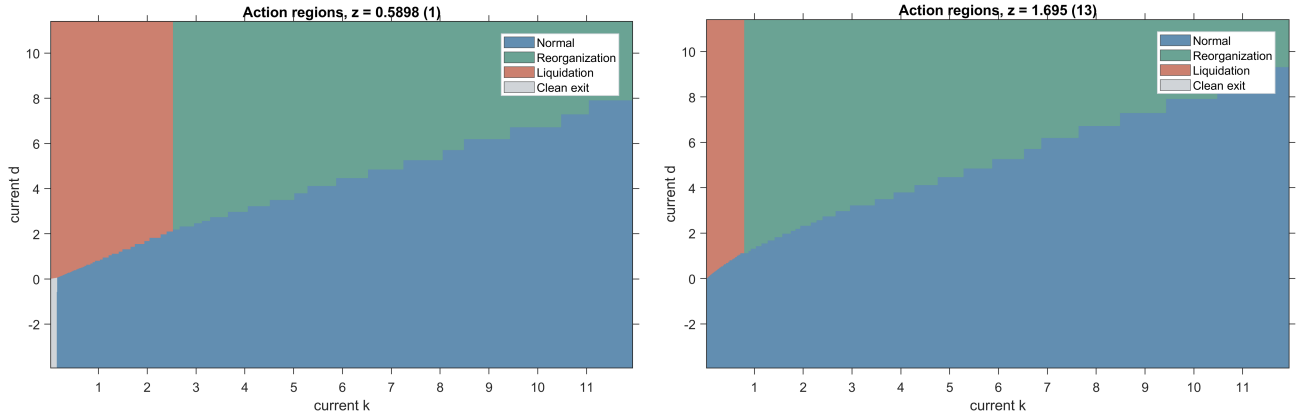
$$C = \frac{w}{\Phi}. \tag{77}$$

Given this level of aggregate consumption, the resource constraint determines the equilibrium entrant mass M, and labor-market clearing determines counterfactual aggregate employment L.

4.4 Firm decisions and debt pricing

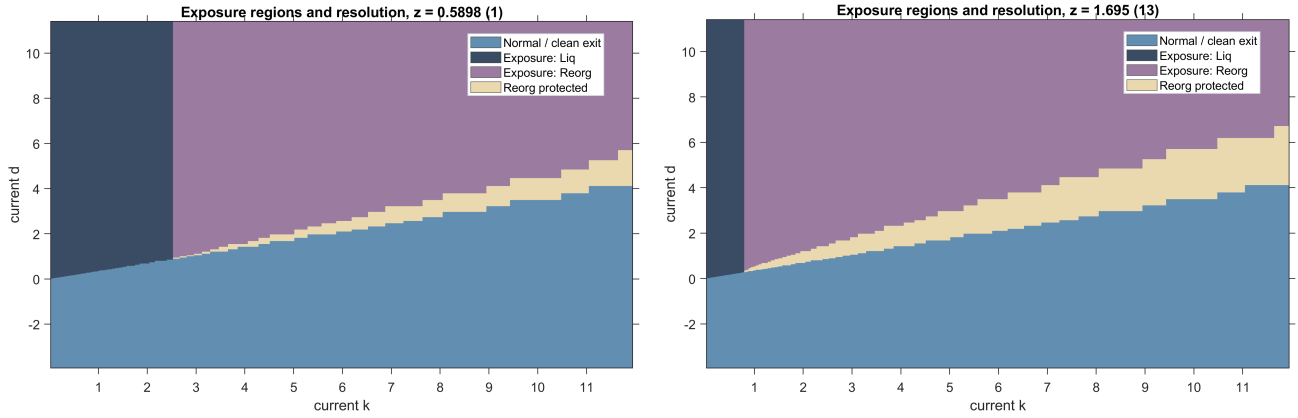
We begin by describing firms' refinancing, exit and bankruptcy choices. Recall the firm's value of attempting to refinance in Equation (57). It is straightforward to see that, holding V^N, V^L, V^R, V^X fixed, current-period rollover risk leaves the active default regions unchanged, but may shift the boundary between refinancing and voluntary exit, inducing some firms to exit with full repayment rather than attempt to refinance.

Figure 6 presents the bankruptcy and exit decision rules across capital, debt and productivity.



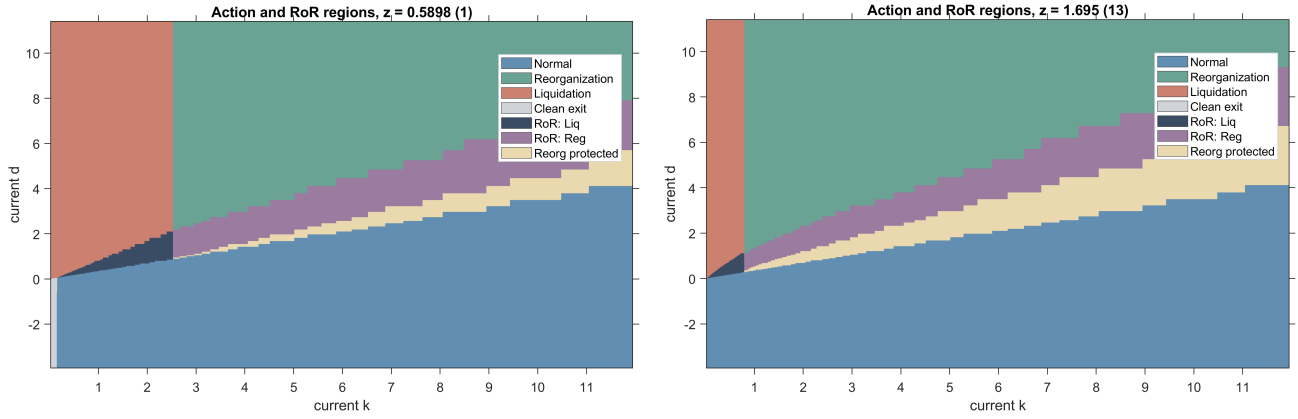
(a) Low productivity (b) High productivity

Figure 6: **Firm decision regions**



(a) Low productivity (b) High productivity

Figure 7: **Firm rollover exposure**



(a) Low productivity (b) High productivity

Figure 8: **Firm decisions and rollover exposure**

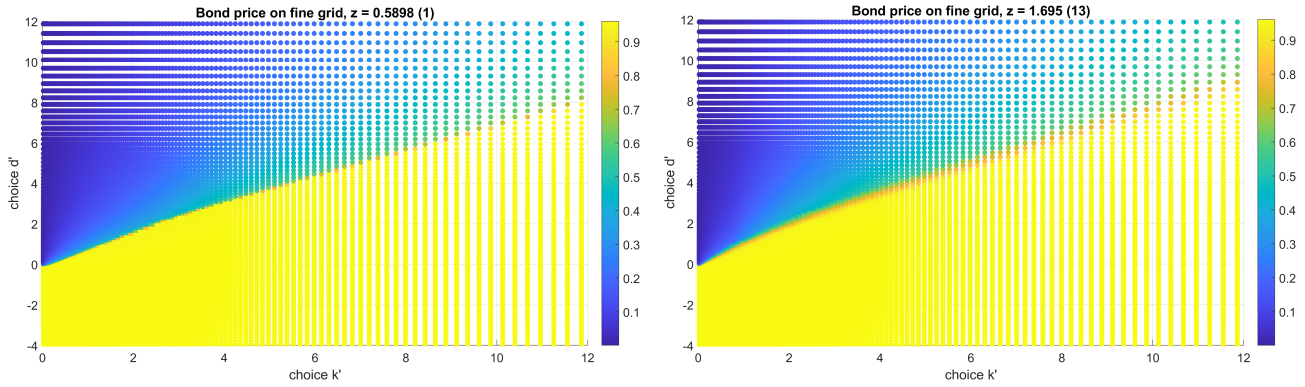
The left panel shows the decision rules for a firm with low productivity, while the right panel shows the decision rules for a firm with high productivity. As in Corbae and D'Erasmo (2021), firms with high productivity do not exit no matter what their mix of capital and debt. Given a firm's productivity z_t, its size k_t determines how it is handled following a default; given both productivity z_t and size k_t, the firm's maturing debt b_t determines whether the firm wants to default or repay. Highly indebted firms default, while firms with lower debt levels continue operations. Meanwhile, low productivity firms that hold net cash may choose to exit voluntarily.

When a firm relies on multiple creditors to renew its maturing debt, a coordination failure among creditors can prevent the firm from successfully refinancing. Consequently, a default may occur even if the firm is both willing to repay its maturing debts and capable of continuing its operation upon a successful refinancing. Figure 7 presents the rollover exposure regions across capital, debt and productivity. The left and right panels show the exposure regions for firms with low and high productivity respectively. As we discussed in the previous section, if the recovery value in the event of default is sufficient to repay maturing debt, a creditor's decision on whether to roll over a debt does not depend on the actions of other creditors, thereby eliminating rollover risk in this region. If recovery value is insufficient, creditors' rollover decisions become interdependent, and the firm enters a rollover risk exposure region. Firms in the black and purple regions are exposed to rollover risk. Refinancing failure leads to liquidation in the black region and reorganization in the purple region. When the default option is liquidation, creditors rely on the liquidation value of capital to obtain repayment in the event of default. Consequently, the rollover-safe region is bounded by liquidation value of capital. Reorganization preserves continuation value, thereby increasing recovery value in the event of default and raising the ceiling for rollover safe debt capacity. The light yellow region represents the additional rollover safe region made possible by reorganization, where maturing debt exceeds the liquidation value of capital but remains fully recoverable under reorganization.

Figure 7 highlights two key features of the rollover safe region: First, larger firms (k_t) are more likely to opt for reorganization in the event of a default. Consequently, as a firm grows in size (k_t) and enters the region in which reorganization is possible, the rollover-safe region expands. This allows larger firms to safely sustain a higher level of debt. Second, higher productivity translates into a greater continuation value. Since reorganization allows firms' continuation value to be utilized to support debt repayment, more productive firms benefit from a higher rollover safe debt ceiling within the reorganization feasible region.

To illustrate the interaction between firms' decisions and creditors' rollover decisions, Figure 8 overlays the firm's decision regions with the rollover exposure region. From Figure 8,

we can see that all active reorganization regions are exposed to rollover risk. The blue refinancing region shown in Figure 6 is further partitioned according to rollover exposure and the bankruptcy outcome conditional on refinancing failure in Figure 8. If the court cannot verify whether a creditor coordination failure prevented refinancing, it is unable to distinguish ex post between rollover-induced default and active default. With limited creditor bargaining power, the same reorganization procedure that mitigates rollover risk can also weaken firms' repayment incentives, creating a trade-off between coordination benefits and repayment discipline.



(a) Debt price function $Q(z_L, k', b')$

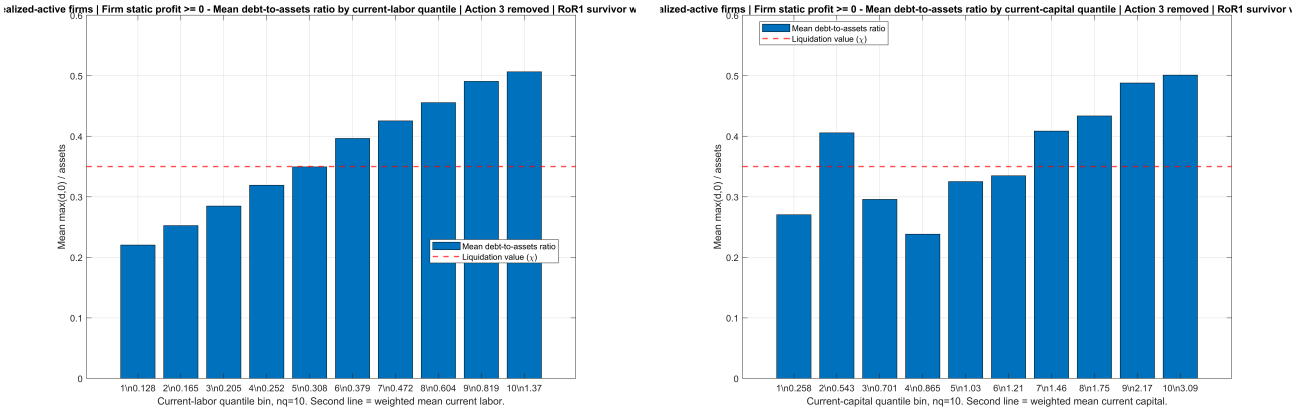
(b) Debt price function $Q(z_H, k', b')$

Figure 9: **Debt price schedules**

4.5 Cross-sectional borrowing patterns

I first evaluate the model's cross-sectional implications for firm financing. Figures 10 reports mean debt-to-asset ratios across firm-size deciles after excluding firms with negative EBITDA. When firm size is measured by employment, the model generates a strong and nearly monotonic positive relation between firm size and leverage. When firms are ranked by current capital, the relationship is less smooth across intermediate deciles, but leverage again rises substantially toward the upper end of the distribution. This difference is natural in the presence of capital adjustment frictions: current capital is a sluggish state variable.

More importantly for the mechanism of the paper, the figures reveal a systematic change in what supports firms' borrowing across the size distribution. The dashed horizontal line denotes the leverage ratio that can be fully supported by the liquidation value of their assets. Smaller firms generally remain close to, or below, this benchmark, so liquidation value provides a tight discipline on their borrowing. Firms toward the upper end of the size distribution, by contrast, increasingly borrow beyond the liquidation value of their assets. This pattern is consistent with the evidence in Kermani and Ma (2023) and Lian and Ma (2021): borrowing by smaller firms



(a) By labor decile

(b) By capital decile

Figure 10: **Mean debt-to-asset ratio by firm size, excluding firms with negative EBITDA.** Panel (a) reports the mean debt-to-asset ratio by labor decile. Panel (b) reports the corresponding ratio by capital decile. Both panels exclude firms with negative EBITDA.

is more closely tied to liquidation value, whereas larger firms rely more heavily on the value of continued operation. The key cross-sectional prediction is therefore not simply that leverage rises with firm size, but that the basis of debt capacity shifts from liquidation value toward continuation value.

5 Aggregate Implications of Bankruptcy Design and Rollover Risk

5.1 Easier Reorganization at the U.S. Benchmark

Taking the calibrated U.S. benchmark as the starting point, I now study the effects of reducing the fixed component of reorganization frictions. Specifically, I lower the reorganization cost η while holding the background level of rollover risk and all other structural parameters fixed at their calibrated values.

5.1.1 Reorganization versus liquidation only

The analytical model demonstrates that the effect of introducing reorganization is ambiguous. Allowing a defaulting firm to reorganize does not necessarily improve its value or debt capacity. On the one hand, reorganization preserves a firm's going concern value, enabling a larger volume of debt to be safely rolled over, thereby avoiding coordination failure, and preventing firms that remain economically viable from being forced into default due to a rollover failure. On the other hand, reorganization allows firms to retain a portion of the going concern surplus during

default negotiations, weakens a firm's incentive to repay its debt obligations and reduces the pledgeability of its going concern value. Given the firm's bargaining power, the net effect of reorganization depends on the relative magnitude of two competing forces. Consequently, while the analytical model can illustrate the underlying mechanisms, it cannot definitively establish which of these forces dominate in the U.S. context.

To address this question, I compare the calibrated U.S. steady state with a counterfactual economy that allows only for liquidation. In this counterfactual scenario, reorganization is no longer an available option for resolving defaults, while all other underlying parameters, including the conditional probability of rollover failure, remain fixed at their calibrated values from the U.S. benchmark. Consequently, firms' investment and borrowing policies, creditors' debt pricing, firms' endogenous exposure to rollover risk, the distribution of firms, and entry and exit behavior–all of these can adjust endogenously to the liquidation only steady state. By comparing two steady state equilibria, I assess whether allowing for reorganization improves aggregate welfare in the U.S. economy.

Table 4: U.S.-Calibrated Benchmark and Liquidation-Only Counterfactual

Moment	U.S. Benchmark	Liquidation Only
Aggregate debt-to-asset ratio	38.92%	30.59%
Default rate (annual)	0.952%	0.680%
Average labor	0.4206	0.4019
Average firm size (k)	1.1899	1.1238
Consumption	0.4079	0.4049
Aggregate firm mass	0.8692	0.8910
Exit rate	8.82%	7.24%

Table 4 isolates the quantitative contribution of the reorganization margin by comparing the calibrated U.S. benchmark with the liquidation-only counterfactual. Allowing for reorganization significantly expands the debt capacity of firms. Compared to the economy where only liquidation is permitted, the aggregate debt-to-asset ratio in the U.S. benchmark economy rises from 30.59% to 38.92%, an increase of 8.33 percentage points. Concurrently, the average capital scale increases from 1.1238 to 1.1899 (a rise of approximately 5.9%), while the average labor input grows from 0.4019 to 0.4206 (an increase of about 4.7%). These results are consistent with the underlying mechanism: reorganization preserves a firm's going concern value, allowing a portion of debt, which exceeds the firm's liquidation value, to be safely rolled over. This, in turn, supports higher leverage and a larger scale of operations.

The debt expansion resulting from reorganization is accompanied by higher rates of firm turnover and default. The annual default rate rises from 0.680% to 0.952%, the annual exit rate increases from 7.24% to 8.82%, and the total number of firms decliens from 0.8910 to 0.8692. Consequently, restructuring does not improve economic outcomes by simply reducing realized defaults. Instead, it raises the level of debt that firms can sustain and alters their decisions regarding borrowing, defaulting, and exiting. The decline in the total number of firms, coupled with an increase in the average firm size, suggests that the shift in average size may stem from an adjustment in the composition of firms in the steady stat, rather than merely reflecting a mechanical expansion in the scale of individual firms.

Despite rising default and exit rates, household consumption increased slightly from 0.4049 to 0.4079, an increase of approximately 0.7%. This indicates that the debt capacity and gains in firm scale resulting from reorganization have a positive aggregate impact.

5.1.2 Comparative statics in the fixed cost of reorganization

The comparison above indicates that, under the U.S. calibration, allowing for reorganization, as opposed to permitting only liquidation, increases both debt capacity and aggregate welfare. However, this comparison does not reveal whether further reductions in reorganization fixed costs would continue to be beneficial. Since both corporate policies and the steady state distribution adjust endogenously, the relationship between aggregate moments and reorganization costs may be non-linear and non-monotonic. Therefore, in this section, I systematically vary the reorganization fixed cost η and resolve the steady state equilibrium at each cost level.

Figure 11 and Figure 12 examine the steady state effects of varying the fixed reorganization cost. A lower η implies that reorganization is easier to implement. The conditional probability ξ, the likelihood of a coordination failure once a firm enters the rollover exposure region, is held constant. However, whether a firm chooses to expose itself to rollover risk, and the resulting realized default rate, remain endogenously determined. The red dashed line represents a liquidation only economy, while the U.S. benchmark corresponds to $\eta = 0.95$.

Figure 11 presents the primary results. As reorganization cost η decreases, the debt-to-asset ratio of firms rises significantly, and the annual bankruptcy rate increases. Meanwhile, aggregate welfare also improves. Conversely, when η increases, all three variables gradually converge toward their values in the liquidation-only economy. This finding suggests that easier reorganization allows firms to support more debt in the U.S. environment. Firms utilize this additional financing to increase their leverage, which in turn leads to a higher realized bankruptcy rate. Nevertheless, an increase in the bankruptcy rate does not imply a decline in welfare. Within

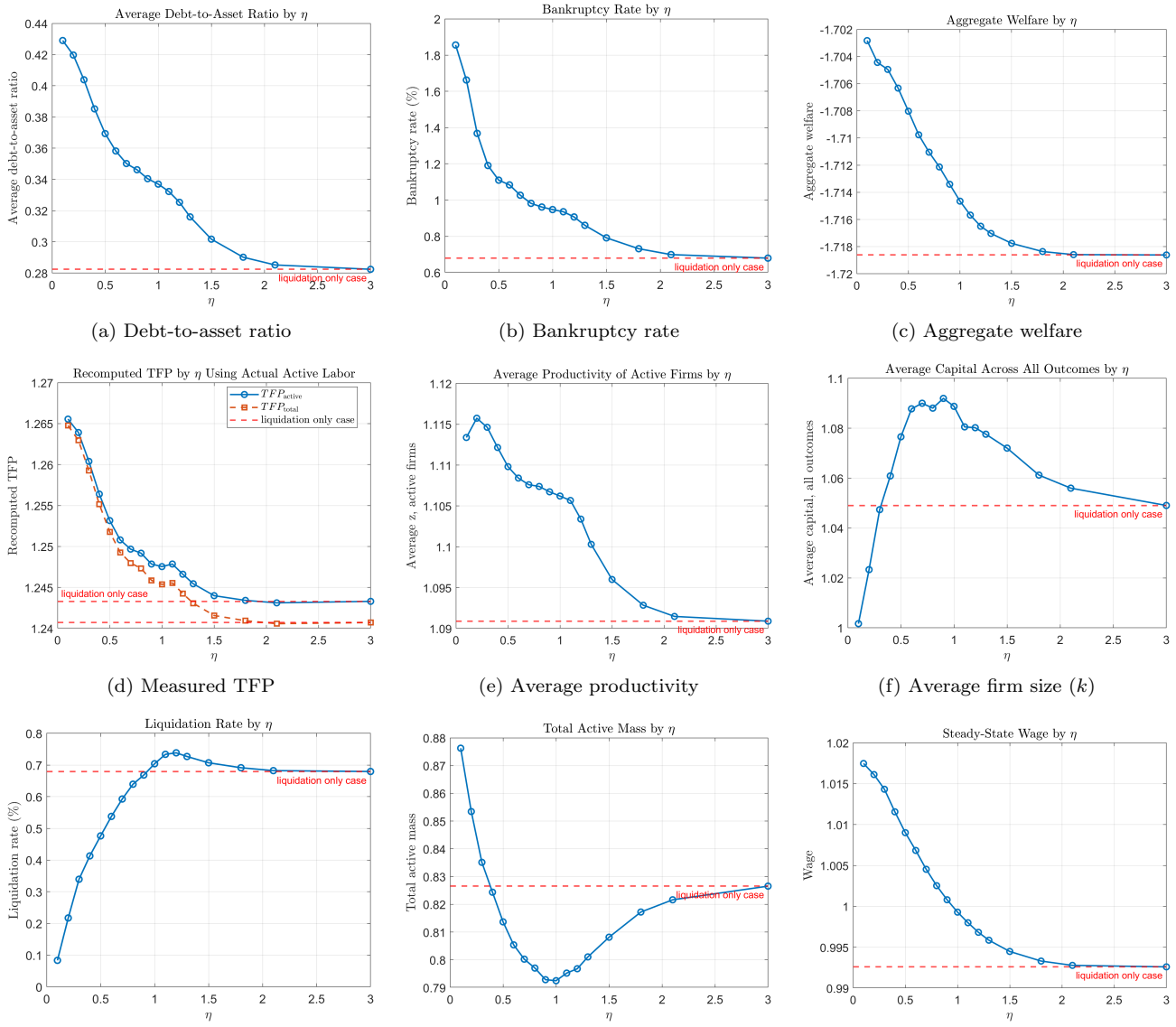
the parameter range shown, the relationship between welfare and η is non-linear yet monotonic: lower reorganization costs translate into higher welfare.

To understand why the bankruptcy rate rises, Figure 12 first decomposes total bankruptcies into reorganizations and liquidations. The reorganization rate increases significantly as η decreases, while the liquidation rate exhibits a non-monotonic pattern. Thus, the rise in the total bankruptcy rate is not merely a result of increased liquidations. It reflects both a higher incidence of firms entering default proceedings and a shift in the resolution of defaults toward reorganization.

The second and third rows of Figure 12 further distinguish between active defaults and defaults induced by rollover risk. In the calibrated U.S. benchmark, most reorganizations are triggered by rollover failure rather than strategic default as shown in Figure 12f. This is consistent with the model-based inference in Guntin (2023), whose calibrated model attributes most restructuring events to rollover crises. In this region, apart from expanding ex ante rollover-safe debt capacity, reorganization primarily serves as an ex post safety net: It allows firms, which would otherwise be willing to repay their debts and continue operations, to preserve their continuation value in the event of a coordination failure. As η decreases further, active reorganizations increase rapidly, while the share of reorganizations driven by rollover risk declines. This indicates that as reorganization becomes easier, its nature gradually shifts: it no longer merely protects firms facing coordination failures, but also makes choosing reorganization an increasingly attractive option for firms and thereby increases strategic default.

The response of firm composition is non-monotonic. Starting from the liquidation-only economy, the initial reductions in reorganization costs disproportionately benefit larger firms, for which the fixed procedural cost absorbs a smaller share of continuation surplus. As shown in Figures 11f and 11h, the initial decline in reorganization costs raises average firm size and reduces the mass of active firms, mirroring the transition from liquidation only to the calibrated U.S. benchmark. As reorganization costs fall further, however, reorganization becomes feasible and valuable for progressively smaller firms as well. This indicates that a reduction in reorganization fixed costs operates through different margins of adjustment depending on the range: at higher cost levels, the primary effect is the expansion of surviving firms; at lower cost levels, more firms are able to survive or enter, making an increase in the total number of firms the more significant factor. Consequently, average firm size cannot, by itself, serve as a metric of the aggregate gains from reorganization reforms.

The productivity and general equilibrium results shown in Figure 11 explain why welfare can

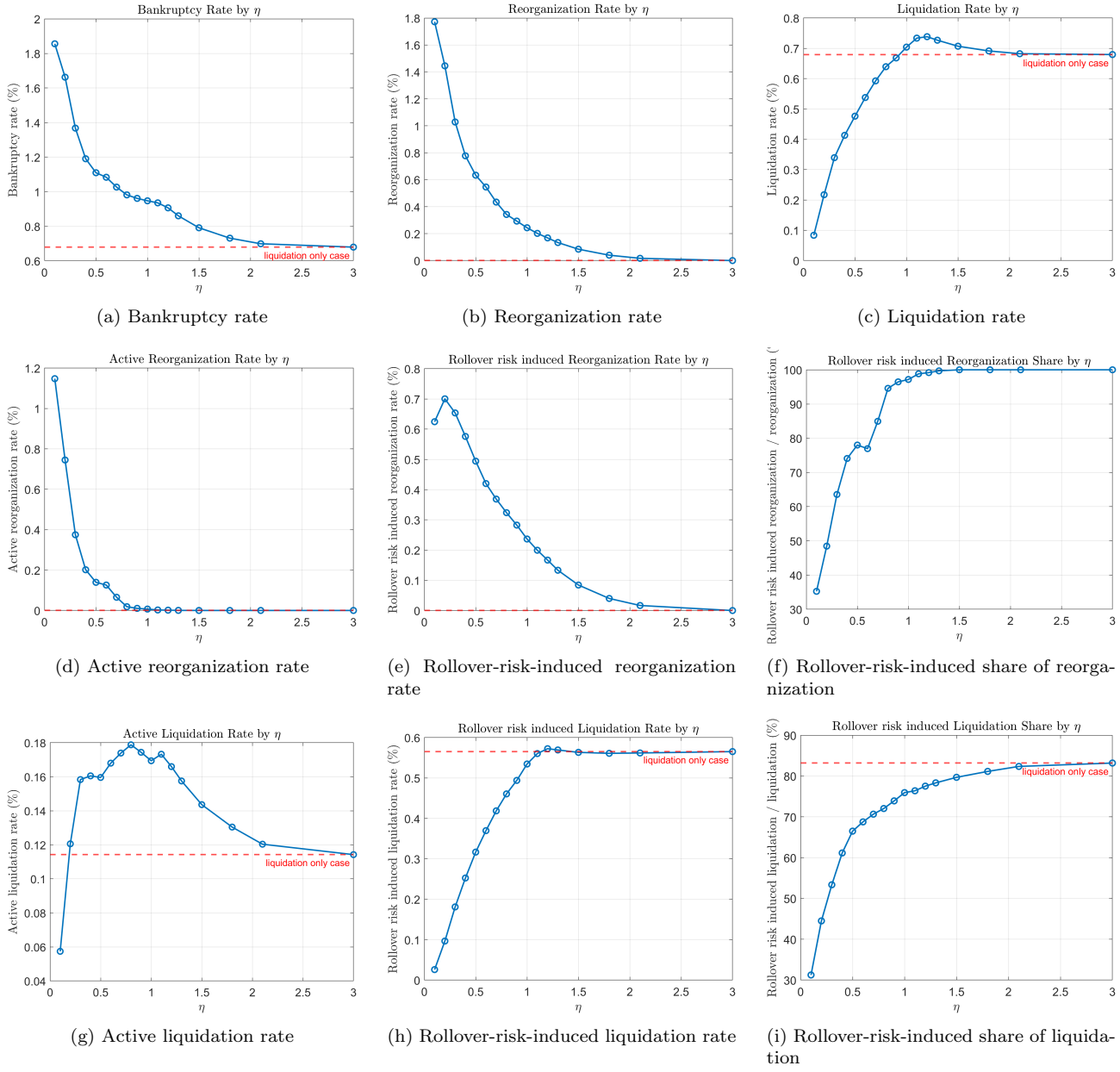


(a) Debt-to-asset ratio (b) Bankruptcy rate (c) Aggregate welfare

(d) Measured TFP (e) Average productivity (f) Average firm size (k)

(g) Liquidation rate (h) Active firm mass (i) Wage

Figure 11: **Steady-state effects of easier reorganization at the U.S. benchmark.** The background level of rollover risk is held fixed at its calibrated U.S. value while the reorganization cost η varies. Lower values of η correspond to easier reorganization. The first row reports financing, bankruptcy, and welfare outcomes; the second row reports productivity and aggregate allocation; and the third row reports liquidation and general-equilibrium adjustments.



(a) Bankruptcy rate

(b) Reorganization rate

(c) Liquidation rate

(d) Active reorganization rate

(e) Rollover-risk-induced reorganization rate

(f) Rollover-risk-induced share of reorganization

(g) Active liquidation rate

(h) Rollover-risk-induced liquidation rate

(i) Rollover-risk-induced share of liquidation

Figure 12: **Bankruptcy resolution and rollover-risk-induced outcomes.** The background level of rollover risk is held fixed at its calibrated U.S. value while the reorganization cost η varies. Lower values of η correspond to easier reorganization. The first row reports the aggregate bankruptcy rate and its two resolution outcomes, reorganization and liquidation. The second row decomposes reorganization into active and rollover-risk-induced events and reports the share of all reorganizations induced by rollover risk. The third row provides the corresponding decomposition for liquidation. The rollover-risk-induced shares are measured relative to total reorganization and total liquidation, respectively.

improve even as the bankruptcy rate rises. As reorganization costs fall from the liquidation-only economy toward the U.S. benchmark, measured TFP rises in part because the reform allows larger, more productive firms to operate at greater scale and improves the composition of active firms. Importantly, measured TFP continues to rise as reorganization costs fall further, even though average firm size begins to decline. This increase is therefore not simply a mechanical consequence of reallocating production toward smaller firms under decreasing returns to scale. Average productivity among active firms also continues to rise overall, despite some local non-monotonicity, indicating that the expansion in firm mass does not come at the cost of a deterioration in the productivity composition of active firms. Aggregate output and the equilibrium wage rise as well, and welfare continues to increase as reorganization becomes easier at the calibrated U.S. level of rollover risk. In other words, easier reorganization not only alters the frequency with which bankruptcy procedures are used, but also leads to a greater allocation of capital and labor toward more productive firms, thereby improving the allocation of resources.[6] The resulting gains in productivity and wages outweigh the costs associated with higher leverage and more frequent bankruptcies.

Overall, reducing fixed reorganization costs expands a firm's debt capacity and increases its equilibrium leverage. While this also leads to a higher incidence of realized bankruptcy, the resulting defaults are more frequently resolved through reorganization. Concurrently, productivity and wages rise, and aggregate welfare improves.

5.1.3 Descriptive historical evidence: the 1978 bankruptcy reform

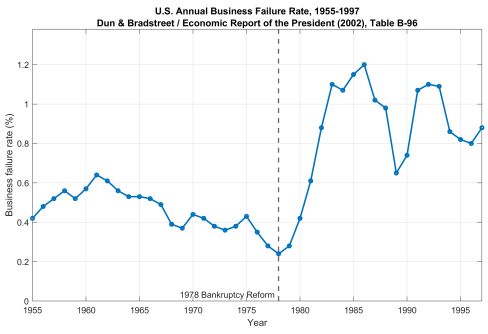
The preceding counterfactual yields a counterintuitive implication: easier reorganization could simultaneously lead to a higher share of reorganization in default and a higher default rate. Next, we examine whether the aggregate data from before and after the 1978 reforms are

[6]Relatedly, Szekely (2025) also argues that lower reorganization costs increase firm mass and aggregate productivity, but with a negative composition effect as more low- and intermediate-productivity firms remain active in the calibrated U.S. economy. In his model, firms are subject to an exogenous default shock that arrives with the same probability across firms, and the probability of this shock is calibrated to generate the observed external risk premium. The shock therefore creates financial frictions ex ante, but also generates a strong survival margin ex post. When a firm is hit by the exogenous shock, it defaults and is subsequently exits through liquidation or continues operating after reorganization. Firms with higher continuation values relative to their liquidation values are more likely to reorganize. Lower reorganization costs therefore improve financing conditions ex ante, but also change the resolution of the exogenous default shock: among firms hit by the shock, more reorganize rather than being liquidated and exiting. This survival channel is central to the negative composition effect in his model, so average productivity among active firms falls. In my model, by contrast, rollover exposure is endogenous: firms can self-insure by limiting their refinancing exposure, so rare realized default can coexist with substantial rollover risk. Lower reorganization costs relax these constraints, particularly for productive constrained firms, and the resulting increase in firm values and equilibrium wages strengthens selection against low-productivity firms.

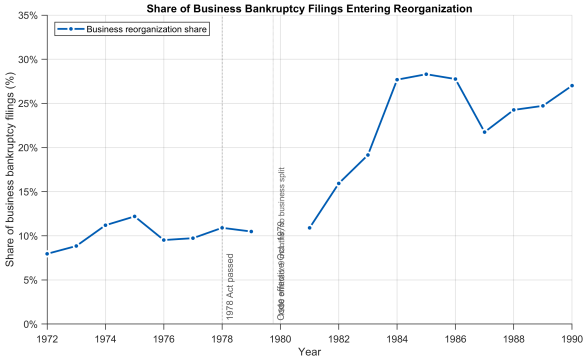
consistent with this pattern.

Institutional change The Bankruptcy Reform Act of 1978 substantially changed the institutional structure of corporate reorganization in the United States. Under the pre-1978 regime, corporate debtors effectively faced a trade-off between two distinct reorganization procedures. Chapter X allowed comprehensive restructuring of complex capital structures, but it was rigid, expensive and time consuming. It also generally required the appointment of an independent trustee. Chapter XI was considerably more flexible and generally allowed incumbent management to remain in control, but its arrangements were limited to unsecured debts. It did not permit nonconsensual restructuring of secured debts.

The new Chapter 11 combined a debtor-in-possession framework with substantially broader restructuring powers. Secured and unsecured claims could be addressed within the same proceeding, while class voting and cramdown reduced the extent to which a viable reorganization depended on obtaining the consent of individual dissenting creditors. The reform therefore affected two margins that are distinct in the model. First, it made comprehensive reorganization more accessible, reducing the effective institutional cost of preserving going concern value. Second, by changing the bargaining environment inside reorganization and limiting creditor holdout power, it also changed the division of surplus between debtors and creditors.



(a) Business failure rate



(b) Reorganization share

Figure 13: **Aggregate U.S. business outcomes around the 1978 bankruptcy reform.** Panel (a) plots the D&B business failure rate from 1955 to 1997 using data reported in the *Economic Report of the President* (2002). Panel (b) reports the share of business bankruptcies resolved through reorganization from 1972 to 1990.

Figure 13b shows that prior to the reforms, the proportion of corporate bankruptcy fillings entering reorganization remained relatively stable at around 10%. Following the reforms, this share rose significantly during the first half of the 1980s. Meanwhile, Figure 13a shows that the business failure rate, as recorded by D&B, surged in the early 1980s and remained above

pre-reform levels for a prolonged period thereafter.[7] This historical pattern aligns with the qualitative predictions of the model: lowering barriers to reorganization may increase the use of reorganization procedures without necessarily reducing the rate of realized default.

5.2 Reorganization in a Low-Rollover-Risk Economy

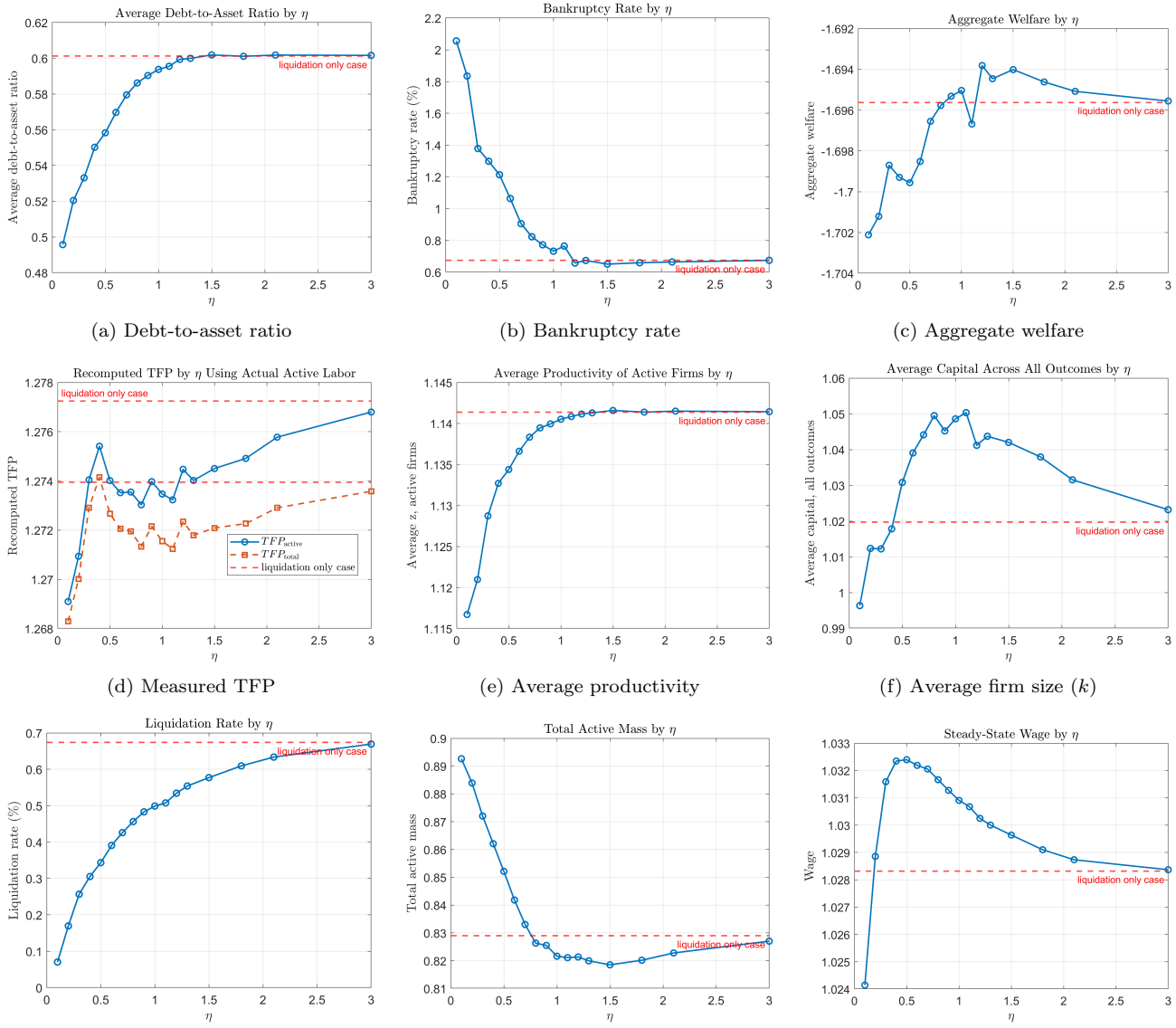
As the analytical model showed, the effects of bankruptcy reform are theoretically ambiguous and depend critically on the conditional probability of coordination failure. I therefore next repeat the counterfactual under a much lower, but still positive, level of rollover risk, where the balance between the coordination benefit of reorganization and the repayment-incentive distortion can reverse. I implement this comparison by lowering the conditional probability of coordination failure, ξ, to 0.5%, while holding all other structural parameters fixed, and repeating the reorganization-cost counterfactual. Figure 14 reports the resulting stationary equilibria.

The effects of further reductions in reorganization costs now differ sharply from those at the U.S. benchmark. Starting from the calibrated U.S. level of η, lowering reorganization costs reduces the average debt-to-asset ratio rather than raising it. It falls from 60%, the level seen in a liquidation only economy, to approximately 50%. Aggregate welfare is not monotonic with respect to the reorganization cost. Overall, however, lowering the fixed cost of reorganization reduces welfare, in contrast to the U.S. benchmark. As η enters the lower range, welfare declines significantly and is lower than in a liquidation only economy. Measured TFP and average productivity among active firms also decline on balance, indicating a deterioration in firm selection, and aggregate welfare falls. However, the annual bankruptcy rate rose from approximately 0.7% to over 2%, as in the U.S. benchmark.

The combination of a decline in leverage and a rise in the default rate is key to understanding this result. In the calibrated U.S. level of rollover risk, preserving continuation value provides a quantitatively important coordination benefit that dominates the associated repayment in-

[7]The post-1978 rise in business failures was already noted contemporaneously. Allman (1984) documents a sharp increase after 1978 that was broad-based across firm sizes and major business sectors, while emphasizing that it was then unclear whether the increase reflected temporary cyclical conditions or a more persistent structural change. As Figure 13a shows, however, the failure rate remained well above its pre-reform level in the years that followed.

A further concern is that D&B expanded the coverage of its business-failure series in 1984, raising the possibility that the persistently high post-reform failure rate partly reflects broader coverage rather than a genuine increase in failures. Naples and Arifaj (1997) address this issue by constructing a consistent spliced series that corrects for the 1984 break. They show that the failure rate rises sharply even when measured on the pre-1984 coverage basis and remains elevated thereafter.



(a) Debt-to-asset ratio (b) Bankruptcy rate (c) Aggregate welfare

(d) Measured TFP (e) Average productivity (f) Average firm size (k)

(g) Liquidation rate (h) Active firm mass (i) Wage

Figure 14: **Steady-state effects of reorganization costs in a low-rollover-risk economy.** Rollover risk is fixed at 0.5 percent while the reorganization cost η varies. Lower values of η correspond to easier reorganization. The first row reports financing, bankruptcy, and welfare outcomes; the second row reports productivity and aggregate allocation; and the third row reports liquidation and general-equilibrium adjustments. Dashed horizontal lines indicate the corresponding liquidation-only outcomes.

centive distortion. When rollover risk is only 0.5%, this coordination benefit is much smaller, while the repayment incentive distortion remains. Further reductions in reorganization costs can therefore lower debt capacity, productivity, and welfare even though rollover risk remains strictly positive. This reversal provides the quantitative counterpart to the ambiguity identified in the three-period model. The same bankruptcy reform can therefore have opposite welfare implications under different levels of rollover risk.

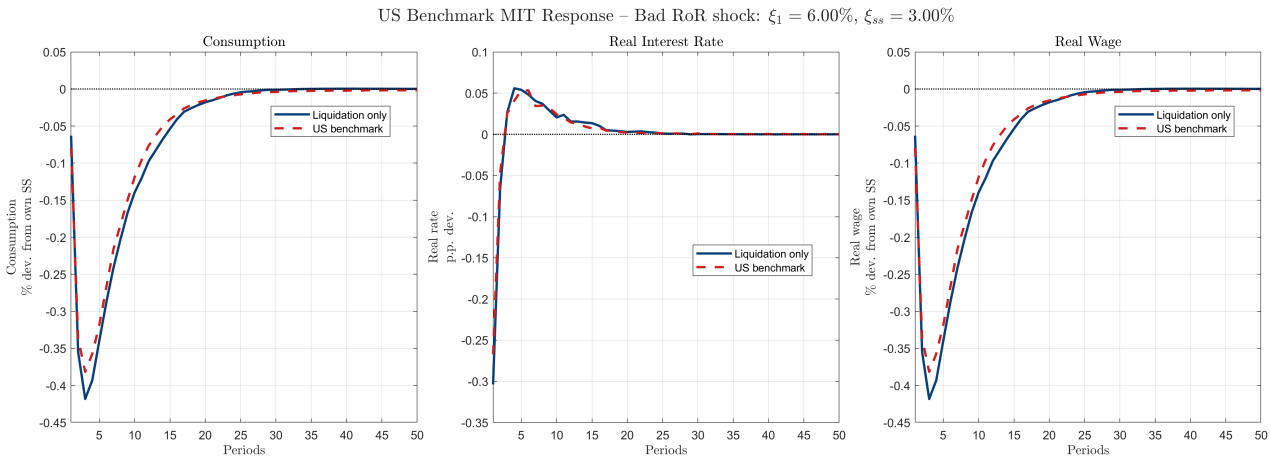
At the same time, the hump-shaped response of average firm size and the U-shaped response of active firm mass remain. Thus, the fixed-cost mechanism governing which firms gain access to reorganization is still present, but its aggregate consequences are reversed: when rollover risk is sufficiently low, easier reorganization no longer expands equilibrium debt capacity or improves the steady state allocation.

5.3 Dynamic Fragility and Rollover-Risk Shocks

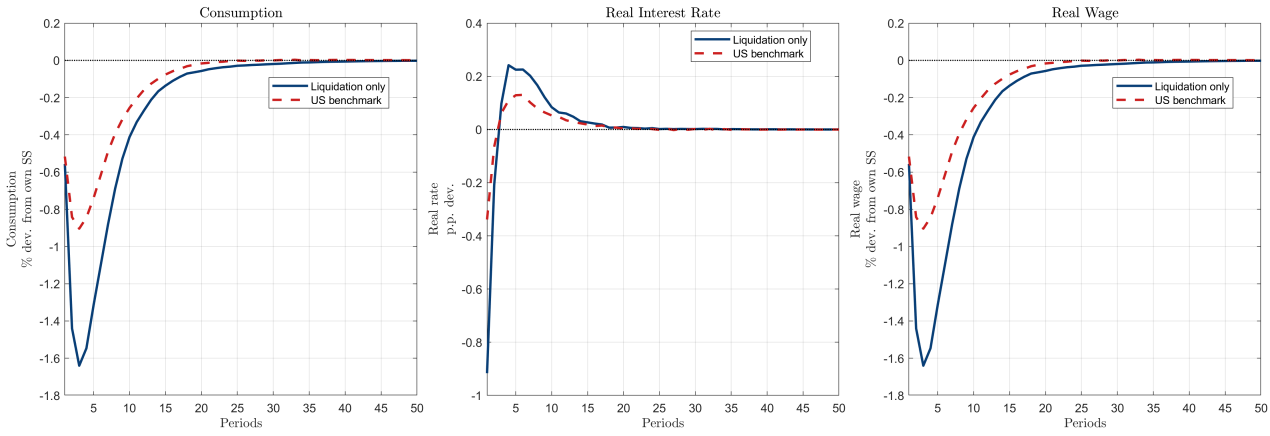
I next study how the economy responds to a deterioration in refinancing conditions and how this response depends on the conditional probability of coordination failure, ξ, in steady state. I consider the same 3-percentage-point increase in the conditional probability of coordination failure, ξ, in three economies: a low-risk economy with $\xi = 0.5\%$, the calibrated U.S. economy with $\xi = 3.0\%$, and a higher-risk economy with $\xi = 4\%$. Figure 15 reports the transition dynamics under the benchmark bankruptcy procedure and under liquidation only. All responses are measured relative to the pre-shock steady state of the corresponding economy.

The first result is that dynamic fragility falls sharply as the steady state rollover risk, the conditional probability of coordination failure, increases. The same three-percentage-point increase in the conditional probability of coordination failure generates a much larger contraction when the economy starts from $\xi = 0.5\%$ than at the calibrated U.S. steady state with $\xi = 3.0\%$, and an even smaller response when the conditional probability of coordination failure is 4%. This pattern is consistent with endogenous self-insurance. When the conditional probability of coordination failure are already high in the steady state, firms have strong incentives to limit their exposure to rollover-sensitive financing positions. As a result, less continuation value is exposed when the conditional probability of coordination failure subsequently rises. A low conditional probability of coordination failure therefore need not imply low financial fragility: by encouraging greater ex-ante exposure, it can make the economy substantially more sensitive to an adverse rollover-risk shock.

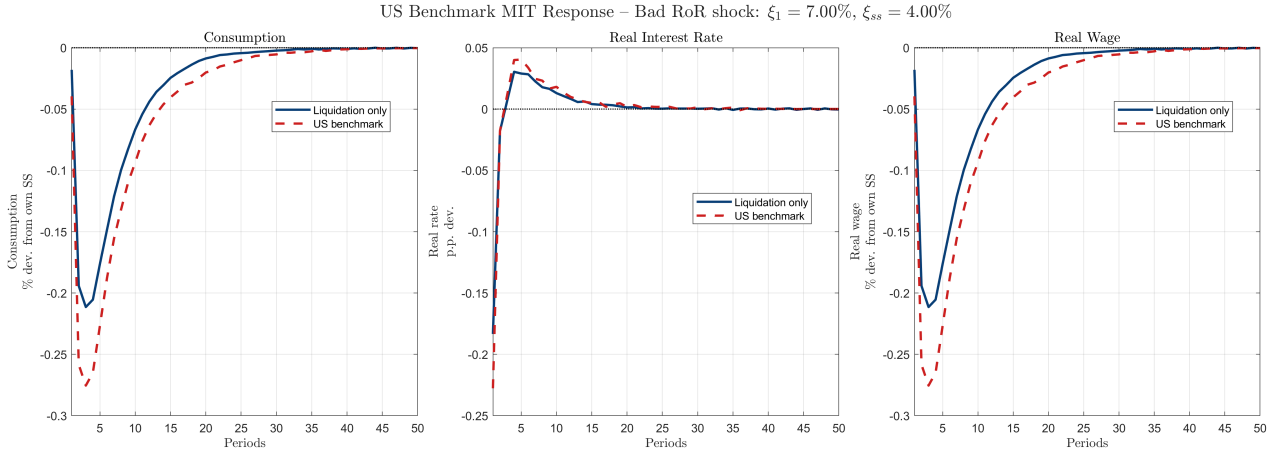
The stabilizing effect of reorganization also depends strongly on the conditional probability



(a) U.S. benchmark rollover risk



(b) Rollover risk: 0.5 percent



(c) Rollover risk: 4.0 percent

Figure 15: **Dynamic responses to rollover-risk shocks at different levels of rollover risk.** Each panel compares the responses under alternative bankruptcy procedures. Panel (a) reports the calibrated U.S. economy, panel (b) an economy with rollover risk of 0.5 percent, and panel (c) an economy with rollover risk of 4.0 percent.

of coordination failure. In the low-risk environment, the contraction is substantially larger in the liquidation-only economy than in the benchmark reorganization economy. Reorganization therefore provides its greatest protection precisely in the environment in which endogenous refinancing exposure makes the economy most vulnerable to a sudden increase in the conditional probability of coordination failure. When the steady state conditional probability of coordination failure is at the calibrated U.S. level, the difference in contraction size between the two economies is considerably smaller. However, the contraction remains larger in the liquidation only economy than in the benchmark reorganization economy. In an environment with a high conditional probability of coordination failure, this ranking reverses for consumption and wages, with the benchmark reorganization economy experiencing a slightly larger contraction. Importantly, however, this reversal occurs only after the absolute response to the rollover-risk shock has already become small under both procedures. The main change across steady states is therefore not the reversal in the relative performance of the two bankruptcy procedures, but the sharp decline in the economy's overall sensitivity to rollover-risk shocks.

These dynamic results complement the steady-state counterfactuals above. When the conditional probability of coordination failure is low, the coordination benefit of easier reorganization is small in steady state, and the repayment-incentive distortion can dominate, lowering debt capacity, productivity, and welfare. Yet the same low-risk environment induces greater refinancing exposure and therefore greater vulnerability when the conditional probability of coordination failure suddenly increases. Conversely, a higher conditional probability of coordination failure makes reorganization more valuable as a steady-state coordination device while inducing firms to self-insure more aggressively against future refinancing disruptions. The steady-state welfare value and the dynamic stabilization benefit of reorganization therefore need not move together: the environments in which reorganization is least valuable in normal times can be precisely those in which it provides the greatest protection against an unexpected deterioration in refinancing conditions.

6 Conclusion

This paper studies how bankruptcy procedures shape firms' debt capacity, endogenous exposure to rollover risk, and aggregate fragility. I develop a heterogeneous firm general equilibrium model in which short-term debt must be refinanced before production and creditor coordination failures can trigger default. The central mechanism operates through the interaction between creditor coordination and firm repayment incentives.

Under liquidation, borrowing beyond liquidation value exposes continuation surplus to self-fulfilling rollover failure, inducing firms to limit leverage and refinancing exposure. Reorganization mitigates this trade-off. Because going concern value can be preserved through the bankruptcy procedure, reorganization expands the region in which continuation-backed borrowing can be sustained without exposure to a rollover crisis. At the same time, a more favorable reorganization procedure raises the firm's payoff in default and can weaken repayment incentives. Which force dominates depends critically on the conditional probability of coordination failure and creditor bargaining power.

In the calibrated U.S. economy, the coordination benefit dominates: further reductions in reorganization costs raise leverage, productivity, and welfare. The fixed cost of reorganization introduces scale-based differences in this process. Larger firms find it easier to leverage reorganization to preserve going concern value, thereby securing financing that exceeds the liquidation value of their assets. This provides a mechanistic explanation for the size-dependent financial friction documented by Lian and Ma (2021).

In the counterfactual economy, where the conditional probability of coordination failure is sufficiently low, however, the repayment-incentive distortion can instead dominate. So easier reorganization can have opposite welfare effects across financing environments.

The dynamic results further show that steady-state welfare and financial resilience need not move together. When the conditional probability of coordination failure is high, firms proactively limit their risk exposure; conversely, when such risk is low, they are more willing to take on greater refinancing exposure. As a result, an unexpected increase in rollover risk of a given magnitude leads to a more pronounced contraction in an economy where initial risk is low. Reorganization mitigates losses from refinancing risk through two margins: Ex ante, it expands the rollover-safe region; ex post, it allows firms that encounter a rollover failure to continue operating rather than liquidate. This stabilizing effect is particularly significant in low risk environments, precisely where the steady-state welfare gains from reorganization may be minimal or even negative.

These results imply that the effects of bankruptcy design cannot be evaluated independently of the financial environment in which firms operate and the risk exposure that firms endogenously choose in that environment.

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Appendix

A Proofs for the Three-Period Model

A.1 Additional Proposition

Proposition 7. *The firm does not overinvest to make reorganization feasible.*

Proof. Suppose $\eta > W(z_1, k^*) - \chi k^*$. Let $\hat{k} = k^* + \epsilon$, satisfy $W(z_1, \hat{k}) - \chi\hat{k} - \eta = 0$.

Under reorganization, the investment decision is not distorted. This implies that the firm wants to reach k^*. Therefore, if the firm wants to enter the region where reorganization is feasible, it must choose at least $\hat{k}$, the minimal possible k_1, which makes reorganization feasible.

At $\hat{k}$, the firm's value under reorganization is:

$$V_R(z_1, \hat{k}) = W(z_1, \hat{k}) - (\hat{k} - e_0) - \xi\eta$$

However, we could write down the firm value in terms of the liquidation only case:

$$V_L(z_1, \hat{k}) = W(z_1, \hat{k}) - (\hat{k} - e_0) - \xi(W(z_1, \hat{k}) - \chi\hat{k})$$

Since, at $\hat{k}$, $W(z_1, \hat{k}) - \chi\hat{k} = \eta$, we have:

$$\begin{aligned} V_R(z_1, \hat{k}) &= W(z_1, \hat{k}) - (\hat{k} - e_0) - \xi\eta \\ &= W(z_1, \hat{k}) - (\hat{k} - e_0) - \xi(W(z_1, \hat{k}) - \chi\hat{k}) \\ &= V_L(z_1, \hat{k}) \end{aligned}$$

Since the optimal scale under risky borrowing in the liquidation-only region is k^{L*}, where $k^{L*} < k^* < \hat{k}$. We must have:

$$V_L(z_1, k^{L*}) > V_L(z_1, \hat{k})$$

So, the firm will not overinvest.

□

Corollary 2. *If $\eta \in \left(\bar{V},\, W(z_1, k^*) - \chi k^*\right]$, reorganization is feasible only for a subset of investment levels $k_1 \in (0, k^*]$. In this region, some firms may be able to make reorganization feasible*

by choosing a sufficiently high investment scale, but optimally choose not to do so.

Lemma 1. *When the firm's borrowing constraint binds under reorganization, debt must satisfy:*

$$d_0^{Rs}(e_0) = (1-\xi)\Big(W(z_1, e_0 + d_0^{Rs}(e_0)) - \overbrace{\theta\big(W(z_1, e_0 + d_0^{Rs}(e_0)) - \eta - \chi(e_0 + d_0^{Rs}(e_0))\big)}^{\textit{Strategic default}}\Big)$$
$$+ \xi\Big(\underbrace{(1-\theta)(W(z_1, (e_0 + d_0^{Rs}(e_0))) - \eta)}_{\textit{Cash flow saving}} + \theta\chi(e_0 + d_0^{Rs}(e_0))\Big) \tag{78}$$

We will have:

$$\frac{\partial d_0^{Rs}(e_0)}{\partial \eta} \propto (\theta - \xi) \tag{79}$$

Proof. Notice:

$$\frac{\partial d_0^{Rs}(e_0)}{\partial \eta} = \frac{\theta - \xi}{(1-\theta\chi) - (1-\theta)\frac{\partial W}{\partial k}} \tag{80}$$

$$\frac{\partial d_0^{Rs}(e_0)}{\partial \xi} = \frac{-\eta}{(1-\theta\chi) - (1-\theta)\frac{\partial W}{\partial k}} \tag{81}$$

$$\frac{\partial V}{\partial \eta} = \frac{\partial d_0^{Rs}(e_0)}{\partial \eta}\left(\frac{\partial W}{\partial k} - 1\right) - \xi \tag{82}$$

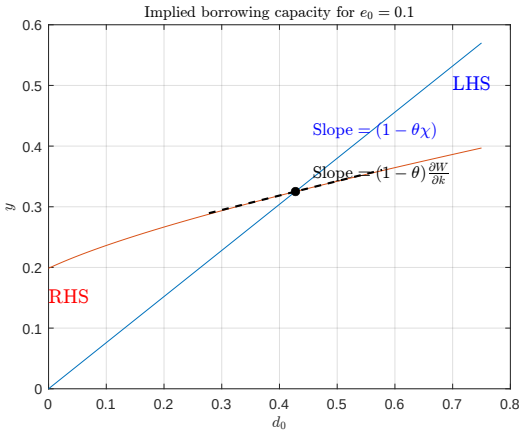


Figure 16: Debt Capacity under Reorganization

We notice the borrowing limits could be rewritten as:

$$(1-\theta\chi)d_0 = (1-\theta)W(z_1, (e_0 + d_0)) + \theta\chi e_0 + (\theta - \xi)\eta$$

Note that $(1-\theta\chi)$ is the slope of the line, whereas $(1-\theta)\frac{\partial W}{\partial k}$ is the slope of the curve. Then, we must have: $(1-\theta\chi) > (1-\theta)\frac{\partial W}{\partial k}$

Therefore, we have:

$$(1-\theta\chi) - (1-\theta)\frac{\partial W}{\partial k} > 0$$

In other words:

$$\frac{\partial d_0^{Rs}(e_0)}{\partial \eta} \propto (\theta - \xi) \tag{83}$$

□

A.2 Case 3: Reorganization is partially available

Finally, consider the intermediate case in which $\eta \in \left(\bar{V},\, W(z_1, k^*) - \chi k^*\right]$. In this region, reorganization is feasible only for a subset of investment levels. Hence, unlike in the two polar cases, the firm can affect the availability of reorganization through its investment decision. This introduces an additional extensive-margin choice: whether to choose a sufficiently high investment scale to make reorganization feasible.

Let $k(\eta)$ denote the threshold investment level at which reorganization is just feasible. It is defined by

$$V^R(z_1, k(\eta)) = 0 \quad \Longleftrightarrow \quad \eta = W(z_1, k(\eta)) - \chi k(\eta). \tag{84}$$

Thus, reorganization is feasible if and only if $k_1 \geq k(\eta)$. In the intermediate case, this threshold satisfies $k(\eta) \leq k^*$, with strict inequality whenever $\eta < W(z_1, k^*) - \chi k^*$.

We first show that, absent rollover risk, no firm is trapped in the liquidation-only region. The intuition is as follows. When $\xi = 0$, rollover failure never occurs. Therefore, reorganization does not provide the benefit of preserving cash flow in a rollover crisis. Instead, it only creates an opportunity for strategic default and debt renegotiation. In this sense, absent rollover risk, reorganization operates as a pure financial friction: it reduces creditors' expected repayment and tightens the firm's debt capacity.

However, this friction cannot trap the firm below the reorganization threshold. By definition, at $k(\eta)$ the firm is indifferent between liquidation and reorganization:

$$V^R(z_1, k(\eta)) = 0. \tag{85}$$

Equivalently, reorganization generates no surplus relative to liquidation at this threshold. Therefore, even though reorganization may reduce debt capacity above $k(\eta)$ through strategic default, it cannot prevent the firm from financing $k(\eta)$ itself. Since reorganization is feasible at the efficient scale by assumption, $k(\eta) \leq k^*$. Hence, when $\xi = 0$, every firm can finance at least the threshold investment level $k(\eta)$, and no firm is endogenously trapped in the liquidation-only region. We summarize this result in the following proposition.

Proposition 8 (No liquidation-only trap without rollover risk)**.** *Suppose reorganization is feasible at the efficient investment level, that is,*

$$\eta < \eta(k^*), \tag{86}$$

where

$$\eta(k) \equiv W(z_1, k) - \chi k. \tag{87}$$

If there is no rollover risk, $\xi = 0$, then no firm is trapped in a region where liquidation is the only outside option. Equivalently, for any initial endowment $e_0 \geq 0$, the firm's optimal investment satisfies

$$k_1(e_0) \geq k(\eta), \tag{88}$$

where $k(\eta)$ denotes the threshold investment level at which reorganization becomes feasible, and $k_1(e_0)$ denotes the optimal investment scale chosen by a firm with initial endowment e_0.

When $\xi > 0$, rollover risk first creates a debt-capacity channel that sorts firms across bankruptcy regimes. Conditional on reorganization being feasible, the firm would like to use reorganization as the relevant outside option. However, a higher probability of rollover failure reduces the amount of debt that can be supported by the recovery value under reorganization.

If the safe repayment value provided by reorganization is sufficiently large, firms can still finance the threshold investment level $k(\eta)$ and access reorganization. If this repayment value is insufficient, then for sufficiently high ξ, the debt capacity supported by reorganization becomes too low for low-endowment firms to reach $k(\eta)$. These firms remain below the reorganization threshold and are therefore trapped in the liquidation-only region. The following proposition isolates this debt-capacity channel.

Proposition 9 (Size-dependent financial friction)**.** *Suppose reorganization is feasible only for some investment levels, that is, $\eta \in \left(\bar{V},\, W(z_1, k^*) - \chi k^*\right]$. Let $k(\eta)$ denote the threshold capital*

level at which the firm is indifferent between reorganization and liquidation. Suppose further that the safe repayment value provided by reorganization for all capital levels k at which reorganization is feasible is insufficient to fully protect the associated capital k:

$$max_{k\in[k(\eta),k^*]}\{\bar{R}^R(k) - k\} < 0 \tag{89}$$

where

$$\bar{R}^R(k) \equiv (1-\theta)\big[W(z_1,k) - \eta\big] + \theta\chi k \tag{90}$$

Then there exists a threshold level of rollover risk $\hat{\xi}$ such that, if $\xi \geq \hat{\xi}$:

1. *low-endowment firms remain in the liquidation-only region;*

2. *high-endowment firms can still use reorganization as the relevant outside option.*

Beyond this debt-capacity channel, the intermediate case also features an endogenous access margin. Since reorganization becomes feasible only once investment reaches the threshold $k(\eta)$, some firms may be able to access reorganization by increasing their investment scale. However, doing so may be privately suboptimal if the required increase in scale is too costly. Thus, even firms that could make reorganization feasible may optimally choose not to do so. The following corollary summarizes this additional force.

Corollary 3 (Endogenous access to reorganization)**.** *If the conditions in Proposition 9 hold, some firms may be able to make reorganization feasible by choosing a sufficiently high investment scale, but optimally choose not to do so.*

Taken together, Case 3 shows that access to reorganization is endogenous: it depends not only on the bankruptcy regime, but also on firms' ability and incentives to finance the threshold investment level $k(\eta)$.

The source of fragility is whether debt above liquidation value is protected in the rollover-failure state. Rollover risk arises because each creditor worries that other creditors may not roll over, causing the firm to default and reducing the creditor's own recovery. But if the creditor expects to be repaid even when rollover failure occurs, then its repayment does not depend on others' rollover decisions. Rolling over is then safe, so creditors have no incentive to run in the first place. Hence, when reorganization provides enough safe repayment value to cover the debt claim, leverage above the liquidation-value benchmark (χ) does not expose the firm to rollover risk. The firm is effectively in the safe-debt region: even though book leverage exceeds

what liquidation value alone can support, creditors are protected by the reorganization payoff, so the no-run outcome is sustained. By contrast, firms in the liquidation-only region lack this additional repayment value. For these firms, borrowing beyond liquidation value can be repaid only if the firm continues in the no-run state. Therefore, the same leverage that is safe for a firm with access to reorganization is fragile for a firm whose outside option is liquidation.

There is a second layer of fragility among firms that are exposed to rollover risk. Conditional on rollover failure, small firms in the liquidation-only region must liquidate, whereas larger firms that have access to reorganization can preserve firm cash flow through reorganization. Hence, even among firms with debt claims exposed to rollover risk, smaller firms face a more severe downside because rollover failure leads to liquidation rather than reorganization.

B Quantitative Model

B.1 Transition Equilibrium

Definition 2 (MIT Transition Competitive Equilibrium)**.** *Given an initial stationary distribution $\mu_0 = \mu^{SS}$, a deterministic path of rollover risk $\{\xi_t\}_{t\geq 0}$, and a fixed flow of potential entrants equal to its steady-state value M^{SS}, an MIT transition competitive equilibrium consists of sequences*

$$\{w_t, C_t, L_t, Q_t, V_t, \mu_t\}_{t\geq 0},$$

together with the associated firm and entrant policy rules, such that, at every date t:

1. ***Incumbent optimization.***

   Given current and expected future aggregate prices and the path of rollover risk, incumbent firms optimally choose financing, investment, continuation, exit, liquidation, and reorganization according to the dynamic problem characterized above.

2. ***Bankruptcy resolution.***

   Conditional on reorganization, creditor recovery satisfies the Nash bargaining problem described above.

3. ***Lender break-even.***

   Competitive atomistic lenders earn zero expected profits. Newly issued debt is priced using

the household stochastic discount factor

$$m_{t,t+1} = \beta \frac{C_t}{C_{t+1}},$$

together with the equilibrium probabilities of repayment, rollover failure, default, and recovery.

4. ***Entry and participation.***

   In each period, a mass M^{SS} of potential entrants arrives. Given current and expected future equilibrium prices, each potential entrant solves the date-t entry problem and optimally chooses its initial scale and financing subject to the equity-issuance cost. After observing its entry signal, the entrant operates only if its optimized date-t entry value is nonnegative. There is no free-entry condition along the transition. Let μ_t^E denote the measure over initial firm states generated by one unit mass of potential entrants, including the participation decision.

5. ***Distribution dynamics.***

   The measure of incumbent firms evolves according to

$$\mu_{t+1} = \mathcal{T}_t(\mu_t) + M^{SS}\mu_t^E, \tag{91}$$

   where $\mathcal{T}_t$ incorporates optimal firm policies, productivity transitions, ordinary exit, rollover failures, liquidation, and reorganization. Successful date-t entrants join the incumbent distribution at date $t+1$.

6. ***Household optimality.***

   Household choices are optimal given equilibrium prices. In particular, the stochastic discount factor is

$$m_{t,t+1} = \beta \frac{C_t}{C_{t+1}},$$

   and the intratemporal labor-supply condition is

$$w_t = \Phi C_t. \tag{92}$$

7. ***Labor-market clearing.***

Aggregate labor demand equals household labor supply:

$$L_t = \int l_t(s)\, d\mu_t(s). \tag{93}$$

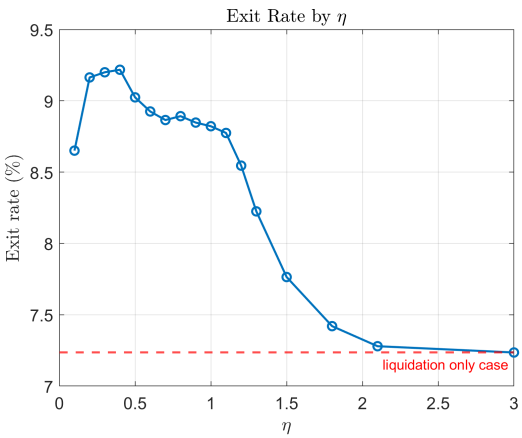
8. ***Taxes / transfers satisfy government budget balance.***

9. ***Goods-market clearing.***

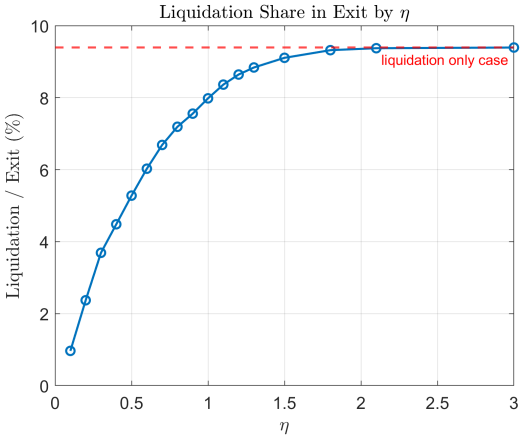
   Aggregate consumption satisfies the date-t resource constraint, including production, investment, adjustment costs, entry costs, and bankruptcy losses.

When the exogenous rollover-risk path converges to its steady-state value, the equilibrium sequences converge to the corresponding stationary equilibrium.

B.2 The Effects of Reorganization under Different Levels of Rollover Risk

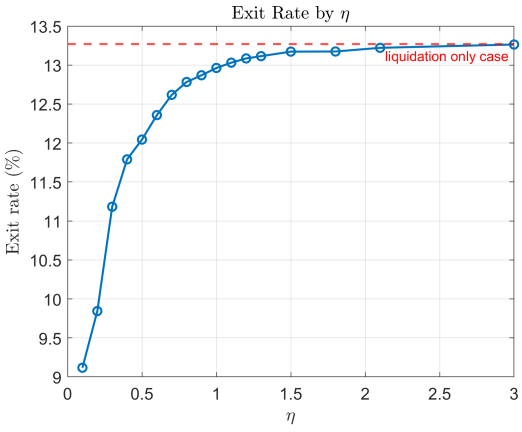


(a) Exit rate

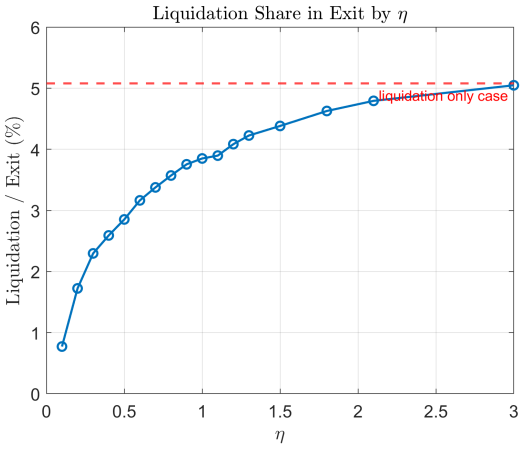


(b) Liquidation share of exit

Figure 17: **Additional steady-state responses to reorganization costs.** The panels report exit outcomes as the reorganization cost η varies, holding the rollover risk fixed at its calibrated U.S. value. Lower values of η correspond to easier reorganization.



(a) Exit rate



(b) Liquidation share of exit

Figure 18: **Additional steady-state responses in the low-rollover-risk economy.** Rollover risk is fixed at 0.5 percent while the reorganization cost η varies. Lower values of η correspond to easier reorganization. The panels report additional exit outcomes. Dashed horizontal lines indicate the corresponding liquidation-only outcomes.