Cash Flow-Based Lending, Bankruptcy Resolution, and the Macroeconomy

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Abstract

Creditors limit lending against future cash flows if they expect the borrower to be liquidated under financial distress. This puts small and medium-sized firms at a disadvantage as high reorganization costs often force the liquidation of these businesses. I study the general equilibrium effects of this dynamic in a heterogeneous firms model, calibrated to the U.S. economy. The inadequate access to cash flow-based debt experienced by small firms suppresses entry, and yields credit misallocation and significant productivity losses. Recent policy efforts, that aim to streamline the reorganization process for small firms, such as the Small Business Reorganization Act of 2019, can boost aggregate productivity by improving small but productive firms' access to external finance.

Keywords: Heterogeneous firms, Credit market frictions, Cash flow-based lending, Bankruptcy, Liquidation Risk

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1 Introduction

Borrowing constraints defined by the value of collateralizable assets act as major impediments to firm growth, as they create a self-perpetuating cycle: insufficient collateral limits access to external finance, which in turn limits firm growth and delays the accumulation of collateral.[1] Borrowing against future cash flows could, in principle, alleviate collateral constraints for small but productive firms because this type of debt evaluates future earning potential rather than the accumulated collateral (Lian and Ma, 2021). However, for moderately-sized firms, borrowing against future cash flows (CF-based debt) remains significantly more expensive than borrowing against physical assets (asset-based debt).[2] The high cost of CF-based debt has major macroeconomic consequences as it contributes to the misallocation of credit, and hinders firms from scaling up to their efficient sizes.

A key factor contributing to the high cost of CF-based debt for small and medium-sized firms is liquidation risk. Small firms are significantly more likely to liquidate under financial distress than large enterprises, which reflects the large administrative and time expenses of the reorganization process (Antill and Grenadier, 2019; Corbae and D'Erasmo, 2021).[3] Since liquidation terminates all future cash flows, lenders must impose higher spreads on CF-based debt allocated to these firms to offset the elevated liquidation risk. This mechanism limits access to CF-based debt for productive, but small firms seeking external finance to scale up. Motivated by these observations, I study the extent to which high reorganization costs limit access to CF-based debt, create misallocation of credit, and lead to a loss of productivity.

First, using a dataset of debt contracts held by US non-financial corporations between

[1] This notion traces back to Bernanke et al. (1999), originally applied to credit cycles, but it extends across the life cycles of firms as well. Accordingly, Beck et al. (2006), Schmalz et al. (2017) and Catherine et al. (2021) identify collateral constraints as a key impediment to firm growth.

[2] US non-financial corporations under 100M USD of assets pay an average credit spread of 7.19% on CF-based debt and only 5.25% on AB-debt. This result is robust to multivariate analysis. For the same set of firms, CF-based debt is associated with a 0.8pp higher spread (S$P Capital IQ).

[3] Data published by the Federal Judicial Center (FJC) show that 57.9% of US firms with assets under 100M USD liquidate in default, compared to just 5.7% for larger firms.

2010 and 2023, I present indirect empirical evidence that liquidation risk increases credit spreads for CF-based debt contracts. A wide body of literature argues that the presence of multiple creditors exacerbates coordination failures in reorganization, increasing the likelihood of liquidation in default (Brunner and Krahnen, 2008; Zhong, 2021). This observation suggests high creditor dispersion limits access to CF-based debt. Consistent with this argument, I find that conditional on other firm characteristics the number of debt contracts held by a firm (a proxy for the number of lenders) raises the credit spreads on CF-based debt. In contrast, this variable has no significant effect on asset-based debt contracts, which are not exposed to liquidation risk.

The main contribution of this paper is the development of a heterogeneous firms model that quantifies the general equilibrium effects of reorganization costs on liquidation probability, optimal debt financing strategies, and access to debt finance, along with macroeconomic implications such as misallocation and aggregate productivity. This requires a rich model framework that incorporates in-equilibrium defaults and firm-specific external finance premia (Khan, Senga, and Thomas, 2017), bankruptcy resolution decisions (Tamayo, 2017; Antill and Grenadier, 2019; Corbae and D'Erasmo, 2021), and heterogeneity of debt contracts (Lian and Ma, 2021; Drechsel, 2023; Gonzalez and Sy, 2024). To the best of my knowledge, this is the first model that studies the macroeconomic effects of asset-based and CF-based debt financing in the presence of in-equilibrium defaults and heterogeneous bankruptcy resolution decisions.

In the model, firms finance their investments by net wealth and borrowing against assets or future cash flows. A fraction of firms experience financial distress in equilibrium, which leads to liquidation or reorganization (Chapter 7 and Chapter 11 of the U.S. bankruptcy code). Reorganization allows firms to continue operating but incurs a high fixed cost, which introduces economies of scale into bankruptcy resolution: large firms typically reorganize while smaller firms often liquidate. The lender sets firm-specific interest rates based on risk associated with default. In the case of cash flow-based debt, the lack of physical collateral increases potential losses in-

curred under liquidation. Hence, the lender must compensate for liquidation risk by raising credit spreads on CF-based debt contracts. As a result, small but productive firms that are expected to liquidate in default due to their size, face limited access to CF-based debt. This mechanism forces small firms to fall back to asset-based borrowing, which perpetuates credit misallocation, suppresses firm entry, and yields a loss of productivity.

The model is brought to the data using a combined dataset on US non-financial corporations and their debt financing strategies, while the default resolution process is informed by a comprehensive dataset of US bankruptcy filings over the same period. The calibrated model closely replicates the key facts about about firms' debt financing strategies and default resolution decisions as well as the financing gap observed between large and small firms.

I use the calibrated model to estimate the effects of a reform that implements a more reorganization-friendly bankruptcy regime. The baseline reform halves the fixed costs of reorganization. Small firms, who are disproportionately burdened by reorganization costs experience a large reduction in average liquidation probability, which fundamentally changes their debt financing strategy. Their average reliance on CF-based debt jumps from 14% to 50% allowing them to rely on external finance more intensively. Their debt-to-collateral ratio rises by 4 percentage points, and the average interest rate falls by 0.65 percentage points. Large firms experience qualitatively similar, but much smaller changes, hence the financing gap between small and large firms narrows considerably. Beyond firms' debt financing decisions, the reform also has a significant impact on the broader economy. Better access to external finance improves credit allocation and better growth prospects incentivize firm entry. As a result, average productivity increases by 1.4%.

The paper is organized as follows. Section 2 reviews the related literature. Section 3 addresses the empirical analysis, section 4 introduces the structural model framework, section 5 details the calibration of the model, and Section 6 discusses the effects of policy reform that reduces reorganization costs. Section 7 discusses the potential

effects of the SBRA firms' access to CF-based debt finance and section 8 concludes.

2 Related Literature

This paper contributes the most to the rapidly expanding literature on cash flow-based lending and its role in shaping credit market frictions and macroeconomic outcomes. Corporate credit frictions have traditionally been characterized as borrowing constraints defined by the value of pledgeable assets. Recent research challenged this view based on more granular analyses of credit contracts. Prominently, Lian and Ma (2021) finds that most of US corporate debt is backed by future cash flows rather than specific physical assets, suggesting that credit frictions are better described as earnings-based borrowing constraints. They support this claim by documenting the extensive use of earnings-based debt covenants in US corporate debt contracts.[4]

This result prompted several studies to re-evaluate the role of credit market frictions in structural models. Drechsel and Kim (2024) argues that firms subject to earnings-based constraints under-borrow, while those facing asset-based constraints over-borrow. Drechsel (2023) demonstrates that the effects of investment shocks are heterogeneous across firms depending on the debt contract in place.[5] Öztürk (2023) identifies quantitative differences in firms' reaction to contractionary monetary policy shocks, with asset-based borrowers experiencing a sharper decline in borrowing. Gonzalez and Sy (2024) documents that reliance on CF-based borrowing is U-shaped across firms size, in Spain.[6] Similarly, Caglio et al. (2021) documents that in the US, SMEs often borrow against 'enterprise value' rather than specific physical assets. My analysis contributes to this literature in two distinct ways.

First, I consider in-equilibrium defaults and endogenous default resolution decisions in my analysis, which highlights ex-ante liquidation probability as a key determinant

[4]Debt covenants are legally binding agreements imposed by the creditor on the lender. These typically take the form of hard constraints similar to those implied by the 'no equilibrium defaults' model framework.

[5]Investment shocks move the price of the capital countercyclically.

[6]CF-reliance is defined as the share of CF-based debt to total debt

of credit spreads for CF-based debt contracts. While previous studies have alluded to the importance of this factor, it has not yet been examined in a structural model (Lian and Ma, 2021). Second, my analysis presents a novel emphasis on the role of credit spreads in regulating borrowing behavior. Prior structural analyses of asset-based and cash flow-based lending impose borrowing limits such that firms always choose to meet their debt obligations.[7] Since debt contracts are always honored in these models, every firm faces the same risk-free interest rate. As a result, prior structural analyses typically focus on debt covenants, while credit spreads receive less attention. My analysis shifts the focus on credit spreads, as in-equilibrium defaults generate an endogenous variation in the cost of external finance.

A large body of research highlights the role of institutional factors, such as the protection of creditor rights, court enforceability, and the efficiency of the legal system as key determinants of SMEs' financing opportunities (Beck et al., 2006; OECD, 2006; Rao et al., 2022).[8] This is reinforced by evidence that 'country effects' play a significant role in determining the severity of the financial constraints SMEs face (Beck and Demirguc-Kunt, 2006). I extend this discussion by emphasizing that bankruptcy frameworks that facilitate and incentivize the reorganization of small firms alleviate borrowing constraints for SMEs, by improving their access to CF-based debt.

I also contribute to the literature on credit market frictions and their role in capital misallocation and aggregate productivity losses (Banerjee and Moll, 2010; Buera, Kaboski, and Shin, 2011; Midrigan and Xu, 2014).[9] Despite the clear link to credit misallocation, few studies consider CF-based debt in quantifying misallocation caused by limited access to external finance (Gonzalez and Sy, 2024). The main result of this paper quantifies productivity losses from misallocation in two distinct scenarios. In the baseline case, firms have access to both asset-based and cash flow-based debt,

[7] This yields 'hard constraints' to borrowing: firms that borrow against assets are constrained by the value assets, whereas those borrowing against cash flows are limited by current earnings.

[8] For comprehensive overviews of the SME financing literature see Esho and Verhoef (2018) and Rao et al. (2023).

[9] For a comprehensive overview of the misallocation literature, see Restuccia and Rogerson (2012) and Hopenhayn (2014).

but high reorganization costs often lead to the liquidation of smaller firms. This is compared to a model calibration where reorganization costs are lower, limiting the liquidation risks and improving small firms' access to debt finance.

3 Empirical Analysis

3.1 Reorganization Costs and Liquidation Probability

I study bankruptcy resolution decisions using the Federal Judicial Center's Integrated Database (IDB), which contains a total of 160,367 Chapter 7 and Chapter 11 bankruptcy filings between 2010 and 2023. Panel A of Figure 1 documents all Chapter 7 (liquidation) and Chapter 11 (reorganization) filings across firm sizes - measured by total assets. Panel B shows that the share of firms liquidating under financial distress declines sharply with firm size. This trend has been documented before on various datasets by Bris et al. (2006), Yu and He (2018), and Corbae and D'Erasmo (2021).

Resolving default via reorganization often entails lengthy negotiations between debtors, creditors, and courts, which imposes large time costs as well as administrative and legal expenses on the affected parties. Evidence suggests that a significant share of these costs is independent of firm size. For instance, LoPucki and Doherty (2004, 2011) find that professional fees as a percentage of assets decrease with firm size. Bris et al. (2006) finds a similar trend for the total costs of reorganization. The declining probability of liquidation can be attributed to these costs, as small and medium-sized enterprises often lack the resources to cover these expenses. Consistent with these observations, Antill and Grenadier (2018) and Corbae and D'Erasmo (2021) replicate the decreasing liquidation probability in structural models by incorporating large *fixed costs* of reorganization.

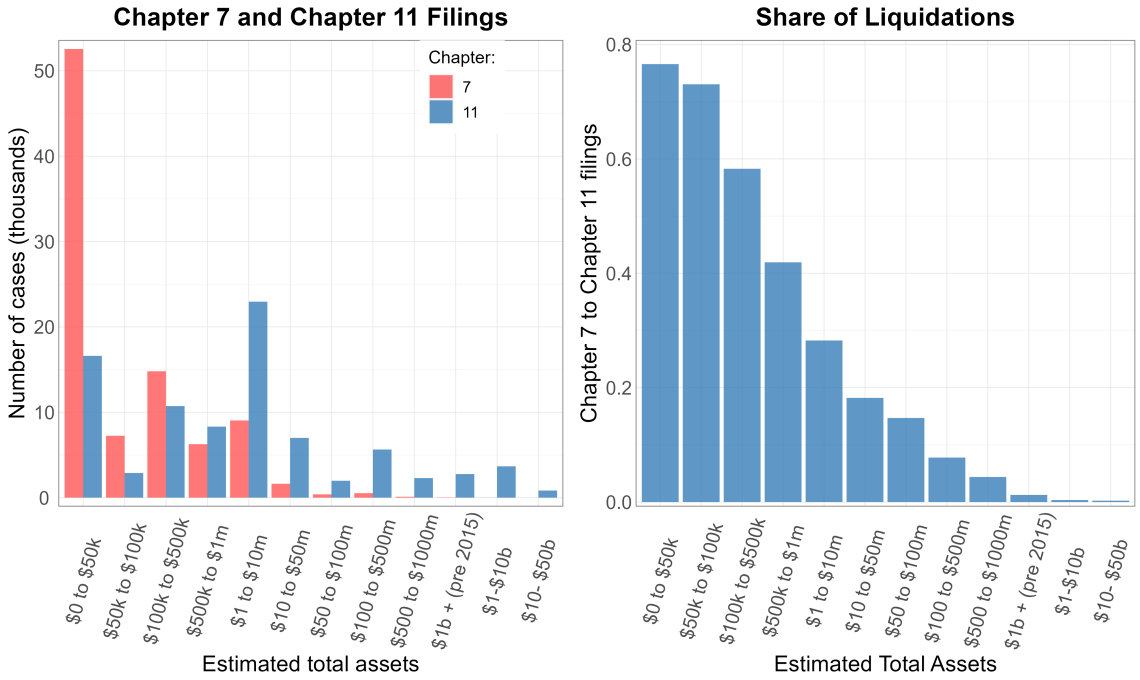


Figure 1: Panel A. shows all Chapter 7 and 11 instances between 2010 and 2023 across firm sizes. Panel B. shows the proportion of Chapter 7 filings as a share of total bankruptcies.

3.2 Credit Spreads and Liquidation Risk

I study the determinants of credit spreads on a total of 113,774 debt contracts held by 6,925 U.S. non-financial corporations between 2010Q1 and 2023Q2.[10] Section C.2 of the appendix presents firm-level summary statistics. Classification into asset-based and CF-based debt contracts follows the principles outlined by Lian and Ma (2021) - see section D.1 of the appendix. I find that 52.7% of debt contracts can be classified cash flow-based. Since these are often large in terms of value, they collectively constitute 76.7% of the total debt by volume, which aligns well with the

[10]Debt-level data is provided by S&P's Capital IQ and firm-level data is from Compustat North America.

aggregate values reported by Lian and Ma (2021).[11]

Table 1 summarizes the main determinants of credit spreads for asset-based and CF-based debt contracts along with the entire sample. Credit spreads are calculated as the difference between interest rates and the treasury rate at the corresponding maturity. To ensure that the observed spread reflects the original terms of the debt contract, I only consider the time of issuance. All three specifications include period fixed effects, sector and credit rating dummies, the logarithm of firm age and employment as well as the share of CF-based debt relative to total debt. Section D.2.1 of the appendix discusses these factors in more detail and table 13 in the appendix presents the full regression output.

	All contracts		CF contracts		AB contracts	
LHS: Spread	Value	SE	Value	SE	Value	SE
Log of EBITDA	-0.163***	(0.011)	-0.119***	(0.012)	-0.205***	(0.020)
Leverage	1.759***	(0.105)	2.189***	(0.136)	0.963***	(0.176)
Log of Assets	-0.394***	(0.049)	-0.452***	(0.060)	-0.321***	(0.086)
Pledgeability	-0.479***	(0.087)	-0.046	(0.107)	-1.013***	(0.153)
Num. Contracts	0.003**	(0.002)	0.012***	(0.002)	0.003	(0.004)
Firm-level controls	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
Observations	17,601		10,620		6,981	
R-squared	0.285		0.404		0.174	

Table 1: The main determinants of credit spreads of new issuances. Firm level controls include sector and credit rating dummies, the logarithm of firm age and employment, and the share of CF-based debt relative to total debt. Robust standard errors are reported in parentheses, *** p<0.01, ** p<0.05, * p<0.1. The full regression table is reported in section D.2.1 of the appendix.

[11]Note however, that my approach is likely to yield a cruder classification, as I have considerably less data at my disposal.

To test the robustness of my results, I repeat these analyses using interest rates as the dependent variable and at a firm-level, using average credit spread as the dependent variable. These results are reported in D.3.

Lenders' perceptions of ex-ante liquidation probability are not directly observable. Therefore, I present *indirect* empirical evidence suggesting that liquidation risk raises credit spreads for CF-based debt contracts. Prior research suggests that coordination failures in reorganization increase with the number of creditors, raising the likelihood that the financial distress is eventually resolved by liquidation (Gilson et al., 1990; Brunner and Krahnen, 2008; Zhong, 2021). For CF-based debt financing, these results imply that the number of creditors increases spreads on CF-based debt contracts. In contrast, asset-based debt is largely unaffected by liquidation risk, hence the number of creditors is expected to have little to no effect on the credit spreads these contracts.

This is confirmed by the empirical analysis. The number of debt contracts held by a firm - which is used as a proxy for the number of creditors, is associated with significantly higher spreads on CF-based debt contracts. A one standard deviation increase in the number of debt contracts raises credit spreads by 0.168 percentage points. In contrast, this effect is much smaller and statistically insignificant on asset-based debt contracts. Moreover, Ayotte and Morrison, 2009, and Blazy and Choppard, 2010 argue that secured creditors are incentivized to obstruct the reorganization process, which amplifies ex-ante liquidation risk further. Consistent with this argument, I find that the number of *secured* debt contracts increases spreads for CF-based debt contracts to an even greater extent - see table 19 in the appendix.

The final piece of evidence on the relevance of liquidation risk concerns the relationship between asset pledgeability and credit spreads. Table 1 shows that greater total asset value is associated with lower credit spreads for both loan types.[12] However, for CF-based debt contracts, asset pledgeability has no significant effect on credit spreads. This suggests that lenders do not view asset values as a direct determinant

[12]Pledgeability is defined as the ratio of collateralizable assets to total assets, see Section C of the Appendix for precise variable definitions.

of in-default payoffs. Instead, they consider firm size as a virtue in itself, which may reflect the declining probability of liquidation across firm sizes. Alternatively, this observation could reflect that information asymmetries are typically less severe for large firms.[13] To control for the effects of information asymmetries as much as possible, I include firm age and credit rating dummies in the estimation.

4 Structural Model Analysis

This section introduces a discrete-time general equilibrium model with firms that are heterogeneous in productivity, own capital, and may borrow against assets or cash flows. Moreover, firms may experience financial distress, which can be resolved either through liquidation or reorganization. Reorganization is subject to fixed costs, which raises the ex-ante probability of liquidation for small firms. The competitive lender must adjust the terms of the debt contract to the credit risk associated with the given firm. When lending against future cash flows, it must impose higher spreads on small firms to offset the elevated liquidation risk. Finally, the model features a representative household that provides an inelastic labor supply and chooses a stream of consumption and one-period, noncontingent bonds to maximize expected discounted utility.

4.1 Heterogenous Firms

Firms produce a homogeneous consumption good, using labor n and capital k, with a decreasing returns to scale production technology:

$$y = \varepsilon k^{\alpha} n^{\nu}, \qquad \alpha, \nu \in (0,1),\ \nu + \alpha \in (0,1) \tag{1}$$

where ε is the idiosyncratic productivity state. In the interest of keeping the notation simple, I omit firm subscripts.

[13] For instance, larger firms may follow superior accounting practices, which could mitigate information asymmetries between borrowers and lenders (Zhou, 2007).

Firms own capital and investments are financed partly by retained earnings and partly by borrowing from a competitive lender. At any given period, a firm can be described by the predetermined capital stock $k \in \mathbf{K} \subset \mathbf{R}^+$, debt $b \in \mathbf{B} \subset \mathbf{R}$ and current productivity $\varepsilon \subset \mathbf{R}^+$. Idiosyncratic productivity is a Markov chain on the finite set $\varepsilon \in \mathbf{E} \equiv \{\varepsilon_1, ..., \varepsilon_{N_\varepsilon}\}$ such that $g_{ij} \equiv \Pr(\varepsilon' = \varepsilon_j | \varepsilon = \varepsilon_i) \geq 0$ and $\sum_{j=1}^{N_\varepsilon} g_{ij} = 1$ for each i. Moreover, it is stochastically monotone such that for any fixed x, $\Pr(\varepsilon' \leq x | \varepsilon = \varepsilon_i)$ is decreasing in ε_i. The distribution of firms can be summarized using the probability measure μ defined on the Borel algebra A, generated by the open subsets of the product spaces $\mathbf{A} = \mathbf{K} \times \mathbf{B} \times \mathbf{E}$.

4.1.1 labor Demand and Production

Production occurs before the realization of exit and entry decisions, and optimal labor demand is independent of current debt. Therefore, at the beginning of the period every firm of state vector (k, ε) faces the same static optimization with respect to labor:

$$\pi(k, \varepsilon) = \max_n \quad \varepsilon k^\alpha n^\nu - wn - c$$

where c is a fixed cost of participating in production, w is the wage and the price of the consumption good is flexible and normalized to 1. Optimization yields the policy function for labor demand, $n(\varepsilon, k)$ and optimal production $y(\varepsilon, k)$:

$$n(k, \varepsilon) = \left(\frac{\nu \varepsilon k^\alpha}{w}\right)^{\frac{1}{1-\nu}} \qquad y(k, \varepsilon) = \varepsilon k^\alpha \left(\frac{\nu \varepsilon k^\alpha}{w}\right)^{\frac{\nu}{1-\nu}}. \tag{2}$$

Firm profit function can be reformulated as:

$$\pi(k, \varepsilon) = y(k, \varepsilon) - wn(k, \varepsilon) - c = (1 - \nu) y(k, \varepsilon) - c. \tag{3}$$

Firms own capital and make investment decisions, subject to a capital accumulation function,

$$k' = (1 - \delta)k + i \tag{4}$$

where δ is the depreciation rate and i is investment. Since capital and debt are free of adjustment costs, firms' financial position can be summarized by the cash on hand variable:

$$x = \pi(k, \varepsilon) + (1 - \delta)k - b. \tag{5}$$

4.1.2 Firm Values

Production takes place at the beginning of the period. Firms set their labor demand given (k, ε), profits are realized and capital depreciates. Then, incumbents may decide to exit, default or continue production to the next period. This decision is governed by:

$$V_0(k, b, \varepsilon) = \max\{V_{def},\ V_{exit}(k, b, \varepsilon),\ V_{cont}(k, b, \varepsilon)\}. \tag{6}$$

Default is associated with zero value independent of the default resolution, meaning that reorganization costs only affect firm values through their effects on credit market conditions,[14]

$$V_{def} = 0. \tag{7}$$

Firms may also decide to exit after repaying their debt obligations. This allows them to retain the value of the undepreciated capital stock net of debt service:

$$V_{exit}(k, b, \varepsilon) = \pi(k, \varepsilon) + (1 - \delta)k - b = x. \tag{8}$$

Firms that decide to continue can obtain external financing through one-period debt contracts. For each unit of debt due in the next period, they receive q units of output, which can be used towards investment into future capital or distributed as dividends. Moreover, continuing firms decide the proportion of their debt to be backed by future cash flows. In the following, I refer to this as CF-reliance, $\tau \in [0, 1]$, measuring the share of CF-based to total debt.

[14] Jostarndt and Sautner (2008) and Ayotte and Morrison (2009) find that the management of the firm is typically replaced under the reorganization process. Hence, this assumption could be interpreted as the management being indifferent between reorganization and liquidation after default occurs.

Continuing firms choose future capital stock k', total future debt b', and CF-reliance τ' to maximize the discounted sum of dividends d,

$$d = x - k' + \ q(k', b', \varepsilon, \tau')b'. \tag{9}$$

Since capital and debt are not subject to adjustment costs, firms' financial position can be summarized by the cash on hand variable defined in equation 5. This reformulation reduces the computational burden of the model. Using the cash on hand variable, the value of continuation can be described as,

$$V_{cont}(x, \varepsilon) = \max_{k', b', \tau'} \left(x - k' + \ q(k', b', \varepsilon, \tau')b' + q_f \, \mathbb{E}_{\varepsilon'|\varepsilon} \, V(k', b', \varepsilon') \right) \tag{10}$$

subject to:

$$x' = \pi(k', \varepsilon') + (1 - \delta)k' - b' \quad \text{and} \quad d \geq 0 \tag{11}$$

where q_f is the firms' subjective discount factor. Note that since firms are owned by the household, future dividend payments are discounted using the household's discount factor, $\beta = q_f$. In the following, I summarize the collection of decision variables as $a = (k, b, \tau)$ to simplify notation. Section 4.2 describes how the inverse interest rate depends on these decision variables.

Finally, entrants are endowed with zero starting cash on hand, reflecting that startups are typically asset-poor. These firms do not produce in the first period, and have the option to exit after drawing an initial productivity value. Hence, their initial decision can be described as:

$$V_e(\varepsilon) = \max\{0, \ V_{cont}(0, \varepsilon)\}. \tag{12}$$

That is, potential entrants solve 10 - 11 similarly to continuing firms, with the difference that their cash on hand is exactly zero. If $V_{cont}(0, \varepsilon)$ is smaller than zero, they exit voluntarily, without ever participating in production.

4.1.3 Firm dynamics

To describe firm dynamics, I define the following indicator functions. Let $\chi_d = 1$ if the firm defaults either due to endogenous decisions or the exogenous shock, $\chi_l = 1$ if the firm is liquidated in default (this decision is further discussed in section 4.2.2) and let $\chi_{ex} = 1$ if the firm exits voluntarily, after fulfilling its debt obligations.

Voluntary exits and liquidations are balanced by a mass M of potential entrants. Entrants' initial productivity is drawn from the stationary distribution of the Markov chain that defines idiosyncratic productivity - this is denoted by $\Phi(\varepsilon)$. Let μ_0 be the measure of the mass of firms at the beginning of the period. Then, taking stock of firm decisions on the extensive margin, the measure of firms at the end of the period can be expressed as: $\mu = (1 - \chi_l - \chi_{ex})\mu_0 + (1 - \chi_{ex})Md\Phi(\varepsilon)$.

The evolution of firm distribution satisfies:

$$\mu_0'(A) = \int \mathbf{I}_{(k',b',\varepsilon')\in A} g(\varepsilon'|\varepsilon)\ d\mu(k,b,\varepsilon) \tag{13}$$

for all Borel sets $A \subset \mathbf{K}\times\mathbf{B}\times\mathbf{E}$ and where $g(\varepsilon'|\varepsilon)$ is the transition probability matrix idiosyncratic productivity. Finally, I summarize the dynamics of firm distribution at the beginning of the period by the mapping $\mu_0' = \Gamma(\mu_0)$.

4.2 Financial Intermediation

4.2.1 The lender's problem

The opportunity cost of lending to firms is determined by the risk-free bond yield q_0. Since corporate lending is subject to default risk, the competitive lender must charge a premium to break even. When setting $q(a', \varepsilon)$ the lender must consider the expected payoff under 3 distinct scenarios: *a)* orderly repayment; *b)* the firm defaults and is liquidated *c)* the firm defaults and is reorganized. It follows from the

zero-profit condition that the debt schedule offered to firms is,

$$\begin{aligned} q(a',\varepsilon)b' = q_0 \big[& (1 - P_D(a',\varepsilon))\, b' + \\ & P_D(a',\varepsilon)\gamma(a',\varepsilon) \min\{b',\ \Pi_l(a')\} + \\ & P_D(a',\varepsilon)(1-\gamma(a',\varepsilon)) \min\{b',\ E_{\varepsilon'|\varepsilon}[\Pi_r(a',\varepsilon')|\chi_r = 1]\}\big] \end{aligned} \tag{14}$$

where

- $\Pi_l(a')$ is the expected payoff if the firms undergoes liquidation,
- $\Pi_r(a',\varepsilon)$ is the expected payoff if the firms undergoes reorganization,
- $P_D(a',\varepsilon)$ is the probability of default,
- $\gamma(a',\varepsilon)$ is the probability of liquidation under financial distress.

In the following, I discuss the determinants of these values, which leads us to the complete description of the debt schedule $q(a',\varepsilon)$.

4.2.2 Default and Default Resolution

Firms may default endogenously, following the decision rule specified in equation 6. Additionally, they may experience an exogenous default shock, which reaches all firms with a uniform probability P_x - this shock is necessary to calibrate the share of reorganizations to the data. The ex-ante probability of default can be described as:

$$P_D(a',\varepsilon) = E_{\varepsilon'|\varepsilon}[\chi_{endo}(a',\varepsilon')] + P_x - E_{\varepsilon'|\varepsilon}[\chi_{endo}(a',\varepsilon')]P_x \tag{15}$$

where $\chi_{endo}(x,\varepsilon) = 1$ if the firms defaults endogenously.

Defaults can be resolved through liquidation or reorganization. In the case of liquidation, the firm exits, and all its undepreciated capital stock is resold at a discounted value, $\phi_l(1-\delta)k$, where $\phi_l \in (0,1)$. The rest of the stock cannot be recovered, which indicates that corporate assets are often highly specialized and illiquid which limits their value for second-hand users (Kermani and Ma, 2020). The proceeds from selling the capital stock are distributed between the lender and the household. The

exact allocation depends on the debt contract in place, this is further discussed in following section.

Reorganization allows the firm to continue, but it incurs a variable cost $\phi_r V_{cont}(x, \varepsilon)$, and a fixed cost ζ_r, borne by the household.[15] This fixed cost is crucial in replicating the decreasing liquidation probability across firm sizes - I discuss the sources of these costs in more detail section 3.1. Moreover, the household pays a fraction of the firms' continuation value to the lender as a lump-sum transfer. This payment represents the renegotiation of the debt contract, when the lender can enforce a payment for that owners of the business who are interested in keeping the firm operational.[16] The exact value of this transfer depends on the debt contract in place - this is discussed further in the following section.

To keep the model parsimonious, I assume that default resolution decision maximizes the value retained after bankruptcy, and does not consider the allocation of payoffs between the lender and the household. Hence, the default resolution decision can be summarized as:

$$\max\{\phi_l(1-\delta)k;\ (1-\phi_r)V_{cont}(x,\varepsilon) - \zeta_r\} \tag{16}$$

And the ex-ante probability of liquidation under financial distress can be defined as:

$$\gamma(a', \varepsilon) = Pr(\phi_l(1-\delta)k\ \geq\ (1-\phi_r)V_{cont}(x,\varepsilon) - \zeta_r | \chi_d = 1) \tag{17}$$

This is a highly stylized description of the default resolution process, but is sufficient to capture the decreasing liquidation probability across firm sizes. In practice, the default resolution process typically involves negotiations between the borrower and multiple creditors, under the oversight of courts. For more realistic depictions of the bankruptcy process, see Tamayo (2017) and Hu and We (2018).

[15] The incidence of these cost has a minimal effect credit market frictions. Lenders' expenses directly raise the external finance premium, whereas households' costs limit access to external finance indirectly by raising liquidation risk.

[16] Corbae and D'Erasmo also model the reorganization process as a lump-sum transfer between the lender and the borrower. However, their approach is richer, as they model the Nash Bargaining process that determines the value of the transfer.

4.2.3 Lenders' In-default Payoffs

This section describes lenders' in-default pay-offs depending on the default resolution and the debt contract in place. These pay-offs are central to the analysis as they shape the debt schedule $q(a', \varepsilon)$, that firms must consider in choosing debt financing strategy. There are two loan-types (asset-based and cash flow-based) and two bankruptcy types (liquidation and reorganization), therefore the lender has four distinct cases to consider.

1.) The recovery of asset-based debt when the firm undergoes liquidation. Since the debt contract is backed by physical assets, the lender can recover the entire liquidation value of the firm, $\phi_l(1-\delta)k$.[17]

2.) The recovery of asset-based debt when the firm undergoes reorganization. When the borrower undergoes reorganization secured lenders are protected by the 'best interest of creditor' test.[18] This states that secured creditors cannot be worse off under the proposed reorganization plan than they would be under liquidation. Accordingly, I assume that in this case the lender can retrieve the same $\phi_l(1-\delta)k$ during the renegotiation of the debt contract.

3.) The recovery of CF-based debt when the firm undergoes liquidation. In this case, the debt is not backed by physical collateral, which makes the lender poorly equipped to recover the liquidation value. As a result, the lender can only recover a small fraction of the total liquidation value, $\kappa\phi_l(1-\delta)k$, where κ is close to zero.

4.) The recovery of CF-based debt if the firm undergoes reorganization. In this case, the lender can claim a fraction of the continuation value such that its payoff is $\phi_c V_{cont}(x, \varepsilon)$. Hence, in this case, the lender's payoff is determined by the continuation value of the firm.[19] In practice, the process of extracting may vary depending on the specifics of the debt contract. When the debt is secured against the entire

[17] This case corresponds to the traditional assumption on lenders' in-default payoffs in models that only consider asset-based debt contracts.

[18] Defined under 11 U.S.C. § 1129(a)(7) of the U.S. Bankruptcy Code.

[19] For an analogous description of lenders in-default payoffs after CF-based debt, see Drechsel (2023).

corporate entity, the lender may gain access to the borrower's cash flows directly. When the debt is unsecured, higher continuation value of the firm allows the lender to negotiate better terms during reorganization. For a detailed description of this mechanism see Corbae and D'Erasmo (2021).

These payoffs summarize the trade-offs between lending against future cash flows and physical assets. It is now possible to outline the lender's expected payoff depending on the debt financing strategy adopted prior to bankruptcy. Recall that the share of CF-debt to total debt is defined by $\tau \in (0, 1)$. Hence, the lender's payoff under liquidation (or reorganization) is a linear combination of the payoffs from asset-backed debt (with weight τ) and CF-debt (with weight $1 - \tau$).

First, consider debt recovery under liquidation. The total value available after the liquidation of firms' assets is $\phi_l(1 - \delta)k$. However, the lender can only retrieve this value for the debt that is backed by physical assets, which is $1 - \tau$ share of the total debt. After the remaining τ share, which corresponds to the share of CF-based debt, the lender can seize only κ fraction of the original value. Whatever is not seized by the lender under the default resolution is redistributed to the household as a lump sum transfer. Taking stock, if the borrower is liquidated the lender receives,

$$\Pi_l(a) = (1 - \tau)\phi_l(1 - \delta)k + \tau\kappa\phi_l(1 - \delta)k. \tag{18}$$

When the firm undergoes reorganization the lender can claim a fraction of future cash flows after CF-based debt. Moreover, in accordance with the 'best interest of creditor test' the lender retrieves a payment that is equal to the liquidation value of the collateral after asset-based debt. Hence, under reorganization, the lender receives

$$\Pi_r(a, \tau) = (1 - \tau)\phi_l(1 - \delta)k + \tau\phi_c V_{cont}(x, \varepsilon). \tag{19}$$

This concludes the description of the four values that lenders must consider when lending against assets or future cash flows. These are default probability (equation 15), liquidation probability (equation 17), and expected payoff under liquidation and

reorganization (equation 18 and 19 respectively). Together with equation 14, these yield a complete description of the debt schedule $q(a', \varepsilon)$ that continuing firms must consider.

4.3 Households

4.3.1 Consumption and Savings Decision

There is a unit measure of identical households that choose a stream of consumption C and one-period, noncontingent bonds B which yield the risk free interest rate q_0 to maximize expected discounted utility. Households take firm measure μ_0 as given. Their problem can be defined recursively as:

$$V_h(B, \mu_0) = \max_{C, B'} U(C) + \beta V_h(B', \mu_0') \tag{20}$$

subject to:

$$C + B \leq wN^s + q_0 B' + T \tag{21}$$

where N^s is the inelastic labor supply, β is the households' discount factor and T denotes expenses and revenues from the production sector, shared within the household. Revenues include dividends from continuing firms, the net wealth from exiting firms, and the value not seized by the lender after liquidations. Expenses cover the costs of reorganization and transfers to the lender under the debt renegotiation process:

$$\begin{aligned} T = & \int (1 - \chi_l - \chi_{ex}) \left(x - k'(k, b, \varepsilon) + q b'(k, b, \varepsilon)\right) d\mu_0(k, b, \varepsilon) \\ & + \int \chi_{ex} \; x \; d\mu_0(k, b, \varepsilon) \\ & + \int \chi_d \chi_l [\phi_l (1 - \delta) k - \min\{b, (1 - \tau)\phi_l (1 - \delta) k + \tau \kappa \phi_l (1 - \delta) k\}] \; d\mu_0(k, b, \varepsilon) \\ & - \int \chi_d (1 - \chi_l) \; \min\{b, (1 - \tau)\phi_l (1 - \delta) k + \tau \phi_c V_{cont}(x, \varepsilon)\} \; d\mu_0(k, b, \varepsilon) \\ & - \int \chi_d (1 - \chi_l) \; [\phi_r V_{cont}(x, \varepsilon) + \zeta_r] \; d\mu_0(k, b, \varepsilon). \end{aligned}$$

4.4 Stationary equilibrium

The stationary competitive equilibrium is described by the set of functions

$$(\mu_0, \mu, w, V, V_{cont}, V_{def}, V_{exit}, V_e, \chi_l, \chi_d, \chi_{ex}, n, k, b, d, \tau, q, C, B)$$

such that:

(i) households solve utility maximization: V_h solves 20-21 and the associated policy functions are (C, B);

(ii) the lender solves 14 while also taking into account 15-19; such that $q(a', \varepsilon)$ yields zero profits in expectation on each debt contract;

(iii) firms solve value maximization: V_0 solves 6, V_e solves 12 and V_{cont} solves 3, 10 and 11; and the associated policy functions are n, for exiting and defaulting firms and (n, k, b, d, τ, q) for continuing and entering firms;

(iv) the default resolution decision solves 16 for χ_l

(v) wages adjust to equate firms' labor demand to the inelastic labor supply

$$N^s = \int n \; d\mu_0(k, b, \varepsilon)$$

(vi) the first order condition households' savings problem implies that the interest rate of the noncontingent bond q_0 is equal to households' discount parameter β; and the financial market clears at $q_0 = q_f = \beta$

$$B = \int b \; d\mu_0(k, b, \varepsilon)$$

(vii) goods market clears due to Walras' law (binding budget constraints and all other markets are in equilibrium) and aggregate consumption is

$$C = Y - I - \Psi$$

where

$$Y = \int y \; d\mu_0(k, b, \varepsilon)$$

aggregate investment is the sum of investment carried out by continuing incumbents and entering firms minus the capital freed up due to liquidations and voluntary exits:

$$I = \int k' - (1-\delta)k \; d\mu(k, b, \varepsilon) + M \int (1 - \chi_{ex}) k' \; d\Phi(\varepsilon)$$
$$- \int \chi_l \chi_d \phi_l (1-\delta) k \; d\mu_0(k, b, \varepsilon) - \int \chi_{ex} (1-\delta) k \; d\mu_0(k, b, \varepsilon)$$

Ψ collects the fixed costs of operation and the costs of default resolution:

$$\Psi = \int \chi_l \chi_d (1 - \phi_l)(1-\delta) k \; d\mu_0(k, b, \varepsilon)$$
$$+ \int (1 - \chi_l) \chi_d [\phi_r V_{cont}(x, \varepsilon) + \zeta_r] \; d\mu_0(k, b, \varepsilon) + \int c \; d\mu_0(k, b, \varepsilon)$$

(viii) the distribution measure of firms is stationary, $\Gamma(\mu_0) = \mu_0$ and prices (w, q) are constant over time.

5 Calibration and Model Fit

I calibrate the model at a yearly frequency. The first set of parameters are set externally, based on comparable structural models, common values adopted in the literature, and previous empirical results. Decreasing returns to scale parameter is set at $DRS = 0.75$, the capital share of production α, is one-third and the labor share ν, is two-thirds. The subjective discount parameter of the household is $\beta = 0.96$ and depreciation is $\delta = 0.1$. These parameter parameter values are within the range of standard values adopted in the literature. The resale value of assets $\phi_l = 0.4$, is calibrated based on Kermani and Ma (2020), who estimates the average recovery rate of assets after liquidation. If the debt is not secured by physical assets, the

lender can only seize $\kappa = 0.1$ share of this value - since this variable has minimal impact on the steady state, it is not calibrated separately.

The productivity process is based on Di Nola, Kaas, and Wang (2023). Idiosyncratic firm productivity follows the AR(1) process

$$\ln(\varepsilon_{t+1}) = (1-\rho)\ln(\varepsilon_0) + \rho\ln(\varepsilon_t) + \sigma\zeta_\varepsilon,$$

where $\rho = 0.969$ is the persistence of productivity the shock, $\varepsilon_0 = 1$ is the normalized average productivity and $\sigma = 0.146$ is the standard deviation of idiosyncratic productivity shocks. The log-process is discretized using Tauchen's method.

I calibrate the rest of the model parameters using a combined dataset of CapitalIQ, Compustat and Federal Judicial Center's Integrated Database (IDB). This presents a challenge, as smaller firms are underrepresented in Compustat-CapitalIQ and likely to be overrepresented in the IDB. To align these two datasets, I classify firms into two categories: small firms, with liabilities under 10 million, and large firms, with liabilities exceeding 10 million.[20] In Compustat, small firms add up to around 21% of the sample, whereas in IDB these are 67% of the sample.[21] Hence, the targeted moments are calculated by mapping Compustat values onto the IDB firm distribution.
Internally calibrated parameters are set to match facts about firms' debt financing strategies and default resolution decisions. Due to general equilibrium effects, parameter values cannot be set in isolation. Yet, they can be associated with closely related data moments. Fixed and variable costs of reorganization are set based on the average liquidation probability. Moreover, the fixed cost of reorganization is important in matching the decreasing liquidation probability across firms sizes. The effect of this parameter is also reflected in the difference between the CFL reliance and the share of outstanding CF-based debt to total debt. The former is significantly lower than the latter because large firms face minimal liquidation risk and typically

[20]This cutoff corresponds the largest firm category (by total liabilities) in the IDB database that contains eligible firms for subchapter V under the SBRA.

[21]I do not consider 'micro' firms that have less than 100k USD of total assets, as they are not represented in the Compustat.

Externally Calibrated Parameters

DRS	Decreasing returns	0.75
α	Capital Share of Output	0.33
β	Discount Rate	0.96
δ	Depreciation rate	0.1
ρ	Produ . Shock Persistence	0.969
σ_ε	Produ . Shock SD	0.146
ε_0	Average Productivity	1
ϕ_l	Resale value of assets	0.4
κ	Unsecured discount	0.1

Internally Calibrated Parameters

ϕ_r	Variable cost of reorganization	0.204
ζ_r	Fixed costs of reorganization	2590
ϕ_c	Lender's payoff under reorganization	0.281
P_x	Exogenous probability of default	0.025
c	Fixed costs of operation	30.2

Table 2: Externally and Internally calibrated parameters values

borrow against cash flows at a much higher volume. The average interest rate is matched by the probability of exogenous default and the debt to collateral ratio is linked to the fixed cost of operation through average firm size.

SS value	**Target value**	**Model value**
Debt to Collateral	0.49	0.47
Average interest rate	5.3	5.37
Average Liquidation prob.	0.48	0.51
Average CF-reliance	0.43	0.49
CF-based to total debt	0.76	0.76

Table 3: Targeted data moments and their model counterparts

The targeted moments and their corresponding model values are summarized in table 3. The model closely replicates the central facts about firms' debt financing strategies, default resolution decisions as well as the external finance premia they

face. To further assess model performance, I compare untargeted moments to their data equivalents. I divide the sample into small and large firms, based on total borrowing. Small firms account for the bottom 66% of firm distribution, which corresponds to the share of firms in IDB with liabilities under 10 million USD. Table 4 presents the targeted moments and their corresponding model values separately, for small and large firms.

The model closely replicates the financing gap observed between small and large firms. Small firms realize significantly lower debt to collateral ratios while facing higher external finance premia. The decreasing probability of liquidation across firm size is also captured well in the model, although this decline is somewhat less pronounced in the data. On the other hand, the model falls short in matching the average CF-reliance. The CFL reliance is in fact U-shaped across firms, with the largest and the smallest firms borrowing most heavily against cash flow (Gonzalez and Sy, 2024). This imprecision arises because the model misses the left side of this U-shape, as it almost always assigns a liquidation probability near 1 to small firms. The ratio of CF-based debt to total debt value is again replicated closely by the model.

SS Value	**Data**		**Model**	
	Small Firms	Large Firms	Small Firms	Large Firms
Number share	0.67	0.33	0.64	0.36
Debt to Collateral	0.42	0.59	0.41	0.54
Interest Rate (%)	5.89	4.63	5.83	4.84
Liquidation Probability	0.70	0.32	0.80	0.16
CF Reliance	0.40	0.47	0.13	0.94
CF-based to total debt	0.32	0.77	0.25	0.80

Table 4: Untargeted data moments and their model counterparts

6 Results and Discussion

This section presents the main findings of the structural analysis. First, I study the effects of a policy reform that reduces reorganization costs, significantly reducing the average ex-ante liquidation risk. This reform improves access to CF-based debt financing, improving credit allocation, increasing the mass of active firms and boosting aggregate productivity. These effects of the reform across different firm sizes and productivity states: the reform has the greatest impact on firms with relatively high productivity, though not at the very top of the distribution. Next, I assess the impact of the reform under alternative model specifications where only asset-based or CF-based lending is available. When asset-based debt is absent, the effects of the reform are overestimated. In contrast, CF-based debt contracts are absent, and the fall in liquidation risk does not influence other equilibrium outcomes.

6.1 The Effects of Reorganization Costs

I use the calibrated model as a laboratory to explore the effects of a policy reform that implements a more reorganization-friendly bankruptcy framework. In particular, I study an alternative model calibration in which the fixed cost of reorganization is half of the baseline value, while the variable cost remains unaffected. This represents a large intervention as average liquidation probability falls from 50% in the baseline model to 32% after the reform. Moreover, to see how these reform effects scale, I also consider an 'extreme reform', which limits the fixed costs of reorganization to one-tenth of the baseline value, reducing average liquidation probability to just 8%. The general equilibrium effects of these reforms are summarized in table 5.

Since large firms are relatively unaffected by fixed cost due to their scale, the reform has the most substantial impact on small firms. Liquidation probability for small firms drops from 0.80 in the baseline calibration to just 0.57 after the reform, which fundamentally changes their debt financing strategy. Small firms' average reliance on CF-based debt jumps from just 14% to 50% and the share of CF-based to total debt volume increases from 25% to 82%. Better access to CF-based debt, allows

these firms to rely on external finance more intensively. The debt to collateral ratio increases by 4 percentage points, while the average interest rate paid on these contracts declines by 0.65 percentage points. These effects point in the same direction for large firms but are significantly smaller. As a result, the financing gap between small and large firms observed in the baseline calibration narrows considerably after the reform.

Average productivity increases by 1.4% after the reform, reflecting the large changes in small firms' access to debt finance. The total mass of firms increases, while the firm size (measured by labor demand) falls by 4.03%. Since the production technology is decreasing returns to scale, the fall in average size boosts aggregate productivity. Capital deepening is not substantial, as the capital to labor ratio increases only by 0.36%. Two conflicting forces contribute to this change. When firms borrow against assets, capital serves both as collateral and a productive asset. Hence, when borrowing against cash flows is limited, firms tend to invest more than optimal (Drecshel and Kim, 2024). On the one hand, cheaper access to debt finance allows firms to reach their optimal size faster, which yields a larger stock of total capital. Hence, the overall effect of CF-based debt financing on the capital stock is ambiguous.

	Baseline	Reform	Extreme Reform
FC of reorganization, ζ_r	2590	1295	259
Aggregates			
Total mass	13.89	14.47	14.92
Mean Employees	720	691	670
Small Firms Share	0.64	0.64	0.64
Wage	1.00	1.014	1.029
Capital Intensity (K/L)	2.74	2.75	2.83
Productivity (Y/L)	2.00	2.027	2.057
Bankruptcy Resolution			
Pr. Liquidation - Small Firms	0.80	0.57	0.15
Pr. Liquidation - Large Firms	0.16	0.03	0.00
Debt Financing Strategy			
CF reliance - Small Firms	0.14	0.50	0.83
CF reliance - Large Firms	0.94	0.97	0.97
CF to total debt - Small Firms	0.25	0.82	0.97
CF to total debt - Large Firms	0.81	0.84	0.83
Access to Debt Finance			
Debt/Collateral - Small Firms	0.41	0.45	0.50
Debt/Collateral - Large Firms	0.55	0.56	0.56
Interest rate - Small Firms	5.83	5.18	4.85
Interest rate - Large Firms	4.84	4.60	4.54

Table 5: Comparison of competitive equilibria

The 'extreme reform' scenario illustrates how the effects of this policy scale as fixed reorganization cost are reduced to a near-zero value. With this reform, liquidation probability is reduced to just 15% for small firms and is effectively eliminated for large firms. This allows most firms to borrow against future cash flows, which is

typically preferable in the absence of liquidation risk. The financing gap between small and large firms almost entirely disappears, and better access to external finance increases aggregate productivity by 2.9%.

Figure 2 illustrates the impact of the smaller reform across different productivity states and cash-on-hand values - and figure 4 in the appendix presents the effects of the 'extreme reform'. Non-colored tiles correspond to states in which the mass of firms is less than 0.01% of the total in the stationary equilibrium. Panel A shows the change in liquidation probability following the reform. The most and least productive firms are largely unaffected by the reform. This pattern arises because the former are unlikely to liquidate even before the implementation of the reform, whereas the latter are unlikely to reorganize even after the reduction of fixed costs. Hence the reform has the greatest impact on firms with relatively high productivity, though not at the very top of the distribution (the lowest 11 productivity states are omitted from Figure 2). These firms however, experience a substantial reduction in ex-ante liquidation probability, by 30 to 70 percentage points.

The rest of the equilibrium outcomes reflect the changes in ex-ante liquidation probability. Panel B shows the change in reliance on CF-based debt. Although the model can, in principle, accommodate any CF-reliance between zero and one, under the current model assumptions firms always choose a corner solution. Hence, CF-reliance is either zero or one in the model and the bright yellow tiles correspond to firms that switch from asset-based borrowing to CF-based borrowing after the the reform. Panels C and D show changes in the debt to collateral ratio and interest rates, respectively. The firms most affected by the reform either borrow at a lower interest rate or realize higher debt to collateral ratios.

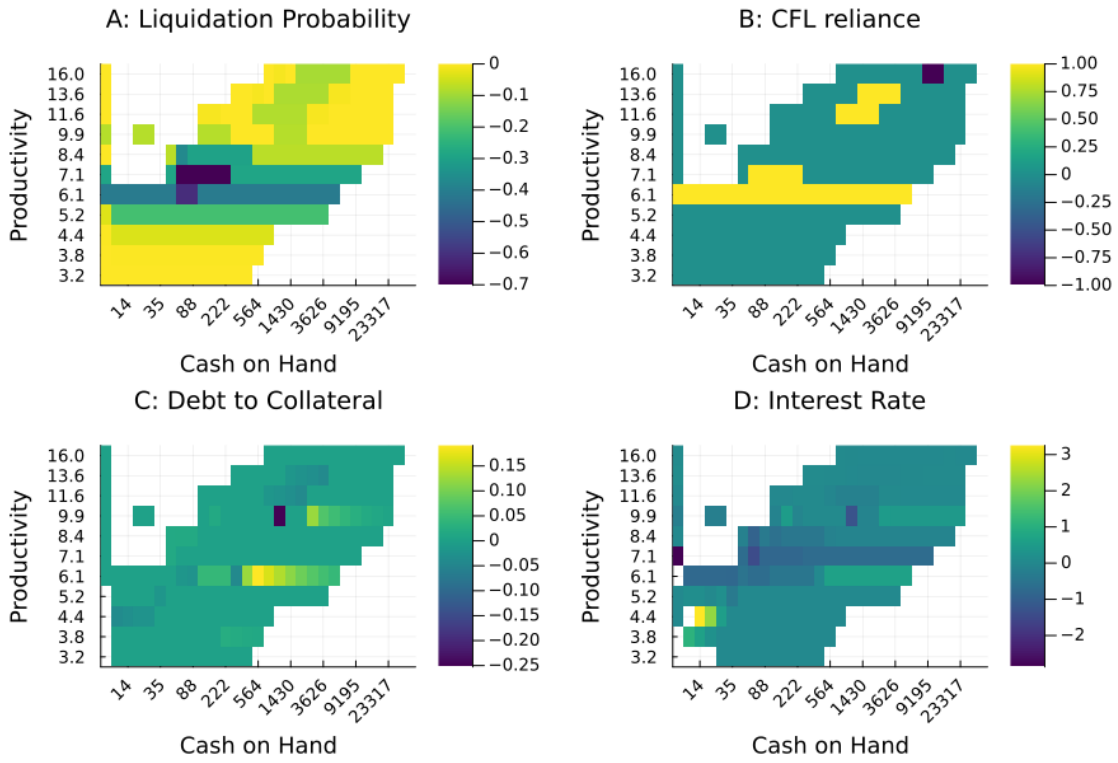


Figure 2: The change in equilibrium outcomes following the reform. The y-axis represents the productivity state, and the x-axis the cash on hand value. The color intensity corresponds to the magnitude of the change. The non-colored tiles correspond to states in which the mass of firms is less than 0.01% of the total in the stationary equilibrium. Panel A shows the change in liquidation probability, Panel B shows the change in reliance on CF-based debt, Panel C shows the change in debt to collateral ratio and Panel D shows the change in interest rates.

Table 6 summarizes the effects of the reform in alternative model specifications, in which firms can access only asset-based debt (AB-only) or only CF-based debt (CF-only). For reference, I also report the reform effects in the baseline model. The 'AB-only' case is implemented by setting lenders' payoffs in reorganization to zero ($\phi_c = 0$) while the 'CF-only' case is implemented by setting lenders' payoffs after liquidation to zero ($\phi_l = 0$). In both cases, the model is recalibrated to match the targeted moments of average liquidation probability, debt to collateral ratio, and

interest rate.

	AB only	**Baseline Model**	**CF only**
Total firm mass	0%	4.2%	20.91%
Mean employees	0%	-4.04%	-17.29%
Productivity (Y/L)	0%	1.34%	2.40%
Capital Int. (K/L)	0%	0.26%	0.68%
Wage	0%	1.34%	2.40%
Pr. Liquidation	-18.06 pp	-18.43 pp	-21.69 pp
Debt/Collateral	0 pp	3.07 pp	5.82 pp
Interest rate	0 pp	-0.45 pp	0.71 pp
CF reliance	0 pp	21.2 pp	0 pp
CF share	0 pp	6.83 pp	0 pp

Table 6: Reform effects in recalibrated model versions where only asset-based debt is available (AB only), and only CF-based debt is available (CF only). The baseline model is also reported as reference.

When only asset-based debt is available, the change in liquidation probability does not influence other equilibrium outcomes.[22] Since most macro-finance models do not account for CF-based debt financing, this case illustrates the effects of the reform in 'standard' macroeconomic models of credit frictions. Hence, this result may explain why ex-ante liquidation probability has received scant attention in prior research. In contrast, when only CF-based debt is available, the model overestimates the impact of the reform. In the baseline case, firms that are expected to liquidate under financial distress can fall back to asset-based borrowing, since this loan type is not exposed to liquidation risk. Without asset-based debt acting as a backstop on external financing costs, the model overemphasizes the effects of liquidation probability. For further discussion on how liquidation probability affects the optimal debt financing strategies and interest rates, see section E.1 in the appendix.

[22]The reform's effects are considered solely through credit frictions. Facilitating reorganizations may have broader implications beyond credit markets, which are not considered here.

7 The Small Business Reorganization Act

In February 2020, the Small Business Reorganization Act (SBRA) introduced Subchapter V to Chapter 11 of the U.S. Bankruptcy Code. This reform was based on the recognition that traditional Chapter 11 bankruptcy is often prohibitively costly and time-consuming for small firms. The SBRA includes several provisions aimed at making the reorganization process more accessible for small businesses.

1. *Elimination of Creditor Committees.* No automatic requirement for a creditors' committee, reducing administrative costs and simplifying the bankruptcy process.

2. *Simplified Creditor Cramdown.* A reorganization plan can be confirmed without unanimous creditor approval, provided the Bankruptcy Court deems it fair and equitable, reducing delays and legal costs.

3. *Elimination of the Absolute Priority Rule.* Firm owners can retain equity without fully repaying unsecured creditors, making restructuring more feasible.

4. *Reduced Reporting and Disclosure Requirements.* Fewer financial disclosure obligations, lowering compliance costs.

5. *Streamlined Reorganization Process.* Deadlines for filing and confirming a plan are shortened, reducing the time and expense of reorganization.

6. *Appointment of a Subchapter V Trustee.* A trustee is assigned to assist the development of a consensual reorganization plan, without assuming control of the business.

Evaluating these provisions separately is beyond the scope of this paper. Yet, the structural model offers valuable predictions about certain aspects of this reform. In the following, I assess the effects of SBRA's focus on small firms relative to a universal policy and the reduction of creditor control over the reorganization process.

Eligibility is limited to small firms.

The eligibility requirements of Subchapter V effectively exclude large firms from filing for this form of bankruptcy.[23] Moreover, the reduced reporting requirements, the streamlined reorganization process, and the appointment of a Subchapter V trustee (provisions 4 to 6) lower the administrative and time costs of reorganization. Hence, a targeted reduction in the fixed costs of reorganization for small firms is a reasonable representation of the SBRA. These provisions likely affect more than just fixed reorganization costs. Therefore, in the appendix, I also study a targeted reduction in variable costs. However, since fixed costs are the primary barrier to reorganization for small firms, I find that this change has negligible effects on equilibrium outcomes.

The second column of Table 7 summarizes the equilibrium effects of a targeted reform, that halves reorganization costs for small firms. Compared to the universal reform, the effects of the targeted policy are somewhat smaller but not significantly so. As discussed in the section 4, fixed reorganization costs disproportionately burden small firms. Hence, it is intuitive that the targeted reduction of these costs does not have an aggregate effect that is too dissimilar from the universal reform. The financing environment for small firms is particularly important, since all firms start small. Better access to external finance, not only allows young firms to reach optimal size faster but also encourages entry, which boosts productivity due to the decreasing returns to scale production technology. In conclusion, the results presented in table 7 confirm that excluding large firms from the SBRA has a limited impact on the reform's overall effectiveness.

Reducing creditor control over the reorganization process

The SBRA enhances debtor rights and streamlines the reorganization process by limiting creditor control. The elimination of creditor committees, allowing deviations from the absolute priority rule, and the simplified creditor cramdown (provisions 1 to 3) all point in this direction. Since these measures reduce lenders' bargaining

[23] At its introduction, Subchapter V eligibility was limited to businesses with no more than approximately $2.75 million in debt. Shortly after, this debt limit was temporarily increased to $7.5 million in response to the COVID-19 pandemic and was later reduced to an original (inflation-adjusted) threshold of around $3 million in June 2024.

power, I represent these in the model as a reduction of lenders' ability to seize future cash flow through the debt-renegotiation process (reduction in ϕ_c). The last column of 7 shows the effects of a reform that halves the fixed costs of reorganization *and* creditors' payoff from the renegotiation of the debt contract. In this case, almost all the benefits from the reduction of fixed costs are diminished. This result warrants caution for policymakers seeking to enhance debtor rights at creditors' expense. Anticipating lower recoveries in a reorganization, lenders may preemptively restrict access to CF-based debt, which limits the benefits of reducing reorganization costs.

	Universal	**Targeted**	**Control Reduc.**
Total firm mass	4.2%	2.20%	1.55%
Mean employees	-4.04%	-2.15%	-1.58%
Productivity (Y/L)	1.34%	0.97%	0.25%
Capital Int. (K/L)	0.26%	1.25%	2.80%
Wage	1.34%	0.97%	0.25%
Pr. Liquidation	-18.43 pp	-11.92 pp	-17.90 pp
Debt/Collateral	3.07 pp	1.53 pp	-0.86 pp
Interest rate	-0.45 pp	-0.35 pp	-0.20 pp
CF reliance	21.2 pp	20.58 pp	-3.47 pp
CF share	6.83 pp	2.23 pp	-54.51 pp

Table 7: Reform effects in recalibrated model versions. Baseline refirm: fixed costs are halved. Targeted reform: the fixed costs of reorganization are halved only for small firms. Creditor control reducing reform: the fixed costs are halved but so is creditors ability to extract future cash flows.

8 Conclusion

This paper demonstrates that reorganization costs raise liquidation risks and limit access to cash flow-based debt for small but productive firms, which has significant consequences for broader macroeconomic outcomes. The empirical analysis establishes that ex-ante liquidation risk increases credit spreads on cash flow-based loans, limiting access to credit for firms that lack sufficient collateral. The structural model quantifies the macroeconomic implications of these credit frictions. High reorganization costs increase small firms' liquidation probability and limit their access to CF-based debt, which contributes to credit misallocation, suppresses firm entry and ultimately yields aggregate productivity losses.

The model also sheds light on the broader effects of bankruptcy reforms, such as the Small Business Reorganization Act (SBRA) of 2019. By reducing reorganization costs, policymakers can enhance credit allocation, alleviate financing constraints and ultimately improve aggregate productivity. Targeted policies that facilitate the reorganization of small firms have similar effects to universal programs that apply to every borrower. However, limiting creditor rights over the reorganization process may have unintended consequences, as poorer bargaining position leads lenders to limit CF-based lending preemptively. These results highlight the importance of designing bankruptcy frameworks that promote debtors' flexibility to resolve bankruptcy by reorganization, without compromising creditor protection.

References

[1] Antill, S., & Grenadier, S. R. (2019). Optimal capital structure and bankruptcy choice: Dynamic bargaining versus liquidation. *Journal of Financial Economics*, **133**(1), 198-224.

[2] Ayotte, K. M., & Morrison, E. R. (2009). Creditor control and conflict in Chapter 11. *Journal of Legal Analysis*, **1**(2), 511-551.

[3] Banerjee, A. V., & Moll, B. (2010). Why does misallocation persist? *American Economic Journal: Macroeconomics*, **2**(1), 189-206.

[4] Beck, T., & Demirguc-Kunt, A. (2006). Small and medium-size enterprises: Access to finance as a growth constraint. *Journal of Banking & Finance*, **30**(11), 2931-2943.

[5] Bernanke, B. S., Gertler, M., & Gilchrist, S. (1999). The financial accelerator in a quantitative business cycle framework. In *Handbook of Macroeconomics* (Vol. 1, pp. 1341-1393).

[6] Blazy, R., & Chopard, B. (2012). (Un) secured debt and the likelihood of court-supervised reorganization. *European Journal of Law and Economics*, **34**, 45-61.

[7] Bris, A., Welch, I., & Zhu, N. (2006). The costs of bankruptcy: Chapter 7 liquidation versus Chapter 11 reorganization. *The Journal of Finance*, **61**(3), 1253-1303.

[8] Brunner, A., & Krahnen, J. P. (2008). Multiple lenders and corporate distress: Evidence on debt restructuring. *The Review of Economic Studies*, **75**(2), 415-442.

[9] Buera, F. J., Kaboski, J. P., & Shin, Y. (2011). Finance and development: A tale of two sectors. *American Economic Review*, **101**(5), 1964-2002.

[10] Caglio, C. R., Darst, R. M., & Kalemli-Özcan, . (2021). Collateral heterogeneity and monetary policy transmission: Evidence from loans to SMEs and large firms (No. w28685). *National Bureau of Economic Research*.

[11] Catherine, S., Chaney, T., Huang, Z., Sraer, D., & Thesmar, D. (2022). Quantifying reduced-form evidence on collateral constraints. *The Journal of Finance*, **77**(4), 2143-2181.

[12] Corbae, D., & D'Erasmo, P. (2021). Reorganization or liquidation: Bankruptcy choice and firm dynamics. *The Review of Economic Studies*, **88**(5), 2239-2274.

[13] Drechsel, T., Kim, S. (2024). Macroprudential policy with earnings-based borrowing constraints. Journal of Monetary Economics, 147, 103595.

[14] Drechsel, T. (2023). Earnings-based borrowing constraints and macroeconomic fluctuations. *American Economic Journal: Macroeconomics*, **15**(2), 1-34.

[15] Di Nola, A., Kaas, L., and Wang, H. (2023). Rescue policies for small businesses in the COVID-19 recession. Review of economic dynamics, 51, 579-603.

[16] Esho, E., & Verhoef, G. (2018). The funding gap and the financing of small and medium businesses: An integrated literature review and an agenda.

[17] Gilson, S. C., John, K., & Lang, L. H. (1990). Troubled debt restructurings: An empirical study of private reorganization of firms in default. *Journal of Financial Economics*, **27**(2), 315-353.

[18] Hopenhayn, H. A. (2014). Firms, misallocation, and aggregate productivity: A review. *Annu. Rev. Econ.*, **6**(1), 735-770.

[19] Jostarndt, P., & Sautner, Z. (2008). Financial distress, corporate control, and management turnover. *Journal of Banking & Finance*, **32**(10), 2188-2204.

[20] Kermani, A., & Ma, Y. (2020). Two tales of debt (No. w27641). *National Bureau of Economic Research*.

[21] Khan, A., Senga, T., & Thomas, J. K. (2014). Default risk and aggregate fluctuations in an economy with production heterogeneity. Unpublished manuscript.

[22] Lian, C., & Ma, Y. (2021). Anatomy of corporate borrowing constraints. *The Quarterly Journal of Economics*, **136**(1), 229-291.

[23] LoPucki, L. M., & Doherty, J. W. (2004). The determinants of professional fees in large bankruptcy reorganization cases. *Journal of Empirical Legal Studies*, **1**(1), 111-141.

[24] LoPucki, L. M., & Doherty, J. W. (2011). Professional fees in corporate bankruptcies: Data, analysis, and evaluation. *Oxford University Press*.

[25] Midrigan, V., & Xu, D. Y. (2014). Finance and misallocation: Evidence from plant-level data. *American Economic Review*, **104**(2), 422-458.

[26] OECD. (2006). The SME financing gap: Volume I. *Organisation for Economic Co-operation and Development Publishing*.

[27] Öztürk, Ö. (2023). Monetary policy with firm heterogeneity (Doctoral dissertation, European University Institute).

[28] Rao, P., Kumar, S., Chavan, M., & Lim, W. M. (2023). A systematic literature review on SME financing: Trends and future directions. *Journal of Small Business Management*, **61**(3), 1247-1277.

[29] Restuccia, D., & Rogerson, R. (2013). Misallocation and productivity. *Review of Economic Dynamics*, **16**(1), 1-10.

[30] Tamayo, C. E. (2017). Bankruptcy choice with endogenous financial constraints. *Review of Economic Dynamics*, **26**, 225-242.

[31] Zhong, H. (2021). A dynamic model of optimal creditor dispersion. *The Journal of Finance*, **76**(1), 267-316.

Appendix

A Model Solution

In the structural model discussed above, optimal firm policies and the interest rate schedule offered by the lender are jointly determined. That is, lenders adjust interest rates to firm policies, while firms choose these policies in light of the interest rate schedule offered to them. To address this issue, I adopt the following solution algorithm:[24]

1. Set $q^0 = 0$ of inverse interest rate for all firm policies and calculate the value of the firm, $V_{cont}(k, b, \varepsilon)$, the optimal firm policies k', b', τ' as well as the exit and liquidation policies.

2. Calculate the following: the probability of default P_D, the probability of liquidation in default γ, the liquidation value; $\phi_l(1-\delta)k'$ and the reorganization value; $\phi_c V(x', \varepsilon')$ given q^0, for each state-policy pair

3. Update interest rate associated with the state-policy pair, taking into account the default and liquidation probability and lenders in-default payoffs. This gives q^1.

4. Repeat $1-3$ until the optimal policies and interest rates do not change in successive iterations - that is, $(k^i, b^i, \chi_d^i, q^i, V^i) = (k^{i-1}, b^{i-1}, \chi_d^{i-1}, q^{i-1}, V^{i-1})$.

This algorithm is relatively robust, but it comes at a great computational cost. It usually takes around 15 to 20 iterations to converge, which implies the same number separate solutions of firm optimization (step number 1) and updating the interests rate schedule (step number 2 and 3).

[24] This follows Corbae and D'Erasmo (2021).

B Costs of Lending against Future Cash Flows

In section 4.2.1, I adopt a highly stylized description of fixed costs: these are imposed only on households which allows me to match the high liquidation probability associated with small corporations. In the interest of keeping the model simple, I do not impose a separate fixed cost on lenders. In practice, however, the default resolution process often involves a lengthy negotiation between debtors, creditors, and courts, which imposes significant costs on every involved party. Hence, when in-default payments are expected through reorganization, the lender must take into account the legal, personnel, and time expenses of this process.

However, maintaining a cash flow-based debt contract may impose significant costs on the lender even in the normal course of business. Asset-based contracts only require occasional audits of the borrower's assets. In contrast, cash flow-based contracts necessitate that the lender carries out its 'due diligence' on an ongoing basis. The apparatus to maintain this monitoring activity may impose significant expenses on creditors.[25] More generally, such costs could be thought of as all additional expenses lenders face on a regular basis when they deviate from standardized asset-based contracts.

In summary, evidence would also support imposing additional fixed costs on creditors for lending against future cash flows. In fact, it would be possible to coin the central trade-off of the model in terms of these fixed costs. In this scenario, asset-based debt would provide the benefit of not having to monitor borrower performance and would offer a quick and cost-effective way to retrieve in default payments. Conversely, CF-based contracts would allow to potentially retrieve a share of the continuation value, but it would impose significant fixed costs on the lender. I do not include this mechanism in the model, as it would produce very similar results to the baseline setup. However, it is important to note that these fixed costs may influence lenders to favor one loan type over another.

[25] This type of cost shares some similarities with the costly state verification first proposed by Towsend (1979).

C Data appendix

C.1 Compustat and Capital IQ

Compustat is a comprehensive, financial database maintained by S&P Global. It offers standardized firm-level information on publicly traded companies compiled from financial statements, regulatory filings, and other financial reports. I use the quarterly tables in Compustat North America and drop firms that are not headquartered in the US. Moreover, I exclude financial corporations (SIC code 6000 to 6799) and utility providers (SIC code 4900-4999).

S&P Capital IQ offers an extensive array of debt-level statistics. The two datasets can be connected via the unique firm identifier (GVKEY), moreover, Capital IQ covers most of the Compustat firms and yields consistent firm-level debt data after the aggregation of debt contracts. Although Capital IQ covers most major economies, I only focus on US corporations, due to limitations introduced by Compustat. Both of these datasets are accessed through Wharton Research Data Services (WRDS).

Although both datasets provide high quality reports, reporting differences necessitate some manipulation of the data. Since monetary variables are often reported in the native currency, I bring all observations to USD. Moreover, Capital IQ reports data points in different units (units, thousands or millions). To be consistent to Compustat, I bring all observations to millions of units. It must also be ensured that each observation is uniquely identified by the combination of year, quarter, and debt ID. This may be violated for various reasons, for instance, debt facilities are often reported twice (once with the total accessible debt and once with the currently outstanding amount). In these cases, I only consider the outstanding amount. Moreover, in some cases, the parent firms and the subsidiaries are both included in the data. In these cases, I only consider parents in order to maintain observations at the highest consolidation level.

In some instances, debt contracts go missing only to reappear a few quarters later. If this gap between observations is no more the four quarters, I use linear interpolation

to fill up the data. These cases are relatively rare as they only amount to approximately 7% of the total sample. To ensure the alignment of consistent observations, I aggregate debt-level data from CapitalIQ to the firm level and cross-reference it with the debt information reported by Compustat. I drop any observations where there is a disparity of more than 20% between the two datasets. This discards around 8% of the original sample. Tables 9 and 8 summarize Capital IQ and Compustat variables, including their original names and definitions in these datasets.

Moreover, I explore bankruptcy data drawn from the Integrated Database (IDB) maintained by the Federal Judicial Center (FJC). This is a comprehensive resource containing detailed records of federal court cases in the United States. It includes data on civil, criminal, bankruptcy, and appellate cases from the Administrative Office of the US Courts. For this analysis, only bankruptcy cases under Chapters 7 and 11 are considered, focusing on the period from 2010 to 2023, which corresponds to the period covered by the Capital IQ - Compustat dataset.

Variable	Capital IQ
Loan value	dataitemvalue
Decimal of the value	unittypeId
Currency of issuance	issuedCurrencyId
Used for contract classification	
Description of the contract	capitalstructuredescription
Type of the debt contract	capitalstructuresubtypeid
Debt description in text	descriptiontext
Secured dummy	securedtypeid
Seniority	leveltypeid
Firm-level aggregated variables	
Total debt value	Sum of all contracts value
AB value	Sum of all AB debt
CF value	Sum of all CF debt
CF-share	CF value / Total debt

Table 8: Variables downloaded from Capital IQ and their corresponding name in WRDS.

Variable	Compustat Definition	Description
Total debt	dlcq+dlttq	Long-Term Debt + Debt in Current Liabilities
Leverage	(dlcq+dlttq)/atq	Total debt / Total Assets
Collateral	ppentq+invtq+rectq	Total Property, Plant and Equipment (net) + Receivables + Inventory
Pledgeability	(ppentq+invtq+rectq)/atq	Collateral / Total Assets
Interest coverage	oibdpq / xintq	Operating income before depreciation / Interest related expenses
Investment	capxq-sppeq	Capital expenditures - Sale of Property
Investment rate	(capxy - sppey) / l.ppegtq	Investment / Lag of Total Property, Plant and Equipment (gross)
Equity	atq-ltq	Total assets / Total liabilities
Net debt	dlcq+dltq-chq	Total debt - Cash Holdings
Liquidity	chq/atq	Cash Holdings / Total Assets
Assets	atq	Total Assets (book value)
Liabilities	ltq	Liabilities (book value)
Revenue	revtq	Total quarterly revenue
EBITDA	oibdpq	quarterly EBITDA measure
Employees	emp	Total number of employees (thousands)
Industry spec.	sic	SIC code
Credit rating	spcsrc	S&P credit rating
Age	from Capital IQ	Current year - Year founded + 1

Table 9: Variables downloaded from Compustat and their corresponding name in WRDS.

Variable	Description
SNAPSHOT	Date variable
SNAPFILE	1 if filed in the period
SNAPPEND	1 if still pending in the period
SNAPCLOS	1 if ended in the period
ORGFLDT	Original filing date
CLOSEDT	Closing date
CRNTCHP	Current bankruptcy chapter
CLCHPT	Closing bankruptcy chapter
EASST	Estimated total assets
ELBLTS	Estimated total liabilities

Table 10: Variables downloaded from IDB and their corresponding name in WRDS.

C.2 Summary Statistics

Firm-Level Summary Statistics

	Mean	**p10**	**p25**	**Median**	**p75**	**p90**
Total Assets (millions USD)	5235.16	11.39	73.11	582.60	2696.20	9567.60
Qtr. Revenue (millions USD)	1073.75	0.18	8.77	109.62	551.79	1891.00
Employees (thousands)	11.93	0.03	0.15	1.37	6.91	22.85
Firm Age (years)	44.61	9	16	30	59	109
Cash to Assets (Liquidity)	0.17	0.01	0.03	0.09	0.21	0.46
Debt to Assets (Leverage)	0.30	0.03	0.12	0.27	0.43	0.61
Debt to Collateral	0.51	0.11	0.26	0.52	0.75	0.89
Asset Pledgeability (%)	47.21	9.32	23.48	46.91	70.53	85.81
Total debt (millions USD)	1817.35	1.06	8.33	132.69	960.90	3562.65
CF-share	0.45	0.00	0.00	0.40	0.92	1.00
Average Maturity (years)	6.7	1.4	4.0	6.1	8.6	12.2
Average Interest Rate (%)	4.9	0.3	2.7	4.6	6.8	9.2
Average Spread	2.9	0	0.6	2.3	4.4	6.9

Table 11: Summary Statistics - non-financial corporations between 2010Q1 and 2023Q2

Debt-Level Summary Statistics

	Mean	p10	p25	Median	p75	p90
Contract Value (millions USD)	334.53	0.16	2.24	48.24	396.00	859.22
Maturity (years)	9.275	2.50	4.50	7.00	10.00	20.00
Interest Rate (%)	5.79	2.12	3.60	5.25	7.38	10.00
Credit Spread	4.03	0.87	1.88	3.45	5.49	8.06

Table 12: Summary Statistics - debt contracts between 2010Q1 and 2023Q2

D Additional Empirical Analyses

D.1 Classification of Debt Contracts

Classification into asset-based and CF-based debt is conceptually different from the notion of secured and unsecured debt.[26] Security establishes priority in bankruptcy, dictating who 'queues first' to collect payments if the firm goes under. Conversely, the distinction between asset-based and cash flow-based debt refers to the economic determinants of lenders' in-default payoffs. When debt is backed by specific physical assets, lenders' in-default payoffs reflect the liquidation value of these items. In the case of CF-based debt, no specific physical asset serves as collateral meaning that in-default payoffs are chiefly determined by the future cash-flows of the borrower.

I follow the classification strategy of Lian and Ma (2021). Debt contracts that are not explicitly secured by specific physical assets are classified as cash-flow-based debt. Hence, debentures and other unsecured debt contracts are counted towards this category. Bonds and notes are also considered cash flow-based debt, as they are typically unsecured or secured against future cash flows - through liens on substantially all assets or equity. The exceptions to this are mortgage bonds, which are backed by real estate, and thus fall under the category of asset-based debt. Similarly, capital-

[26] Even though they may be strongly correlated. This leads Gonzalez and Sy (2024) to treat them as empirical equivalents. This approach is acceptable when blanket liens are rarely used as is the case for the Spanish corporate credit market.

ized leases are also classified as asset-based. Finally, I consider debt contracts that are categorized as 'term loans', 'revolving credit', or 'other borrowings' by Capital IQ. Depending on the specifics of the contract, these can be asset-based and cash flow-based debt as well. To remain conservative about the share of cash flow-based debt, I classify these instruments as asset-based, unless they are unsecured.

In line with the previous findings of Lian and Ma (2021) and Öztürk (2022), the total outstanding debt volume that can be classified as CF-based is relatively stable at around 75%. However, starting from 2019, this share drops significantly - from 79% in 2018Q4 to 71% 2019Q4 - and it does not fully recover until the end of the sample. It is not clear what causes this abrupt shift in aggregate CF-share. One explanation could be the Covid-induced economic crisis. However, this leaves the initial drop, which happens before the pandemic had a substantial impact on North American economies unexplained. It is not feasible to compare these results with prior studies, as none have studied this time period.

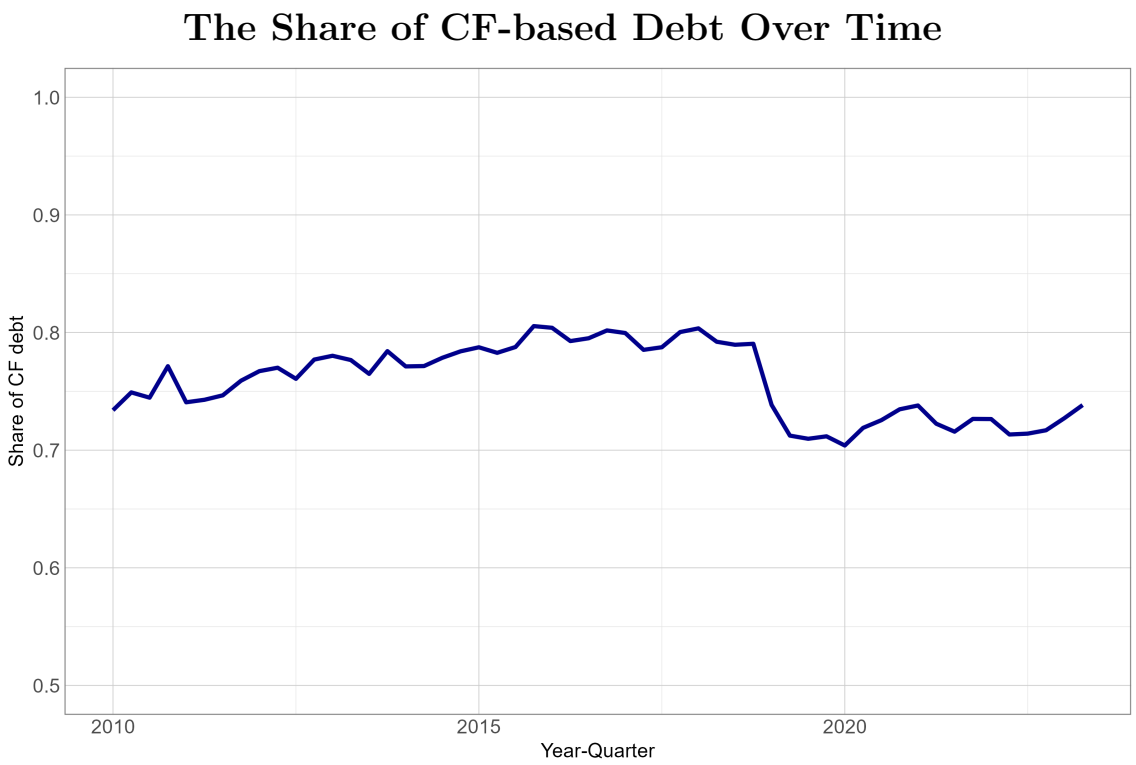


Figure 3: The share CFL debt to total debt, by volume between 2010Q1 and 2023Q3

D.2 Determinants of Credit Spreads

In this section, I study the firm-level determinants of credit spreads for asset-based and cash flow-based debt contracts. The structural model proposed in this paper accounts for endogenous variation in external finance premia, meaning that the empirical results presented here can be studied against predictions of the structural model. Firms with higher EBITDA and larger total asset value benefit from lower credit spreads on both loan-types. Prior analyses that interpret credit market frictions as either asset-based or earings-based limits to borrowing. In contrast, this result suggests that size and profitability are important determinants of these frictions no matter the form of borrowing. Another important determinant of credit spreads is leverage, which has a large, positive effect on credit spreads for both loan-types. Firm age has a significant, negative effect on credit spreads, suggesting that

strong creditor-debtor relationships can help reduce the cost of external finance.

The coefficient estimates for number of employees are not consistent across specifications. This variable has limited economic impact, which indicates that total assets are a sufficient measure of firm size. Consistent with the idea that lender perception plays a key role in cash flow-based borrowing, worse credit ratings significantly increase credit spreads for this type of debt. In contrast, credit spreads for asset-based debt are influenced only when credit ratings signal the state default or a high risk of it. Sector fixed effects have a mostly insignificant impact on credit spreads for asset-based debt, which is partly due to accounting for pledgeability in the model. For cash flow-based debt, sector differences are more significant, yet they remain relatively unimportant determinants of credit spread variations.

'CF-share' measures the extent to which a firm relies on cash flow-based debt as a fraction of total debt. It is defined as

$$\text{CF-share} = \text{CF-based Debt Value} \;/\; \text{Total Debt Value}.$$

CF-share is correlated negatively with spreads of cash flow-based debt and positively with spreads of asset-based debt, suggesting that firms self-select into these loan-types based on their relative costs. This underlines that debt financing is jointly determined with the credit spreads that firms eventually face.

D.2.1 Limiations of Empirical Analyses

Empirical analyses of credit spreads and firm characteristics face significant limitations. Firms adjust their debt financing strategies based on credit conditions, which are influenced by firm characteristics. In turn, this affects the external finance premia they eventually face. This feedback effect is likely to introduce endogeneity bias. Moreover, certain determinants of credit frictions are difficult to observe. In this paper, I highlight the probability of liquidation, but other factors such as asset specificity (Kermani and Ma, 2020) or the quality of accounting practices and court enforceability (Lian and Ma, 2021) are similarly hard to measure. Therefore, the

identification of causal relationships between firm characteristics and credit spreads is not possible without relying on natural experiments. The structural model discussed below aims to make up for these limitations.

Table 13: The Determinants of Credit Spreads

	All contracts		CF contracts		AB contracts	
LHS: Spread	Value	SE	Value	SE	Value	SE
Log of EBITDA	-0.163***	(0.011)	-0.119***	(0.012)	-0.205***	(0.020)
Log of Assets	-0.394***	(0.049)	-0.452***	(0.060)	-0.321***	(0.086)
Pledgeability	-0.479***	(0.087)	-0.046	(0.107)	-1.013***	(0.153)
Num. Contracts	0.003**	(0.002)	0.012***	(0.002)	0.003	(0.004)
Leverage	1.759***	(0.105)	2.189***	(0.136)	0.963***	(0.176)
Log of Age	-0.135***	(0.026)	-0.133***	(0.030)	-0.147***	(0.045)
Log of Employees	-0.011	(0.020)	-0.094***	(0.025)	0.084***	(0.031)
CF-share	0.446***	(0.064)	-0.339***	(0.112)	0.737***	(0.111)
Industries - baseline: Agriculture and Fishing						
Construction	0.742***	(0.269)	1.246***	(0.461)	0.271	(0.375)
Manufacturing	0.280	(0.242)	0.641	(0.446)	0.124	(0.310)
Mining	0.856***	(0.251)	1.020**	(0.455)	0.728**	(0.333)
Retail Trade	0.676***	(0.255)	1.234***	(0.455)	0.057	(0.338)
Services	0.283	(0.247)	0.776*	(0.448)	-0.176	(0.321)
Public Utilities	0.586**	(0.247)	0.878*	(0.449)	0.290	(0.330)
Wholesale Trade	0.672**	(0.262)	0.757	(0.462)	0.565	(0.345)
Credit Ratings - baseline: Rating: A						
Rating: A+	0.144	(0.095)	0.351***	(0.087)	-0.418	(0.570)
Rating: A-	0.169**	(0.077)	0.185***	(0.065)	-0.059	(0.363)
Rating: B+	0.715***	(0.071)	0.698***	(0.065)	0.149	(0.326)
Rating: B	0.207***	(0.068)	0.107*	(0.058)	-0.044	(0.331)
Rating: B-	0.976***	(0.072)	1.159***	(0.069)	0.195	(0.325)
Rating: C	1.690***	(0.082)	1.613***	(0.091)	1.090***	(0.327)
Rating: D	2.020***	(0.140)	2.429***	(0.185)	1.072***	(0.362)
Firm-level controls	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
Observations	17,601		10,620		6,981	
R-squared	0.285		0.404		0.174	

Table 14: Determinants of credit spreads of new issuances. Robust standard errors are reported in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

D.3 Robustness tests

In this section, I test the robustness of the empirical results in alternative model specifications. First, I keep the same specification but replace the variable of interest with the number of *secured* debt contracts. Table 19 summarizes these results. Ayotte and Morrison (2009) and Blazy and Choppard (2010) argue that security backed by physical assets often incentivizes creditors to obstruct the reorganization process. This suggests that the number of secured creditors should have an even greater impact on CF-based debt contracts. Consistent with this notion, I find that the effect of secured debt contracts on credit spreads is four times larger for CF-based debt, compared to the baseline case. The negative coefficient on AB-debt contract spreads is somewhat puzzling, which can be attributed to lower liquidation risk. Zhong (2021) argues that a greater threat of liquidation reduces default probability, as firms are less likely to strategically demand reorganization.

Table 15: The Determinants of Credit Spreads

	All contracts		CF contracts		AB contracts	
LHS: Spread	Value	SE	Value	SE	Value	SE
Log of EBITDA	-0.160***	(0.0106)	-0.108***	(0.0121)	-0.205***	(0.0203)
Log of Assets	-0.372***	(0.0478)	-0.404***	(0.0584)	-0.273***	(0.0859)
Leverage	1.826***	(0.109)	2.179***	(0.137)	1.146***	(0.181)
Pledgeability	-0.427***	(0.0904)	-0.0790	(0.109)	-0.847***	(0.157)
Secured contracts	0.007	(0.006)	0.051***	(0.011)	-0.021**	(0.009)
Firm-level controls	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
Observations	17,514		10,640		6,874	
R-squared	0.287		0.406		0.174	

Table 16: The main determinants of credit spreads of new issuances, when the number of secured debt contracts is taken into account. Robust standard errors are reported in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Calculating credit spreads is subject to uncertainty, as it is not clear interest rate the lender used as a refernce. Therefore the analyses presented in table 3 are repeated with interest rate as the dependent variable. In this specification, debt contract maturity is included alongside other firm-level controls. Table 17 summarizes these results. The central findings remain unchanged, though the effect of the number of debt contracts on CF-based debt contracts is somewhat smaller. The negative coefficients for asset-based contracts likely reflect a stronger commitment to fulfilling the debt obligations.

Table 17: The Determinants of Interest Rates

	All contracts		CF contracts		AB contracts	
LHS: Interest Rate	Value	SE	Value	SE	Value	SE
Log of EBITDA	-0.127***	(0.0106)	-0.0870***	(0.0126)	-0.178***	(0.0186)
Leverage	1.969***	(0.105)	2.218***	(0.141)	1.545***	(0.164)
Log of Assets	-0.348***	(0.0528)	-0.386***	(0.0703)	-0.206**	(0.0833)
Pledgeability	-0.302***	(0.0885)	0.00467	(0.116)	-0.640***	(0.141)
Num. contracts	0.001	(0.001)	0.009***	(0.001)	-0.006*	(0.004)
Firm-level controls	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
Observations	22,652		12,613		10,039	
R-squared	0.235		0.335		0.143	

Table 18: Determinants of interest rates of new issuances. Robust standard errors are reported in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Limiting the analysis to new issuances reduces the sample size. By using a weighted average of firm-level credit spreads as the outcome variable, it is possible to explore the variables that influence external finance premia beyond the time of issuance. Here, I consider three sub-samples: firms that borrow inly against assets, only against and cash flows as well as the entire sample. Despite relying on an entirely differnt approach to the analysis of credit spreads, the main results remain largely unchanged.

Table 19: The Determinants of Credit Spreads

	All contracts		CF contracts		AB contracts	
LHS: Spread	Value	SE	Value	SE	Value	SE
Log of EBITDA	-0.058***	(0.005)	-0.009	(0.015)	-0.192***	(0.012)
Log of Assets	-0.0286	(0.0235)	-0.490***	(0.0793)	-0.0338	(0.0478)
Leverage	2.049***	(0.0484)	1.942***	(0.177)	1.909***	(0.112)
Pledgeability	-0.237***	(0.0424)	0.758***	(0.154)	-0.940***	(0.0832)
Num. Contracts	0.006***	(0.001)	0.026***	(0.005)	-0.038***	(0.006)
Firm-level controls	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
Observations	78,714		8,938		26,604	
R-squared	0.144		0.167		0.157	

Table 20: The main determinants of credit spreads of new issuances, considering the number of secured debt contracts. Robust standard errors are reported in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

E Additional Model Results

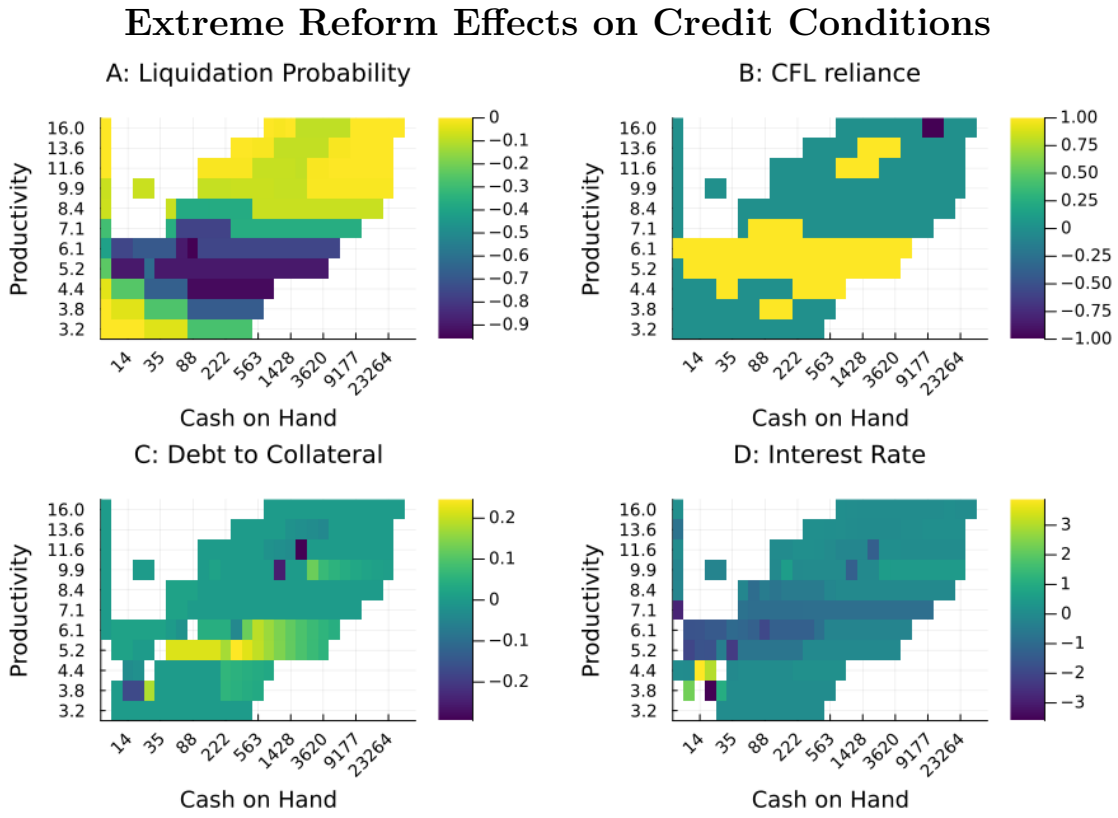


Figure 4: The change in equilibrium outcomes following the *extreme* reform. The y-axis represents the productivity state, while the x-axis represents the cash on hand value, the color intensity corresponds to the magnitude of the change. The non-colored tiles correspond to states in which the mass of firms is less than 0.01% of the total in the stationary equilibrium. Panel A shows the change in liquidation probability, Panel B shows the change in reliance on CF-based debt, Panel C shows the change in debt to collateral ratio and Panel D shows the change in interest rates.

E.1 Liquidation Risk and Credit Conditions

In this section, I present model predictions on how liquidation risks affect the cost of external finance and firms' optimal debt financing strategy. In the general equilibrium model liquidation probability does not change exogenously, therefore this

exercise is based on a reduced version of the model. Based on equation 14, I determine the interest rate that would support the equilibrium policies of (k', b'), under different liquidation probabilities. Moreover, I define the corresponding optimal reline on CF-based debt (τ), based on equation 10. Figure 5 presents these results for a high-productivity firm, for three different values of cash on hand. The lines are color-coded to represent the debt financing strategy of the firm, either borrowing against assets (red) or against cash flows (blue).

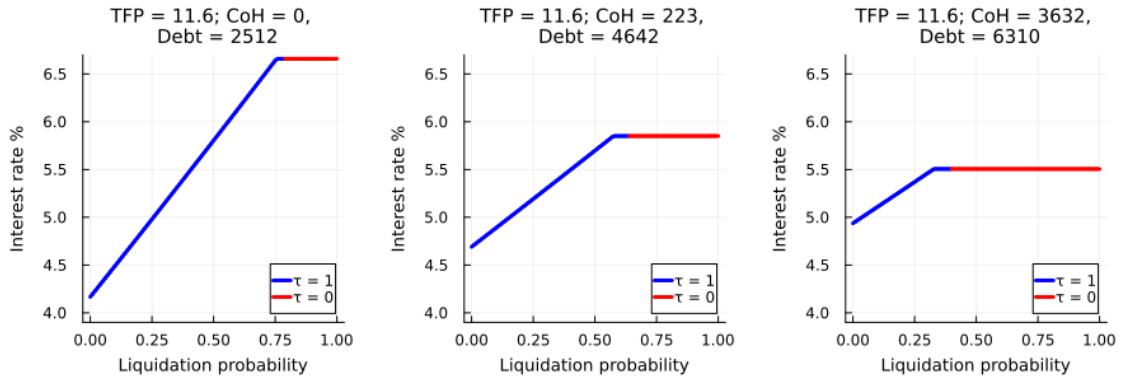


Figure 5: External finance premium based and debt financing strategy necessary to support firms equilibrium policies. Panel A, corresponds to firms starting cash on hand, panel B. depicts expected cash on hand after one period, and panel C. is the steady-state cash on hand at the given productivity level.

Firms enter with zero cash on hand, therefore panel A corresponds to credit conditions upon entry. The effects of liquidation probability are largest for these firms, as they do not have private wealth to support their capital investments. Under zero liquidation probability, these firms may access CF-based financing at a 4.1% rate. This rate increases monotonously until 75% of liquidation probability, at which point firms transition to asset-based borrowing at a rate of 6.6%. This represents an upper bound for interest rates, as asset-based debt contracts are not affected by liquidation probability.

Panel B. corresponds to firms' expected cash on hand after one period, given optimal

policy decisions. Having accumulated some wealth, these firms can access more future capital, which is associated with higher continuation value. Hence, these firms face lower interest rates across all liquidation probabilities. Hence, accumulating cash on hand limits firms' exposure to liquidation risk, and higher capital stock allows these firms to fall back to asset-based debt sooner. Panel C. corresponds to the steady-state cash on hand for the given productivity. This panel shows the same decline in external finance premia across liquidation probabilities, but the overall effects are even more pronounced.

Figure 5 provides further insights into firms' debt financing frictions. First, even though age is not explicitly considered in the model, firms' lifecycle affects their credit conditions. Small but productive firms, who benefit the most from reducing liquidation risks, are almost always young firms, within the first three years of entry. Hence, the model predicts that reducing reorganization costs aids young firms the most. Second, although the model can accommodate any CF-reliance between zero and one, under the current assumption firms always choose a corner solution, either borrowing only against assets or entirely against cash-flows. Third, the value-maximizing debt financing strategy maximizes the inverse interest rate faced by the firm. Both of these results follow from firm value being in zero and default.