Maturity Walls*

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Abstract

Maturity walls occur when most of a firm's debt comes due within a short window of one to two years, raising rollover risk. Yet 48% of non-financial bond issuers have one. I introduce a continuous measure of repayment concentration and show that, beyond leverage and average maturity, walls are associated with higher default risk and credit spreads. I develop and estimate a dynamic model in which firms jointly choose the level and concentration of their debt, trading the fixed cost of bond-market access against rollover risk. In the model, firms with low rollover risk are the ones that concentrate their debt, and the rollover exposure a wall creates is priced. Walls raise credit spreads by 36 bps (21%) and default rates by 30 bps (25%), and in the model cheaper issuance can make firms riskier rather than safer. Firms with walls are also far less resilient to a credit-market freeze, an exposure that models ignoring maturity concentration understate by up to 60%.

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1 Introduction

Large, infrequent debt payments increase a firm's rollover risk — the risk of being unable to raise enough external funds to cover its maturing liabilities, especially in the face of a negative shock. When a large share of a firm's debt comes due within a short window, typically one to two years, the firm faces a *maturity wall*. Firms that fail to roll over such a payment often cut investment, lay off workers, or default (Almeida, Campello, Laranjeira, and Weisbenner, 2009; DeFusco, Nathanson, and Reher, 2023). Credit-rating agencies take maturity walls seriously. For instance, on April 2, 2020, Fitch Ratings downgraded Antero Resources, an oil and natural gas company, to "B", noting:

> Antero Resources has a sizable large *maturity wall* due between 2021 and 2023 ($2.63 billion, starting with its 5.375% 2021 note, of which $953 million remains outstanding). The unsecured bond markets have remained closed to the company . . . which underscores the need to address the [*maturity*] *wall* (emphasis added).

Managing rollover risk is a key concern for corporate CFOs (Lins, Servaes, and Tufano, 2010), so firms would seem to have every reason to disperse their maturities, rolling over smaller amounts more often. Yet Antero Resources is not an outlier. Maturity walls are a common feature of non-financial firms' capital structures. Using the universe of U.S. corporate bond issuances, I show that 48% of non-financial issuers have one. Why, then, do so many firms choose to face a maturity wall?

This paper offers an answer grounded in optimal capital structure. Each time a firm taps the bond market, it pays a cost that is largely fixed and does not depend on how much it raises. The underwriter performs its screening and demand-discovery services about once per issuance, whatever the size of the issue. By concentrating its repayments into a wall, a firm can return to the market less often and so save on this fixed cost. In return, it takes on more rollover risk, because a large payment that falls due in a bad state must be met either by issuing equity at a steep cost or by defaulting. A firm with low rollover risk accepts a concentrated structure, because for it the cost of an occasional difficult rollover is small next to paying the issuance cost over and over. Frameworks that summarize debt by total leverage or average maturity miss this trade-off (Leland and Toft, 1996; He and Milbradt, 2016; Arellano and Ramanarayanan, 2012), because the risk of a wall lies in the timing and concentration of repayments, not in their average.

To bring this dimension to the data, I measure repayment concentration by the standard deviation of a firm's weighted maturity dates, σ_{Mat}. I classify a firm as having a maturity wall when it concentrates at least two-thirds of its bond principal within a two-year window, the horizon over which rating agencies assess refinancing risk. I construct the measure from Mergent FISD and Compustat for the universe of U.S. corporate bond issuers, and it is strongly associated with credit risk. Beyond leverage and average maturity, more concentrated repayments are associated with higher default risk and with higher spreads on newly issued bonds. The standard deviation of maturity dates is preferable to share-based measures such as the Herfindahl index because it captures concentration in two ways rather than through shares alone. It responds both to a large share of debt coming due in a single period and to payments bunched into closely spaced periods.[1]

To quantify this trade-off, I build a dynamic structural model of credit risk, in the tradition of Hennessy and Whited (2007); Gomes and Schmid (2021); DeMarzo and He (2021), in which firms jointly choose how much to borrow and how concentrated their repayments are. A firm finances itself with two long-term instruments that differ only in their repayment schedule. The first is a *dispersed* bond that repays a constant fraction of its principal each period, much like a sinking fund. The second is a *concentrated* bond that repays its entire principal at a single, randomly timed maturity date. By mixing the two, a firm can place any share of its debt in a wall, and the state space stays small: I track the two outstanding balances rather than every maturity date. Issuing debt costs a fixed fee, which I estimate to match underwriter fees, and raising equity is convex, which is what makes a poorly timed rollover costly. Debt is priced by a competitive lender who breaks even and recovers only part of firm value in default.

The model's central tension is between this fixed issuance cost and the cost of a difficult rollover. All else being equal, a firm would bunch its repayments and issue as rarely as possible. What holds this in check is the chance that a large payment comes due just as a negative shock makes equity expensive. Which force wins depends on the firm's leverage, because the decision to adopt a wall is made jointly with the leverage choice. When a firm has low leverage, its rollover risk is minimal, so the cost of repeated issuance outweighs the benefit of dispersing and the firm concentrates its debt. As the firm levers up, the risk of rolling over a large concentrated payment grows while the issuance cost stays fixed, so the firm shifts toward dispersed payments. A maturity wall is therefore a choice, and firms make it precisely when their rollover risk is low. Because the wall emerges from this trade-off, the model reproduces untargeted cross-sectional patterns: less-levered and higher-revenue firms hold walls more often, as they do in the data.

I estimate the model by the simulated method of moments, matching both aggregate and distributional moments of firms' debt-repayment schedules, which I construct from Mergent FISD and Compustat. Two parameters do most of the work: the fixed cost

[1] For example, suppose two firms each have \$100 million in debt due in Year 1. Firm A has an additional \$100 million due in Year 2, while Firm B has \$100 million due in Year 20. A measure like the Herfindahl index would treat these firms as having the same concentration of debt because it focuses only on the distribution of debt across periods, not the spacing of those periods. In contrast, the standard deviation of maturity dates accounts for the timing difference: Firm A's debt is concentrated in the near term, while Firm B's is more dispersed over time. This distinction is crucial for understanding rollover risk and default potential.

of issuing debt and the convexity of the equity-issuance cost. They are identified by the average dispersion of maturity dates, the average per-unit underwriter fee, and the average debt-to-income ratio. The issuance cost governs how often firms return to the market, and so how concentrated their debt is, while the equity-cost parameter governs how heavily they lean on debt.

The estimated model matches its targets, and it also captures several untargeted features of the data. It reproduces the cross-sectional relationship between maturity walls and credit risk: holding the level of debt fixed, firms that concentrate their repayments face higher spreads and default more often, as they do in the data. It also matches the persistence of repayment dispersion, and the economies of scale in underwriter fees, which fall with issue size because the issuance cost is largely fixed. Because the model captures these untargeted moments, I use it for the counterfactuals that follow.

I use the estimated model to answer three questions. First, how much do maturity walls raise credit risk? In equilibrium, walls account for 14% of defaults. But because firms choose their walls, this figure mixes the effect of the wall itself with the characteristics of the firms that adopt one. To separate the two, I hold each firm's borrowing at its baseline level and force its debt into a concentrated schedule, which generates exogenous variation in repayment structure within the model. Concentrating an otherwise identical firm's debt into a wall raises its default rate by 30 bps (25%) and its credit spread by 36 bps (21%), holding leverage fixed.

Second, would firms be safer if dispersing debt were cheaper? Since walls raise credit risk, lowering the cost of issuance, which lets firms spread their payments out, might seem to make them safer. I test this by stripping out the underwriter market power that Manconi, Neretina, and Renneboog (2018) estimate at 16–25% of fees. In the model, the answer is no. Cheaper issuance need not make firms safer. Firms do disperse their payments, but dispersed debt is safer at a given level of borrowing, so firms respond by borrowing more. This leverage effect can dominate, so that a fall in issuance costs raises default risk on net.

Third, how does a wall shape a firm's exposure when refinancing markets freeze? I subject the estimated economy to an unexpected, one-time credit-market freeze, during which firms can neither issue new debt nor prepay, and equity becomes more expensive. A firm that must roll over a wall just when markets are shut can neither refinance the payment nor cover it cheaply with equity. Such a firm is about 4 percentage points more likely to default than an otherwise identical firm with little coming due. Adding this exposure up across firms, the economy-wide default rate rises by 1.68 percentage points at the onset of the freeze. Conventional debt-structure models miss this firm-level exposure. A model of long-term, fully dispersed debt (Leland and Toft, 1996; Chatterjee and Eyigungor, 2012) understates the default response by 60%, and a model of average maturity (He and Milbradt, 2016; Arellano and Ramanarayanan, 2012) understates it by

14%. Measuring a firm's tail exposure to rollover risk requires modeling the concentration of its repayments directly.

Literature Review

To my knowledge, this is the first paper in which firms jointly and dynamically choose both the level of their debt and the concentration of its repayment dates, with the resulting rollover exposure priced in equilibrium. The literature usually runs together two margins that I keep separate. A firm can choose its average maturity without choosing how *concentrated* its repayments are, and only the second choice produces a maturity wall. A long tradition treats longer maturity as a shield against rollover risk. I show that long-term debt, when it is bunched into a wall, can be a source of rollover risk.

Empirically, the most closely related paper is Choi, Hackbarth, and Zechner (2018, 2021), who establish maturity dispersion as a distinct dimension of capital structure and show that firms disperse more as their rollover needs rise. I differ in three ways. First, I measure concentration by the standard deviation of weighted maturity dates, a moment that, unlike share-based indices, captures how tightly payments are spaced. Second, I study its consequences for default and spreads rather than its determinants. Finally, I focus on the concentrated end, the wall, whose prevalence Jungherr, Meier, Reinelt, and Schott (2024) also document. A parallel literature studies how maturity structure shapes rollover risk (He and Xiong, 2012a,b; Diamond and He, 2014; He and Milbradt, 2016; Chen, Xu, and Yang, 2021; Hu, Varas, and Ying, 2022) and generally finds that longer or less concentrated maturity reduces it. I instead single out the concentration of long-term repayments as a source of it. Lenders price this exposure, which is consistent with Friewald, Nagler, and Wagner (2022); Liu, Qiu, and Wang (2021), who link rollover risk to equity returns and to the credit-spread jumps of the 2020 freeze.

On the modeling side, the closest paper is Huang, Oehmke, and Zhong (2019), who derive an optimal multiperiod repayment schedule. They do so from a private-information incentive friction rather than a fixed issuance cost, and analytically rather than by estimation. The broader literature on dynamic capital structure is largely theoretical. It represents debt by its level and at most an average maturity, so the concentration of repayments is not a choice (Leland and Toft, 1996; Leland, 1998; DeMarzo and He, 2021; Dangl and Zechner, 2021; Brunnermeier and Oehmke, 2013). Quantitative models fix the schedule in one of two tractable ways. Debt is either fully dispersed (Jungherr and Schott, 2021; Arellano and Ramanarayanan, 2012; Hatchondo and Martinez, 2009) or a single concentrated bond (Geelen, 2016). Firms in the data sit in between. I endogenize the level and concentration jointly, in a two-instrument formulation that spans the range with a small state space. The closest paper with an endogenous dispersion choice is Chaderina (2023). There, concentration is a near-term, distress-driven response under a cash-carrying motive. Here, the wall is a concentration of long-term debt at a distant horizon, micro-founded by a fixed issuance cost and disciplined by estimation.

The fixed-cost mechanism builds on work in which a fixed, size-independent issuance cost generates lumpy, infrequent issuance (Benzoni, Garlappi, Goldstein, and Ying, 2022; Geelen, Hajda, Morellec, and Winegar, 2024). I apply it to the concentration of repayment dates rather than to the timing or asset-matching of issuance. Methodologically, I adapt the discrete-choice smoothing of Dvorkin, Sánchez, Sapriza, and Yurdagul (2021) to obtain differentiable bond-price schedules in this setting.

Road map

The paper is organized as follows. Section 2 describes the data, how I measure maturity walls, and the empirical findings. Section 3 develops the structural credit-risk model, including the firm's recursive problem, the lender's pricing of bonds, and the timing of decisions, with an endogenous choice of how concentrated the repayment schedule is. It emphasizes the role of rollover risk and fixed issuance costs in a firm's decision to adopt a dispersed or a concentrated schedule. Section 4 examines the properties of the model, and Section 5 explains how the model is mapped to the data. Section 6 presents the quantitative analysis, and Section 7 concludes.

2 Empirical Facts

In this section, I introduce a firm-level measure of how concentrated a firm's debt repayments are in time, and I establish three facts. First, maturity walls are common: 48% of bond issuers have one. Smaller and younger firms hold them disproportionately, and, holding size and age fixed, so do less-levered firms. Second, more concentrated repayments are associated with higher default risk and higher borrowing costs, beyond leverage and average maturity. Third, firms face economies of scale in bond issuance, the fixed cost that makes concentrating repayments worthwhile.

2.1 Data Sources

I use data from Mergent Fixed Income Securities Database (FISD) to document the concentration of bond repayment schedules. Mergent FISD contains the universe of corporate bond issuances across all credit ratings and provides detailed information on issue date, amount, coupon, bond maturity, and underwriter fees. This enables me to construct a complete bond maturity profile at the firm-year level. Issue amounts, coupons, and maturities are aggregated annually, weighted by the bond issuance amount. Following Boyarchenko, Kovner, and Shachar (2022), I exclude bonds issued in foreign currency, as well as Yankee, Canadian, convertible, and asset-backed bonds[2].

To analyze firm characteristics associated with dispersed or concentrated debt schedules, I merge the Mergent FISD data with balance sheet information from Compustat. In line with the literature, I exclude financial firms (SIC 6000–6999) and utilities (SIC 4900–4999). The sample consists of non-financial firm-year observations from 1995 to 2019 for firms issuing corporate bonds[3][4]. All variables are winsorized at the top and bottom 0.5% to mitigate the influence of outliers. My final sample includes 1,392 firms and 17,389 firm-year observations. Summary statistics are found in Table 10.

2.2 Measuring Maturity Walls

The term "maturity wall" is used often but defined loosely. It usually means that a large share of a firm's debt falls due within a short window. To study why firms adopt walls, I need a firm-level measure of how concentrated a firm's repayments are in time, and two natural candidates fall short. The number of bonds outstanding ignores how debt is spread across dates. Firms vary widely on this margin (Figure 1; mean 5.4 bonds, median 3), yet two firms with the same number of bonds can face very different rollover profiles. The Herfindahl index of the shares due each year, $\sum_m s_{m,t}^2$, captures how unequal those shares are but not how far apart the payment dates lie. What governs rollover risk, though, is spacing. A firm repaying half of its debt in each of years one and two is far more exposed than one repaying half in year one and half in year twenty, even though the two are identical by bond count and by Herfindahl index.

Timing matters because most corporate debt is long-term and repaid infrequently. In 2007 the median share of debt maturing in more than three years was 56.5% among public U.S. firms (Custódio, Ferreira, and Laureano, 2013), and newly issued bonds had an average maturity near eleven years. A firm's rollover exposure therefore depends less on its average maturity than on when its comparatively few repayment dates cluster.

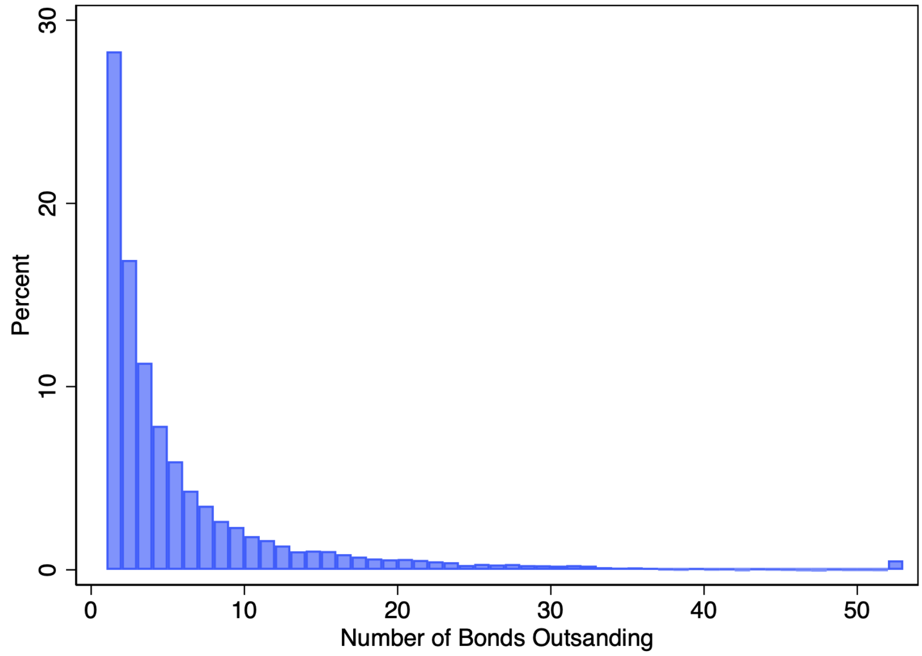
I measure repayment concentration by the issuance-weighted standard deviation of a

[2] 1,236 observations are dropped by excluding Yankee bonds; 721 observations are dropped by excluding Canadian bonds; 3,485 observations are dropped by excluding convertible bonds; 850 observations are dropped by excluding foreign currency bonds; 392 observations are dropped by excluding asset-backed bonds.

[3] While Mergent FISD contains earlier issuances, it only becomes comprehensive after 1995.

[4] The analysis focuses on bond debt, for which maturity walls are the relevant object. Bank debt is a poor candidate on two grounds. First, term loans and other bank facilities typically amortize, so their principal repayments are dispersed automatically. In the model below, such amortizing debt corresponds to the dispersed security b_D. Second, bank debt is held by a few informed lenders, so a firm approaching a large repayment can renegotiate (Crouzet, 2018; Diamond, 1991), which blunts the rollover risk a wall creates. Dispersed, arm's-length bondholders cannot easily coordinate to restructure, so a concentrated bond maturity is a genuine refinancing exposure that is hard to soften. Consistent with this, bond debt remains the dominant financing source even for firms with concentrated repayment schedules, about 81% of their bank-and-bond debt, versus 93% for firms with dispersed schedules, so bank borrowing does not neutralize the rollover exposure that a concentrated bond maturity creates (Table 11).

Figure 1: Number of Bonds outstanding



Notes. Distribution of the number of bonds outstanding per firm-year (Mergent FISD, non-financial bond issuers, 1995–2019); mean 5.4 bonds, median 3. Two firms with the same number of bonds can face very different repayment timing, which the count alone does not capture.

firm's maturity dates:

$$\sigma_{Mat,t} = \sqrt{\sum_{m=1}^{M} s_{m,t}(m - \mu_{Mat,t})^2} \tag{1}$$

where $s_{m,t} = b_{m,t}/\sum_{j=1}^{M} b_{j,t}$ is the share of outstanding debt due in m years, $\mu_{Mat,t} = \sum_{m=1}^{M} s_{m,t}m$ is the average maturity of outstanding debts, and M is the longest bond maturity a firm can have[5]. The measure $\sigma_{Mat,t}$ is time-varying, adjusting as firms issue new bonds or repay existing ones.

A lower σ_{Mat} indicates that repayments cluster around the average maturity. In the extreme, $\sigma_{Mat,t} = 0$ means all of a firm's debt comes due in a single year. The measure reflects both the size of payments and their spacing. In the two-firm example above, Firm A has $\sigma_{Mat,t} = 0.5$ and Firm B $\sigma_{Mat,t} = 9.5$, whereas the Herfindahl index scores both at 0.5. So σ_{Mat} separates the firm that must refinance everything within two years from the one whose payments span two decades.

The spacing it captures is not redundant.[6] Table 1 regresses the issuer's credit rating,

[5]I set M to 35 years, as bonds with maturities longer than 35 years account for only 0.5% of the sample.

[6]The empirical design picks out the spacing content. The main outcome regressions condition on

a forward-looking assessment of credit risk, on σ_{Mat} and the Herfindahl index. σ_{Mat} enters strongly with the expected sign, so that more dispersion goes with a safer rating, and it survives controlling for the Herfindahl index in the full sample. In the appendix I run the same horse race for default risk among firms with more than one bond, for which the spacing of maturities, rather than the concentration of shares, is a genuine choice, and σ_{Mat} again enters with the expected sign. I run it again for secondary-market credit spreads, where the evidence is only suggestive, and once more against the maturity-dispersion measure of Choi, Hackbarth, and Zechner (2018), which σ_{Mat} complements rather than duplicates (Appendix Tables 13 and 14, and Appendix B.1).

Table 1: Repayment Dispersion versus the Herfindahl Index: Credit Ratings

	Credit rating (higher = safer)				
	All firms			Multi-bond	
	(1)	(2)	(3)	≥ 2	≥ 3
Repayment dispersion (σ_{Mat})	0.573***		0.467***	0.427***	0.375***
	(0.067)		(0.074)	(0.077)	(0.082)
Herfindahl index		-0.412***	-0.182**	-0.337***	-0.502***
		(0.073)	(0.082)	(0.091)	(0.110)
Observations	9851	9881	9817	7096	5423
R^2	0.740	0.736	0.740	0.727	0.722

Notes. The dependent variable is the issuer's numerical S&P credit rating (higher = safer). Regressors are the standardized lag of repayment dispersion σ_{Mat} and/or the standardized lag of the Herfindahl index of maturity shares, with firm controls (size, market leverage, profitability, tangibility, cash, average maturity, and bond share of total debt) and industry and year fixed effects; standard errors clustered by firm. Columns (4)–(5) restrict to firms with at least two and three bonds outstanding. *,**,*** denote $p < 0.10$, 0.05, 0.01.

These patterns mirror how credit-rating agencies assess risk. Agency methodologies evaluate refinancing and liquidity risk over a twelve- to twenty-four-month horizon[7] and explicitly favor issuers whose maturities are "spread evenly over time."[8] This no-refinancing liquidity criterion is the rollover exposure that σ_{Mat} is built to capture.

leverage and average maturity, so σ_{Mat} varies the timing of repayments while holding the amount and average maturity of debt fixed. σ_{Mat} summarizes the firm's maturity profile, following Choi, Hackbarth, and Zechner (2018). The contribution here is to interpret and price its dispersion as refinancing-concentration risk.

[7]S&P's *Methodology and Assumptions: Liquidity Descriptors for Global Corporate Issuers* (2014) scores a sources-to-uses ratio over a twelve-month window (extended to twenty-four months for the strongest categories) with upcoming debt maturities as the central "use," computed assuming no access to debt capital markets. Moody's Speculative Grade Liquidity ratings use a twelve-month horizon.

[8]Moody's *Rating Methodology: Corporates* (2022).

2.3 Fact 1: Maturity walls are common

Figure 2 plots the distribution of σ_{Mat}: the mean is 3.0 years, the median 1.5, with a pronounced mass at zero. The strictest case is $\sigma_{Mat} = 0$: all of a firm's principal comes due within a single year, in one concentrated payment. But this is stricter than what the term usually means. The payment schedule Fitch called a maturity wall at Antero Resources, with bonds bunched over 2021–2023, has $\sigma_{Mat} \approx 1$ and would not qualify. I therefore define a *maturity wall* as a firm that concentrates at least two-thirds of its bond principal within a two-year window, the twelve- to twenty-four-month horizon over which rating agencies assess refinancing risk. The definition does not depend on where the cluster falls: it may sit near or far on the horizon, as Antero's does. Throughout, the wall label is just a binary cutoff on the continuous σ_{Mat}, which is what the analysis relies on, and no inference rests on the cutoffs. The share of firms labeled a wall varies smoothly with the threshold and window, while the wall–non-wall gap in spreads and default risk is nearly flat across them (Appendix Table 17). By this definition, 48% of bond issuers have a maturity wall.

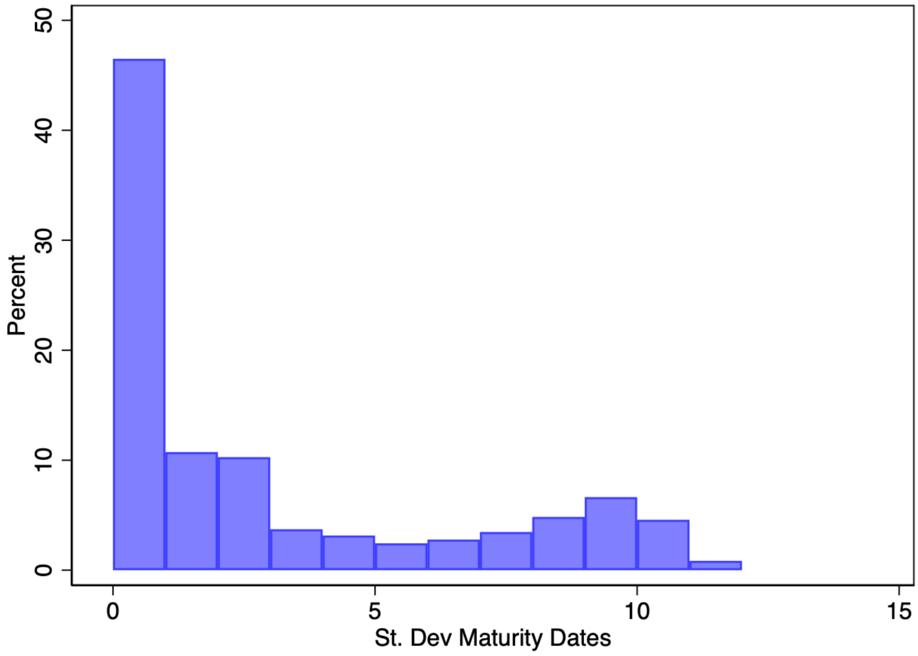
A wall is most common among firms with few bonds. Every single-bond issuer has one, since a lone bond places all of its principal at one maturity, and the share falls to 43%, 20%, and 3% at two, three-to-five, and six-or-more bonds (Table 2). About three-quarters of walls are single-bond firms. Walls are not confined to them, though. The remaining quarter are firms that returned to the bond market and could have spaced their maturities, and they bunched their principal anyway.

Table 2: Maturity Walls by Number of Bonds Outstanding

	1 bond	2 bonds	3–5 bonds	6+ bonds	All
Firm-years	6,018	3,012	4,142	4,217	17,389
Share with a wall	1.00	0.43	0.20	0.03	0.48
Share of all walls	0.73	0.16	0.10	0.01	1.00
Mean σ_{Mat} (yrs)	0.00	2.26	4.25	6.70	—
One-year default probability (%), Merton					
Wall	6.7	8.2	8.4	5.7	
Non-wall	—	3.1	2.5	1.5	
New-issue credit spread (bps)					
Wall	265	308	278	265	
Non-wall	—	214	205	156	

Notes. Firm-years of U.S. non-financial bond issuers (Mergent FISD merged to Compustat, 1995–2019), grouped by the number of bonds outstanding. A firm has a *maturity wall* if at least two-thirds of its bond principal matures within a two-year window. "Share of all walls" is the share of the wall population in each bond-count group. Single-bond issuers are all walls—a lone bond matures on a single date—so within every multi-bond group, wall firms have higher default risk and pay higher credit spreads than non-wall firms, and the wall premium is not a by-product of bond count.

Figure 2: Distribution of Repayment Dispersion σ_{Mat}



Notes. Distribution of repayment dispersion σ_{Mat} (the issuance-weighted standard deviation of a firm's maturity dates, in years) across firm-years; mean 3.0 years, median 1.5, with a pronounced mass at zero. The mass at zero is dominated by single-bond firms, for which $\sigma_{Mat} = 0$ mechanically (Table 2).

To see which firms concentrate their repayments, I regress σ_{Mat} on standardized, one-year-lagged firm characteristics:

$$\sigma_{Mat,i,t} = X'_{i,t-1}\beta + \alpha_{FE} + \varepsilon_{i,t}, \tag{2}$$

where X collects market leverage, size, age, Tobin's Q, profitability, cash, interest coverage, average maturity, the number of bonds outstanding, and the bond share of total debt. I vary the fixed effects α_{FE} across columns (industry and year, firm and year, and firm and industry$\times$year) to absorb unobserved heterogeneity, and cluster standard errors by firm.

Table 3 reports the estimates. Across all specifications, leverage, size, age, and average maturity are strongly associated with repayment dispersion, both economically and statistically.

Larger and older firms hold more dispersed schedules. A one-standard-deviation increase in size (age) goes with a σ_{Mat} about 1.2 (0.4) years higher. More-levered firms also disperse more: a one-standard-deviation increase in leverage goes with a σ_{Mat} 0.30 years higher.

Smaller and younger firms are just the ones a financing-constraint story would flag: perhaps they hold walls not by choice but because they cannot access the bond market

Table 3: σ_{Mat} and Firm Characteristics

	St. Dev of Maturity Dates		
	(1)	(2)	(3)
Leverage	0.369***	0.304***	0.300***
	(0.069)	(0.065)	(0.069)
Size	1.391***	1.219***	1.210***
	(0.111)	(0.219)	(0.219)
Age	0.196***	0.444**	0.395**
	(0.066)	(0.180)	(0.185)
Q	0.139*	-0.096	-0.198*
	(0.077)	(0.089)	(0.101)
Profit	0.124**	0.040	0.096*
	(0.054)	(0.045)	(0.052)
Cash	0.095*	0.021	0.022
	(0.057)	(0.055)	(0.058)
Fraction of Bond Debt	0.309***	0.118**	0.157***
	(0.051)	(0.046)	(0.051)
No. Bonds Outstanding	0.717***	0.701***	0.773***
	(0.121)	(0.117)	(0.127)
Interest Coverage Ratio	0.018	-0.272*	-0.219
	(0.148)	(0.156)	(0.151)
Avg. Bond Maturity	1.996***	1.161***	1.084***
	(0.077)	(0.093)	(0.103)
Observations	6477	6693	6249
R^2	0.714	0.862	0.880
Fixed Effects	Ind & Year	Firm & Year	Firm & Ind × Year

Notes. Estimates of $\sigma_{Mat,i,t} = X'_{i,t-1}\beta + \alpha_{FE} + \varepsilon_{i,t}$. The dependent variable is repayment dispersion σ_{Mat} (in years); all regressors are standardized, one-year-lagged firm characteristics. Columns differ in fixed effects, as listed in the bottom row; standard errors clustered by firm in parentheses. *,**,*** denote $p < 0.10$, 0.05, 0.01.

often enough to spread their maturities. This reading is intuitive. In the appendix I provide evidence that suggests otherwise, and I summarize it here (Appendix B.2).

First, firms do not behave as if a wall binds them (Table 4). Those with a large payment approaching do not hoard cash or cut investment, and they do not retire debt early to forestall it. These are the defensive responses a binding constraint would force. Second, walls do not disappear among firms that plainly can disperse. Roughly one in five investment-grade or old firms still chooses a wall, and within such groups the probability of a wall falls with leverage rather than rising with a distress proxy, so it is the low-rollover-risk firms that concentrate. Together, these patterns are more consistent with the maturity wall being a choice than with a binding borrowing limit.

Table 4: Repayment Schedule Concentration and Firm Actions

	(1) Cash	(2) Investment	(3) Buyback Debt
% Debt Due in 1 Year	-0.002	0.007	-0.241***
	(0.007)	(0.008)	(0.052)
% Debt Due in 2 Years	-0.003	0.002	-0.228***
	(0.008)	(0.008)	(0.051)
% Debt Due in 3 Years	-0.002	0.003	-0.217***
	(0.007)	(0.008)	(0.049)
% Debt Due in 4 Years	-0.006	0.002	-0.253***
	(0.007)	(0.008)	(0.048)
% Debt Due in 5 Years	-0.007	0.002	-0.222***
	(0.006)	(0.007)	(0.048)
Observations	6657	6676	6793

Notes. Each column regresses a firm action, cash holdings, investment, and an indicator for buying back debt early, on the share of debt coming due in each of the next several years, with firm controls (leverage, size, Tobin's Q, profitability, and bond share of debt) and firm and year fixed effects; standard errors clustered by firm. Horizons 1–5 are shown; the full specification through ten years is in Appendix Table 21. Cash and investment do not respond to an approaching payment, and the (negative) buyback loadings show that firms do not retire debt early to forestall it, none of the defensive behavior a binding constraint would force. *,**,*** denote $p < 0.10$, 0.05, 0.01.

2.4 Fact 2: Firms with concentrated debt payments appear more risky

Does this concentration matter for outcomes? I relate firm outcomes to debt-structure characteristics,

$$Y_{i,t} = X'_{i,t-1}\beta + \alpha_{FE} + \varepsilon_{i,t}, \tag{3}$$

where Y is, in turn, the probability of default and the yield, coupon rate, and credit spread on newly issued bonds. The regressors of interest are leverage, average maturity, and repayment dispersion, the part of σ_{Mat} that is uncorrelated with average maturity,[9] alongside firm and bond controls. I include industry and year fixed effects[10], standardize all regressors, and cluster by firm.

Table 5 reports the results. In column (1), leverage is strongly associated with default: a one-standard-deviation increase corresponds to a 5.8 pps higher one-year probability of default. More dispersed repayments are associated with lower default risk: a one-

[9]Because average maturity and σ_{Mat} are correlated, I use the part of σ_{Mat} that is uncorrelated with average maturity. This tells me whether the spacing of payments matters for outcomes beyond their average horizon.

[10]I use industry rather than firm fixed effects here because many firms are infrequent issuers, leaving too few within-firm observations for the new-issuance outcomes.

standard-deviation increase in σ_{Mat} corresponds to a 0.45 pps lower probability, holding leverage and average maturity fixed. Intuitively, concentrated repayments leave the firm having to refinance a large amount at once, possibly under adverse market conditions or poor performance, and that is a natural reason for the association.

Table 5: σ_{Mat} and Firm Outcomes

	(1) Prob Default (pps)	(2) Yield (pps)	(3) Coupon Rate (bps)	(4) Credit Spread(bps)
Leverage	5.784***	0.579***	65.881***	50.792***
	(0.422)	(0.099)	(7.661)	(8.061)
Avg. Bond Maturity	-0.286	0.053	0.438	4.558
	(0.254)	(0.053)	(4.895)	(4.911)
St. Dev of Maturity Dates$_{t-1}$	-0.454*	-0.151***	-13.248***	-14.311***
	(0.249)	(0.052)	(5.096)	(4.788)
Size	-0.316	-0.144**	-24.253***	-6.665
	(0.344)	(0.065)	(6.216)	(6.295)
Age	-0.325*	0.027	1.438	3.194
	(0.170)	(0.041)	(3.990)	(3.212)
Cash	0.821***	0.108***	5.515	12.031***
	(0.219)	(0.041)	(4.240)	(3.933)
Profit	-0.541*	-0.151***	-12.646***	-13.488***
	(0.303)	(0.046)	(4.167)	(4.040)
Tangibility	-0.033	0.011	-1.935	1.113
	(0.320)	(0.065)	(5.814)	(5.568)
Credit Rating	0.622*	-0.782***	-86.964***	-64.195***
	(0.357)	(0.080)	(7.028)	(6.824)
Fraction of Bond Debt	0.485**	0.006	-5.211	-2.797
	(0.229)	(0.060)	(4.218)	(5.576)
Amount New Issuance		0.225***	8.985	30.468***
		(0.054)	(5.587)	(5.311)
Maturity at Issuance		0.304***	31.050***	-0.870
		(0.024)	(2.669)	(2.101)
Observations	6367	1374	1910	1216
R^2	0.241	0.769	0.764	0.692
Fixed Effects	Industry & Year	Industry & Year	Industry & Year	Industry & Year

Notes. Each column regresses a firm outcome on debt-structure characteristics and controls. The outcomes are the one-year probability of default from the Merton distance-to-default (pps, column 1) and the yield (pps), coupon rate (bps), and credit spread (bps) on newly issued bonds (columns 2–4). "St. Dev of Maturity Dates" is the part of σ_{Mat} that is uncorrelated with average maturity. All regressors are standardized one-year lags; industry and year fixed effects; standard errors clustered by firm in parentheses. *,** ,*** denote $p < 0.10$, 0.05, 0.01.

Columns (2)–(4) report the terms on newly issued bonds, adding issuance controls (issue size and maturity at issuance). I focus on the credit spread in column (4). The pricing pattern mirrors the default results: a one-standard-deviation increase in leverage is associated with 51 bps higher spreads, while more dispersed repayments are associated with about 14 bps lower spreads. This is consistent with lenders pricing concentrated repayment schedules as riskier, beyond leverage and average maturity. Neither relationship is an artifact of wall firms simply holding fewer bonds. The outcome regressions control for the number of bonds outstanding. The same ordering also holds within every bond-count bin. Among multi-bond issuers alone, firms with a wall have a one-year Merton default probability of 8.1% against 2.1% and pay new-issue spreads of 291 against 174 basis points (Table 2). In the appendix I show that σ_{Mat} is associated with credit risk among these multi-bond firms as well, where the spacing of maturities is a real choice rather than a mechanical consequence of holding a single bond (Appendix B).

The default outcome in Table 5 is a market-implied (Merton) probability, a deterministic function of leverage and equity volatility. Repayment concentration is also associated with *realized* default and firm failure, meaning a bond default in Mergent FISD or a forced delisting in CRSP. In the appendix I show that this association is absent within the current year, as one would expect of a measure of *future* rollover exposure, and that it grows at longer horizons (Appendix Table 18). A maturity wall is associated with a 2.8 to 3.9 percentage-point higher probability of a default or failure over the next three to five years, and a one-standard-deviation increase in σ_{Mat} with a 0.7 to 1.5 point lower probability, off base rates of 5 to 8%. The same association therefore appears in two independent data sources, not just in the model-implied measure.

2.5 Fact 3: Firms face economies of scale in bond issuance

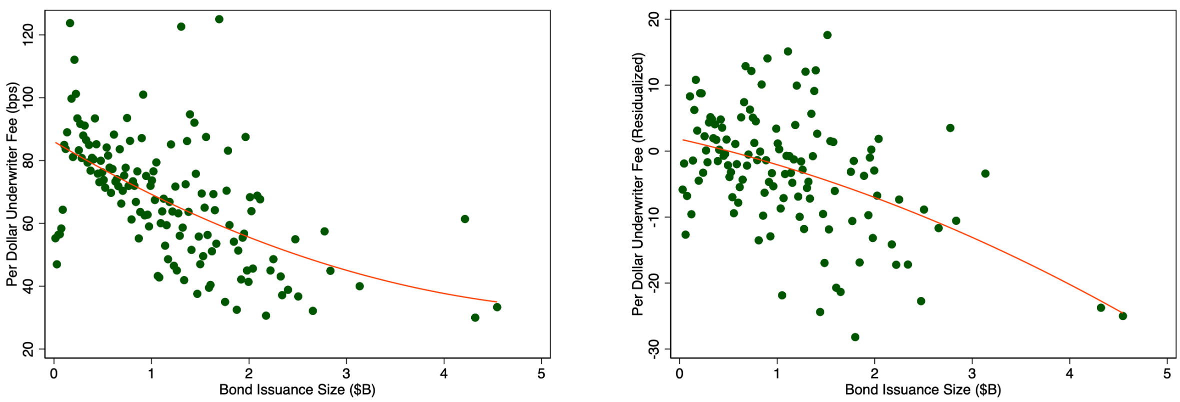
Many firms have very concentrated debt payments, and this concentration is strongly correlated with worse outcomes. It is therefore puzzling that so many firms choose concentrated payments in the first place. I now introduce a mechanism that can explain the choice: there are large fixed costs of bond issuance. I provide evidence for economies of scale in underwriter fees in the data.

When a firm issues bonds it hires an underwriter. The underwriter's fee pays for two services that are largely fixed per issuance: the firm incurs them for each issue it brings to market, roughly independent of how much it raises. The first is *screening and certification*. The underwriter produces information about the issuer and certifies its quality to investors, which lowers the issuer's cost of capital (Chemmanur and Fulghieri, 1994; Fang, 2005). In the bond market this certification operates through repeated underwriter–issuer relationships (Mota and Siani, 2023). The second is *demand discovery and placement*. The underwriter runs a price-discovery process, soliciting indications of interest and allocating the issue to locate the marginal investor (Benveniste and Spindt, 1989). Siani (2022) documents this mechanism for corporate bonds, a multi-round process in which the underwriter announces candidate spreads and observes demand, and investors reveal demand truthfully because issuance is a repeated game. Both services attach to the bond rather than to the dollar amount raised: each bond has its own terms and investor base, so demand must be discovered and the issue placed separately for every bond, even when several are sold at once. Their cost therefore has a large size-independent component, a fixed cost per bond, so a firm saves by raising a given amount in fewer, larger bonds rather than many small ones.[11]

Part of the underwriter fee, however, is not a real cost but rent. Manconi, Neretina, and Renneboog (2018) show that more powerful underwriters charge higher fees and reject certification as the explanation for the power–fee relationship. The fee therefore decomposes into a real-service component (the screening and placement services above) and a rent component.[12]

Figure 3: Economies of Scale in Bond Issuance: Underwriter Fees

(a) Raw Data (b) Residualized Underwriter Spreads



Notes. The underwriter spread (gross underwriting fee as a fraction of issue proceeds, in bps) against the size of the bond issue. Panel (a) plots the raw relationship; panel (b) residualizes both variables on firm size, age, sales, and credit rating, the number of bonds the firm has issued, and the issue's maturity and coupon. The relationship is strongly negative in both panels (large issues pay a lower fee per dollar raised), consistent with a fixed cost of accessing the bond market.

Firms can cut this fixed cost by issuing larger bonds. Figure 3a plots the underwriter spread (the fee as a fraction of issue size) against issue size, and the relationship is strongly negative: firms issuing less than $1B pay an average spread of about 85 bps, while those issuing over $3B pay 40 bps or less. The pattern survives controlling for firm and bond characteristics that proxy for issuer information, underwriter relationships, and issue terms (Figure 3b): bonds over $3B still pay roughly 25 bps less per dollar than bonds

[11]A natural concern is that shelf registration, which a large share of issuers use, lets a firm spread the fixed cost over many takedowns on a "pay-as-you-go" basis, weakening the link between fixed costs and concentrated issuance. Shelf registration saves on the one-time SEC *registration* step, but the costs that dominate the underwriter fee and motivate the mechanism here (the underwriting spread, legal and due-diligence work, and the demand-discovery and placement process described above) recur with each takedown rather than being pro-rated across them. The underwriter spread in Figure 3a is the realized fee per issue, net of whichever registration route the firm uses, and it still falls steeply with issue size, indicating that a substantial per-issuance fixed component survives shelf registration.

[12]This distinction matters for interpreting later counterfactuals, not for the existence of the cost. Concentrating debt saves on the real, size-independent cost of accessing the market, and a separate exercise (Section 6) strips the rent away to measure it. The rent is itself likely bond-specific: underwriter power reflects how hard a bond is to place, so bonds of different characteristics carry different rents, just as they carry different real placement costs.

under \$1B. This is what a large fixed cost of bond-market access implies: the per-dollar cost of issuing falls with issue size.

Altınkılıç and Hansen (2000) report the same pattern. Underwriter fees average about 1% of issue value, and while their headline result is that the marginal cost of issuance rises with size, the per-dollar underwriter spread falls with size. That decline is the economies of scale in the fixed component of the fee. The firm-level counterpart appears in the cross-section of repayment schedules. Larger and older firms hold more dispersed schedules (Table 3), as they should if the cost is fixed: larger firms spread it over bigger issues, and older, more transparent firms face lower frictions in returning to market. More-levered firms disperse more as well. As leverage rises, the rollover risk of a concentrated schedule grows, so firms pay the repeated issuance cost to hedge it.

Firms also issue bonds infrequently and in large amounts, a pattern Leary and Roberts (2005) attribute to the fixed costs of issuing securities: the underwriter fee discussed above, together with the legal, accounting, and administrative expenses of bringing an issue to market. Appendix Table 12 reports the details: firms issue in only 15% of years, on average 3.3 years apart, and when they do the issue is large (a median of \$350M, mean just under \$500M, roughly 40% of outstanding debt) and largely a rollover, at about 110% of maturing legacy debt. Infrequent, lumpy issuance is the financing pattern that a large fixed cost produces.

3 Model

The facts in Section 2 are associations. They cannot tell me how much of a wall firm's credit risk comes from the wall itself and how much from the kind of firm that chooses one, and they cannot say what would happen if bond-market access got cheaper or if it were lost altogether. To answer those questions I need a model in which the firm chooses its repayment schedule, trading off a fixed cost of bond issuance against rollover risk. The model is a discrete-time structural credit-risk model of a single firm and the competitive lenders who price its debt. Each period the firm draws an idiosyncratic income shock, borrows using a dispersed or a concentrated bond, pays a dividend, and decides whether to default. The lenders anticipate that the firm may renege on its promised payments, and they price its bonds to break even given its forecast default. I hold the risk-free rate fixed. This is a partial-equilibrium device that isolates the firm-level mechanism, and it is consistent with later embedding the firm in a richer environment with aggregate fluctuations. I use the estimated model to quantify the credit-risk consequences of the maturity-wall choice, and the fact that it also reproduces the empirical patterns documented above serves as external validation.

3.1 Firms

The firm is endowed with an asset that generates stochastic revenue. Each period it chooses its holdings of two bonds, a dispersed bond b_D and a concentrated bond b_C, to maximize the expected present discounted value of its dividends $\psi(d)$, discounted at the factor β. Here d is the per-period payout to equity holders, and $\psi(\cdot)$ governs that payout.

Profits

The firm has a unit of installed capital that generates stochastic income $y \in Y \equiv \{y_1, y_2, \ldots, y_{n_y}\}$, following a first-order Markov process with transition matrix $G_y(y'|y)$. To produce each period, the firm pays a fixed production cost c_f, so its pre-tax profit is income net of that cost, $\pi = y - c_f$. It pays corporate taxes on profits and, as the tax code allows, deducts the coupon payments on its bonds, leaving taxable income $\Upsilon = \pi - \tilde{c}b$, where $b = b_D + b_C$ is total bonds outstanding and $\tilde{c}$ the coupon rate. Taxes are $T^c = \mathbb{1}_{\{\Upsilon \geq 0\}} \tau \Upsilon$, where $\mathbb{1}$ is an indicator and τ the corporate tax rate; the deductibility of coupons is the tax benefit of debt in this framework.

Bond financing

The firm's operating cash flows can turn negative for low realizations of income. To finance its operations it borrows from the bond market[13] or raises equity from shareholders ($d < 0$); there is no storage technology, so it cannot carry cash across periods.[14] Issuing a bond requires the payment of a fixed issuance cost c_I.

The firm can issue two types of bonds: a dispersed bond b_D and a concentrated bond b_C. The dispersed bond promises an infinite stream of principal payments declining at a constant rate λ: a bond of size b_D promises $\lambda(1-\lambda)^{s-1} b_D$ of principal s periods later, so that, absent default, the firm pays $b_D(\lambda + \tilde{c})$ each period. This geometric schedule is not meant as a literal security. It is a reduced-form, tractable way to represent a firm whose principal repayments are dispersed across many future dates rather than concentrated at one, and it is the standard device for modeling long-term debt in the corporate-finance

[13] I model bond debt only, for two reasons. First, the arms-length, competitively priced creditor of the model is a poor description of bank debt, whose lenders are concentrated and engage in monitoring and renegotiation from which the model abstracts. Second, the omission is quantitatively minor for the firms I study: conditional on being a bond issuer, bonds are the majority of debt—on average about 88% of a firm's bank-and-bond debt, with a median of 100% (Table 10).

[14] Abstracting from cash holdings—and, similarly, from a physical investment margin—is a deliberate simplification: in practice firms can self-insure against rollover risk by accumulating liquid balances or drawing on committed credit lines, margins the model does not provide. Two considerations bound how much this matters. First, the firms in my sample hold little cash (about 7% of assets, Table 10) and, as Table 21 shows, do not build it up as a large payment approaches, so cash buffering is not a first-order substitute for the repayment-structure choice I study. Second, these self-insurance margins would blunt a firm's exposure to a maturing payment, so omitting them makes the model's rollover-risk exposure, if anything, an upper bound; adding them would attenuate, not overturn, the wall's fragility. An extension with endogenous cash and investment is natural but beyond the present scope.

and sovereign-default literatures.[15] Its advantage is that it does not enlarge the state space[16]: the entire schedule is summarized by the outstanding stock b_D and the decay parameter λ. Modeling long-term debt this way nonetheless imposes a smooth repayment schedule, at odds with the maturity walls and lumpy payments firms exhibit in the data, which is what the second bond type is meant to capture.

The concentrated bond b_C instead makes a single principal payment at a random maturity date.[17] Maturity is governed by the i.i.d. shock η, which equals one with probability λ and zero otherwise: when $\eta = 1$ the bond is retired, the firm fully repays b_C and optimally reissues, so that, absent default, it pays $b_C(\tilde{c} + \eta)$ each period.

Modeling the maturity date as random rather than deterministic serves two purposes. First, what matters for the firm is that a bad fundamental shock can coincide with a large payment coming due, and that coincidence is itself a random event. A model with deterministic maturities and random fundamentals would look much the same. Consistent with this, Table 21 shows that impending large payments do not lead firms to hoard cash, cut investment, or buy back bonds early to any economically meaningful degree. Second, a deterministic maturity date would add a state variable and raise the computational cost. This modeling choice is also well rooted in the corporate-finance literature[18].

Figure 4 illustrates the two schedules for one realization of the repayment shock. By construction the bonds are identical except in the timing of payments: conditional on not defaulting both repay the same total, and both have an average maturity of $1/\lambda$, so repayment concentration is the single dimension along which the two instruments differ.[19]

Preference shocks

To make the portfolio choice tractable, I assume the bond instruments take values on a discrete support, $b_k \in \mathcal{B}_k \equiv \{b_{1,k}, \ldots, b_{n_{b_k},k}\}$ for $k \in \{D, C\}$,[20] and I attach an

[15] See, among others, Hatchondo and Martinez (2009); Arellano and Ramanarayanan (2012); Leland and Toft (1996); He and Xiong (2012a); Dangl and Zechner (2021); Jungherr and Schott (2021)

[16] For instance, allowing any maturity up to a maximum M would require tracking M separate state variables, one per maturity.

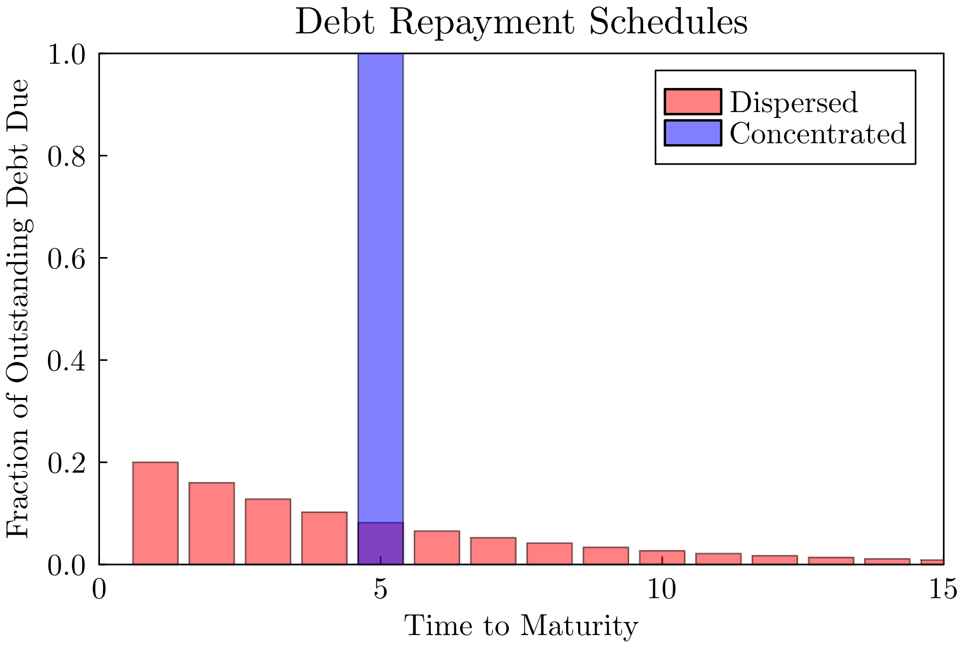
[17] This is akin to a perpetuity with a put position, where the holder decides when the principal comes due.

[18] See, among others, Geelen (2019); Gomes and Schmid (2021); Chen, Xu, and Yang (2021)

[19] The concentrated bond b_C is a *stock* of principal that comes due together, not a single physical security: whether a firm implements a wall as one large bond or several tranches maturing in the same window, the model treats it as the same b_C. The model is thus about the concentration of principal, not the integer number of bonds, which in the data also reflects issue-size limits and the timing of past issuance. A firm financed entirely through b_C is the model's counterpart to a single-bond issuer; and because the maturity shock η is i.i.d., a firm that issues b_C repeatedly draws independent maturity dates and so tends to *disperse*—in the model, concentration comes from issuing seldom, which is why the clearest empirical wall is a firm that has tapped the market once.

[20] A finite grid is a standard numerical requirement in this class of models, and the preference shocks make the discreteness largely innocuous even when the grid is coarse: because similar portfolios receive similar choice probabilities, policy and prices vary smoothly across adjacent nodes and the probability-weighted choice can lie between them, recovering near-continuous behavior without a continuous choice

Figure 4: Model-Implied Bond Repayment Schedules



Notes. Model-implied principal-repayment paths for the two bond types, for one realization of the repayment shock η. The dispersed bond b_D makes small, frequent (deterministic) principal payments; the concentrated bond b_C repays its entire principal at a single date (here period 5). The two bonds are identical in expected total repayment and in average maturity $(1/\lambda)$ and differ only in the timing of payments.

additive manager preference shock $\varepsilon^{(b'_D, b'_C)}$ to each of the $n_{b_D} \times n_{b_C}$ bond portfolios the firm can choose. I assume each shock is an independent draw from a Type-1 Extreme Value (Gumbel) distribution with location normalized to zero and scale parameter $\sigma_\varepsilon > 0$:

$$F(\varepsilon^{(b'_D, b'_C)}) = \exp(-\exp(-\varepsilon^{(b'_D, b'_C)}/\sigma_\varepsilon)), \qquad (b'_D, b'_C) \in \mathcal{B}_D \times \mathcal{B}_C. \tag{4}$$

The scale parameter σ_ε governs the dispersion of the shocks, and as $\sigma_\varepsilon \to 0$ the shocks vanish and the portfolio choice collapses to the deterministic optimum. This is the standard assumption in the dynamic discrete choice literature (Rust, 1987; Train, 2009), where it smooths otherwise discontinuous policy functions and delivers closed-form choice probabilities. Quantitative models of long-term and sovereign debt adopt it for the same reason, to obtain a tractable, differentiable bond-price schedule (Chatterjee and Eyigungor, 2012; Dvorkin, Sánchez, Sapriza, and Yurdagul, 2021). The device is less familiar in corporate finance, so I emphasize that it is purely instrumental: the shocks stand in for unobserved, manager-level costs and benefits of a given bond portfolio that the model

set. Dvorkin, Sánchez, Sapriza, and Yurdagul (2021) establish this formally in a sovereign model with an endogenous debt-and-maturity grid and document that the shocks' footprint is negligible: doubling their variance, or zeroing their realizations, leaves outcomes essentially unchanged.

does not otherwise specify.[21]

Recursive problem

Throughout, primes denote next-period variables. The firm enters the period holding dispersed bonds b_D, concentrated bonds b_C, and income y, with the maturity shock η realized; its state is (b_D, b_C, y, η). It chooses between two discrete actions, to stay in the economy and produce or to default on its bonds and exit, maximizing its value over the two:

$$V(b_D, b_C, y, \eta) = \max_{\delta \in \{0,1\}} \Big\{(1-\delta)V^{stay}(b_D, b_C, y, \eta) + \delta V^{default}(b_D, b_C, y, \eta)\Big\}, \tag{5}$$

where $\{V^{stay}, V^{default}\}$ denote the value of staying and of defaulting. If the firm's obligations exceed what it can raise in the bond market plus the equity it can inject, it defaults and obtains $V^{default}(b_D, b_C, y, \eta) = 0$; I write $\delta(b_D, b_C, y, \eta)$ for the default decision rule, equal to one in default. If the firm does not default, its problem of staying takes the recursive form:

$$V^{stay}(b_D, b_C, y, \eta) = \int_{\varepsilon} W(b_D, b_C, y, \eta, \varepsilon) dF(\varepsilon) \tag{6}$$

$$W(b_D, b_C, y, \eta, \varepsilon) = \max_{b'_D, b'_C} \Big\{\psi(d) + \varepsilon^{(b'_D, b'_C)} + \beta \mathbb{E}_{\{y', \eta'\}} V(b'_D, b'_C, y', \eta')\Big\} \tag{7}$$

subject to

$$\psi(d) = \begin{cases} d & \text{if } d \geq 0 \\ d - \alpha d^2 & \text{if } d < 0 \end{cases}$$

where

$$d = (y - c_f - \tilde{c}(b_D + b_C)) - T^c - (\lambda b_D + \eta b_C) + \\ q_D(b'_D, b'_C, y)I_D + q_C(b'_D, b'_C, y)I_C - c_I(\mathbb{1}_{I_D>0} + \mathbb{1}_{I_C>0})$$

and

$$I_D = b'_D - (1-\lambda)b_D$$
$$I_C = b'_C - (1-\eta)b_C.$$

The dividend has four parts. The firm takes operating income net of coupons and corporate taxes T^c. It pays the principal due this period, namely the certain fraction λb_D

[21] The estimated scale is small (Table 6), so the shocks add only minor noise to firm choices and do not drive any of the results below.

on its dispersed bonds and ηb_C on the concentrated bond when it matures. It raises $q_D I_D + q_C I_C$ from net new issuance I_D and I_C of each bond, and it pays the fixed cost c_I whenever it issues either bond. When $d < 0$ the firm injects equity at the convex cost αd^2. This convex cost is the model's reduced-form version of rollover risk. The firm bears it exactly when its bond-market proceeds fall short of its maturing obligations, so a large payment coming due in a bad state is expensive to meet.

It is worth separating this convex cost from an outright loss of market access, since the two are easy to confuse. In the baseline model the firm always keeps access to the bond market: q_D and q_C are strictly positive in every state, so a maturing payment can always, in principle, be rolled over. The convex cost αd^2 bites only when a poorly-timed payment forces the firm to cover a shortfall internally. Rollover risk in the baseline is therefore not a separate market-access friction. It comes from two modeled objects together: the concentration of maturing principal, which makes shortfalls large and state-contingent, and the convexity of covering them, which makes large shortfalls especially costly.[22]

Because the preference shocks are i.i.d. Type-1 Extreme Value, the firm's portfolio choice and its value of staying both have closed forms. Let $\bar{W}(b'_D, b'_C) = \psi(d) + \beta \mathbb{E}_{\{y',\eta'\}} V(b'_D, b'_C, y', \eta')$ denote the deterministic value of choosing portfolio (b'_D, b'_C), gross of the shock. The probability that the firm selects (b'_D, b'_C) is the multinomial logit

$$P(b'_D, b'_C \mid b_D, b_C, y, \eta) = \frac{\exp(\bar{W}(b'_D, b'_C)/\sigma_\varepsilon)}{\sum_{(\tilde{b}'_D, \tilde{b}'_C)} \exp(\bar{W}(\tilde{b}'_D, \tilde{b}'_C)/\sigma_\varepsilon)}, \tag{8}$$

and the value of staying, the integral in equation (7), evaluates to the expected-max ("log-sum")

$$V^{stay}(b_D, b_C, y, \eta) = \sigma_\varepsilon \gamma_E + \sigma_\varepsilon \log \sum_{(b'_D, b'_C)} \exp(\bar{W}(b'_D, b'_C)/\sigma_\varepsilon), \tag{9}$$

where γ_E is the Euler–Mascheroni constant and both sums run over $\mathcal{B}_D \times \mathcal{B}_C$ (as $\sigma_\varepsilon \to 0$, $V^{stay} \to \max_{b'_D, b'_C} \bar{W}(b'_D, b'_C)$). The shocks smooth only the firm's portfolio choice. The stay-versus-default decision δ in equation (5) remains a hard threshold.

Entrants

When a firm defaults it is liquidated and leaves the economy. To hold the mass of firms fixed, I replace each defaulting firm with a new one. An entrant arrives holding no debt, $b_D = b_C = 0$, and draws its income from the stationary distribution of the income process, $\bar{G}_y$.[23] From then on it solves the same problem as any incumbent. Entry plays

[22] A complete loss of market access is a separate friction. It appears only in the credit-market freeze of Section 6.3, where $q_D = q_C = 0$, and it is absent from the baseline equilibrium.

[23] An entrant holds no concentrated bond, so the realization of η at entry has no effect on its budget. I set $\eta = 1$ as a normalization.

no role in the firm's decision problem. It matters only for the stationary distribution, which is what I compute the estimation moments and the counterfactuals over.

3.2 Lenders

A representative financial intermediary has access to a long-duration risk-free bond priced at one and lends discount bonds to firms at firm-specific prices $q_D(b'_D, b'_C, y)$ and $q_C(b'_D, b'_C, y)$, with full information about firms' states. Each price depends on the amount of dispersed bonds and concentrated bonds the firm plans to issue and on its income level. The lender breaks even in expectation on every loan, forecasting the firm's likelihood of default from its current and future bond choices and income.[24] To do so the lender must take a stand on what the firm will borrow next period, and that choice is stochastic, because it depends on the preference shock the manager draws. Let $(b''_D(\varepsilon), b''_C(\varepsilon))$ denote the portfolio that solves the firm's problem (7) at next period's state (b'_D, b'_C, y', η'), given the draw ε. For any function f of that portfolio I write

$$\mathbb{E}^P_{\{b''_D, b''_C\}}[f] \;\equiv\; \int_\varepsilon f(b''_D(\varepsilon), b''_C(\varepsilon))\, dF(\varepsilon) \;=\; \sum_{(b''_D, b''_C)} P(b''_D, b''_C \mid b'_D, b'_C, y', \eta')\, f(b''_D, b''_C),$$

where the second equality follows from the choice probabilities (8). So $\mathbb{E}^P_{\{b''_D, b''_C\}}$ averages a next-period object over the portfolios the firm might choose, weighting each by how likely the firm is to choose it. Applied to the bond price below, it is the price the lender expects the bond to fetch next period. For a firm with income y issuing dispersed bonds b'_D and concentrated bonds b'_C, the zero-profit condition pins down the price of a unit of the dispersed bond recursively:

$$q_D(b'_D, b'_C, y) = \beta \mathbb{E}_{\{y', \eta'\}} \Big\{ (1 - \delta(b'_D, b'_C, y', \eta'))(\tilde{c} + \lambda + (1-\lambda)\, \mathbb{E}^P_{\{b''_D, b''_C\}}[q_D(b''_D, b''_C, y')]) \tag{10}$$

$$+ \delta(b'_D, b'_C, y', \eta') \min \left[1, \chi \frac{\tilde{V}(y')}{b'_D + b'_C} \right] \Big\}$$

[24]The lender is risk-neutral and discounts at the risk-free rate, so the model's credit spreads compensate for *expected default loss* alone and embed no risk premium. Observed spreads also contain a premium for bearing systematic risk (and a liquidity component), so matching the model to the average spread attributes the entire spread to expected loss. This makes the risk-neutral benchmark conservative for the paper's central claim: a maturity wall's rollover exposure is concentrated in precisely the aggregate, freeze-like states (Section 6.3) where investors demand the most risk compensation, so a risk-adjusted lender would *widen* the $q_D > q_C$ wedge rather than narrow it. The freeze exercise is correspondingly framed as a firm-level stress test, not a statement about risk-adjusted asset prices.

where $\tilde{V}(y) = \psi(y) + \beta \mathbb{E}_{\{y'\}} \max\{\tilde{V}(y'), 0\}$ is un-levered firm value. Similarly, the price of a unit of the concentrated bond is:

$$q_C(b'_D, b'_C, y) = \beta \mathbb{E}_{\{y',\eta'\}} \Big\{ (1 - \delta(b'_D, b'_C, y', \eta'))(\tilde{c} + \eta' + (1 - \eta')\, \mathbb{E}^{P}_{\{b''_D, b''_C\}}[q_C(b''_D, b''_C, y')]) \tag{11}$$

$$+ \delta(b'_D, b'_C, y', \eta') \min\left[1, \chi \frac{\tilde{V}(y')}{b'_D + b'_C}\right] \Big\}$$

Each condition equates the lender's cost today (the left-hand side) to the expected revenue over the bond's life (the right-hand side). The price depends on the firm's one-period-ahead default decision $\delta(b'_D, b'_C, y', \eta')$, which is itself a function of today's bond choices: if issuing the concentrated bond makes future default more likely, the lender pays less for it (a higher interest rate). It also depends on future borrowing b''_D, b''_C, since those choices affect future creditworthiness. Because future borrowing enters through the smooth probabilities $P(\cdot)$ rather than a discontinuous policy, the recursion in (10)–(11) is continuous in the firm's state, which stabilizes the joint fixed point for prices and policies.

3.3 Timing

Within a period, events unfold as follows:

1. The firm's income y and maturity shock η are realized; its state is (b_D, b_C, y, η).
2. The firm makes its default decision. If it defaults, it is liquidated and exits the economy: the lender recovers a fraction χ of the firm's unlevered value, and the firm avoids the fixed production cost.
3. If it does not default, the firm pays the fixed production cost, services its bonds, and chooses its bond holdings for next period.

3.4 Definition of Equilibrium

Because the preference shocks make the firm's portfolio choice stochastic, the firm's policy is the choice probabilities P^* rather than a single deterministic portfolio. A recursive Markov equilibrium is a value function V^*, a default rule δ^*, choice probabilities P^*, bond prices $\{q^*_D, q^*_C\}$, and a stationary distribution μ^* over firm states (b_D, b_C, y, η) such that:

1. Taking bond prices $\{q^*_D, q^*_C\}$ as given, V^* solves the firm's recursive problem (5)–(8), and δ^* and P^* are the implied default rule and portfolio choice probabilities.

2. Bond prices $\{q_D^*, q_C^*\}$ satisfy the lender's zero-profit conditions (10)–(11), with continuation borrowing integrated against the choice probabilities P^*.

3. The stationary distribution μ^* is induced by δ^*, P^*, and the laws of motion for y and η, with defaulting firms replaced by an equal mass of entrants as described above.

4 Model Properties

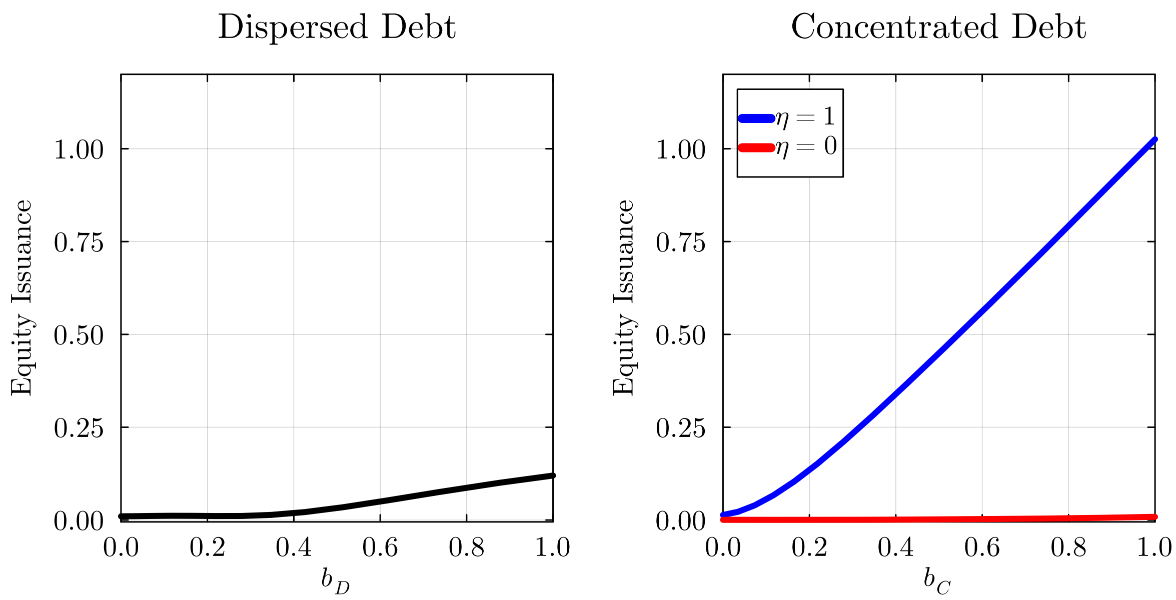
I begin by describing the trade-offs the firm faces when choosing between debt with dispersed and concentrated payments, and then show how the relative cost of issuing debt versus injecting equity shapes capital-structure choices. There are three factors the firm considers when deciding on the composition of its debt: (i) the equity smoothing benefits of dispersed debt, (ii) the issuance cost savings of concentrated debt, and (iii) lower interest rates on dispersed debt, driven by firms defaulting at lower levels of debt when they hold more concentrated debt.

4.1 Equity smoothing benefits of dispersed debt

Dispersed debt acts as a hedge against rollover risk. A firm that cannot raise enough on the bond market to roll over its debt must inject equity from shareholders. Because equity injections are convexly costly, the firm behaves as if risk-averse (owing to the curvature of the payout function $\psi(d)$, governed by α) and prefers to smooth those injections over time.

This smoothing comes from the timing of principal payments. The dispersed bond repays a small, deterministic fraction λb_D each period, so the equity injection it implies is small and independent of the repayment shock η. The concentrated bond instead comes due only when $\eta = 1$. The firm must then roll over the full principal b_C or, failing that, inject a large amount of equity, while when $\eta = 0$ it injects nothing. Figure 5 shows this contrast: required injections grow convexly in debt for both bonds, but are independent of η for b_D and spike with η for b_C. The two bonds carry the same *expected* principal payment each period, λb_D for the dispersed bond and $\mathbb{E}[\eta]\, b_C = \lambda b_C$ for the concentrated one. But the concentrated bond's payment is a mean-preserving spread of the dispersed bond's: it is zero in most periods and the full principal when $\eta = 1$. Because the equity-issuance cost is convex, Jensen's inequality implies that covering the concentrated bond's payments with equity is more costly in expectation than covering the dispersed bond's. Dispersed debt thus acts as insurance against the large, lumpy injections that concentrated debt can require.

Figure 5: Equity Smoothing Benefits of Dispersed Debt



Notes. Equity injection required as a function of the firm's debt level, from the model's policy functions. Left panel: a firm holding only dispersed debt b_D, where injections grow convexly in debt and are independent of the repayment shock η. Right panel: a firm holding only concentrated debt b_C, where injections are larger and depend on η (zero when $\eta = 0$, large when $\eta = 1$, i.e. when the full principal must be rolled over). Dispersed debt thus smooths equity injections across states.

4.2 Issuance cost savings of concentrated debt

Concentrated debt, in turn, saves on issuance costs. As is common in this class of models, the firm has a target leverage ratio that, conditional on income, balances the default cost of debt against its tax benefit. Consider a firm at its target leverage whose income is expected to remain relatively stable: how should it compose its debt?

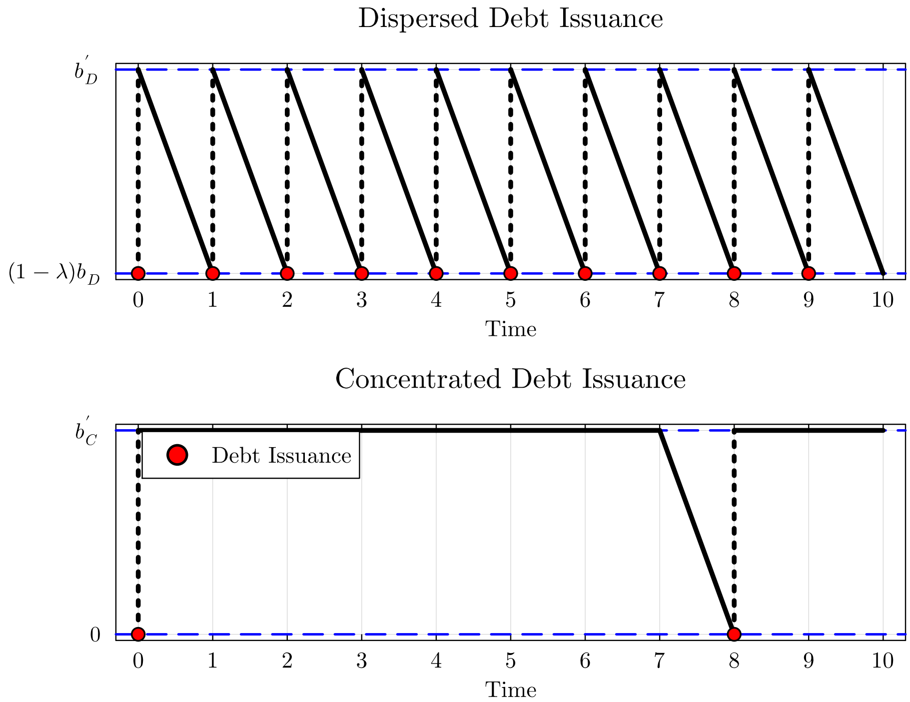
With fixed issuance costs, it prefers concentrated debt. Dispersed debt amortizes every period, so to stay near its target leverage the firm must top up its borrowing more frequently.[25] But because dispersed debt is continually amortizing, the firm crosses its issuance threshold, and pays the fixed cost, more often than under concentrated debt. Concentrated debt makes no principal payment until it matures, letting the firm stay near its target leverage while returning to the market only rarely.

Figure 6 illustrates this for a firm with constant income at its target leverage. Holding b_D, it repays and re-issues λb_D every period, paying the fixed cost each time. Holding b_C, it makes no payment and no issuance until the bond matures (here $t = 8$).

Why can't the firm obtain the same issuance savings by issuing *dispersed* debt infrequently, issuing a large amount of b_D and then staying out of the market for several

[25]Not necessarily every period. The fixed cost makes some inaction optimal, so the firm lets its leverage drift within a band before returning to the market. The point is the frequency of those returns, not that they happen every period.

Figure 6: Issuance Cost Savings of Concentrated Debt



Notes. Illustrative issuance paths for a firm with constant income $\bar{y}$ holding its target leverage. Top panel (b_D): the firm repays λb_D and re-issues the same amount every period to stay at its target leverage, paying the fixed issuance cost each time. Bottom panel (b_C): the firm makes no principal payment and no new issuance until the bond matures (here $t = 8$), avoiding the issuance cost until then. Concentrated debt economizes on the fixed issuance cost.

years? The firm is free to do exactly this. Choosing zero net issuance ($I_D = 0$) is always in its choice set.[26] The firm declines it because dispersed debt amortizes mechanically at rate λ. Letting it run off without re-issuing forces the firm's leverage to drift steadily below its target, forgoing the tax shield and operating away from its optimum for most of the cycle. Concentrated debt is the only instrument that holds leverage at the target while also keeping its issuance infrequent, because its principal does not amortize until the random maturity date.

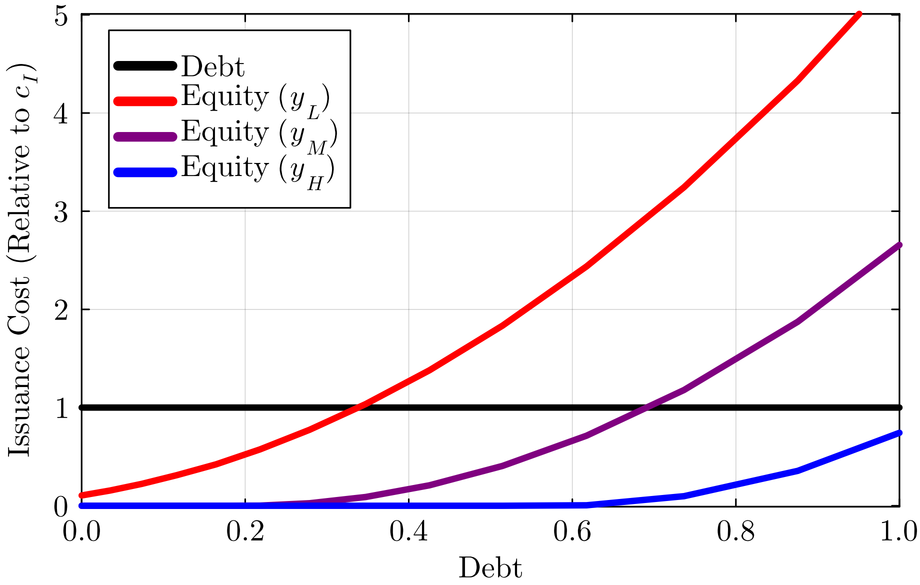
4.3 Relative costs of debt issuance and equity issuance

The two instruments thus offer opposing savings: dispersed debt spares the firm costly equity injections, while concentrated debt spares it the repeated issuance cost of maintaining target leverage. Which a firm prefers turns on the cost of injecting equity relative to the cost of issuing debt. This relative cost determines which firms choose concentrated versus dispersed payments.

Figure 7 plots both costs, normalized by the issuance cost c_I. The cost of issuing debt

[26] The strategy requires no additional state variable, since the outstanding stock b_D is already one.

Figure 7: Relative Cost of Issuing Debt and Equity



Notes. The cost of issuing debt and the cost of injecting equity, both normalized by the fixed issuance cost c_I, as functions of the firm's total debt, for different income levels. The cost of issuing debt (black horizontal line) is flat because issuance is a fixed cost; the cost of equity rises convexly in debt and is higher at low income. Low-leverage (low-rollover-risk) firms lie where equity is cheaper than repeated issuance and choose concentrated debt; highly levered or low-income firms cross to where issuance is cheaper and choose dispersed debt.

(the black line) is flat, since it is a fixed cost. The cost of injecting equity[27] rises convexly in the firm's total debt (both the principal and the coupon grow with borrowing) and is higher at low income.

Low-leverage firms have low rollover risk and choose concentrated payments. When $\eta = 1$ they can comfortably roll the principal over, and even if they fall short the equity injection needed to cover the gap is small. For them, the insurance value of dispersed debt does not justify paying its issuance cost again and again.

As firms lever up, this reverses. Higher leverage means higher rollover risk, and failing to roll over a large concentrated payment forces a costly equity injection. Once that risk is large enough, the cost of equity exceeds the repeated issuance cost, and the firm tilts toward dispersed debt to smooth its injections.

Income works the same way. Low-income firms have less internal resources and face higher borrowing rates, so they are more likely to fall short on a rollover and lean on equity injections. The cost of equity therefore dominates at lower debt levels, and low-income

[27]The cost of issuing equity is $\alpha d(b, y; s_D, b', s'_D)^2 \mathbb{1}_{d<0}$, where s_D is the share of dispersed debt held by the firm, b' is the level of borrowing done by the firm, and s'_D is the new share of dispersed debt borrowed by the firm. I fix s_D, b', s'_D at the level for the average firm in the economy. I have integrated out the repayment shock η.

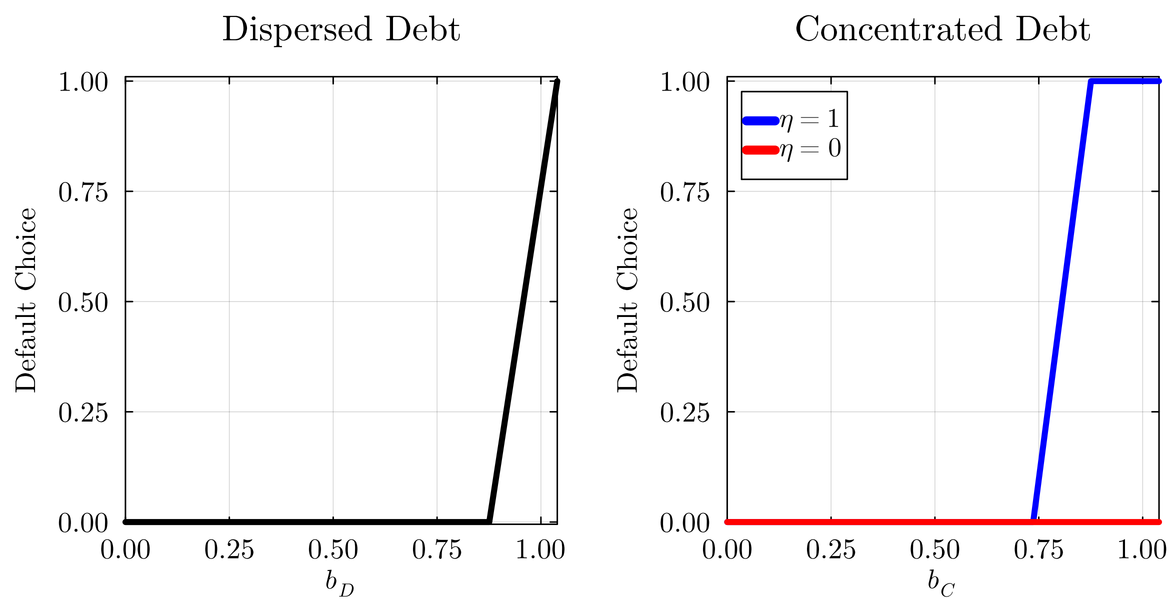
firms prefer dispersed payments even at moderate leverage.

The relative cost of issuing debt versus injecting equity is therefore what drives the large mass of firms holding maturity walls. These firms are not unusually safe. They hold maturity walls because the cost of an occasional failed rollover is small relative to paying the issuance cost again and again.

4.4 Firms default more with higher levels of concentrated debt

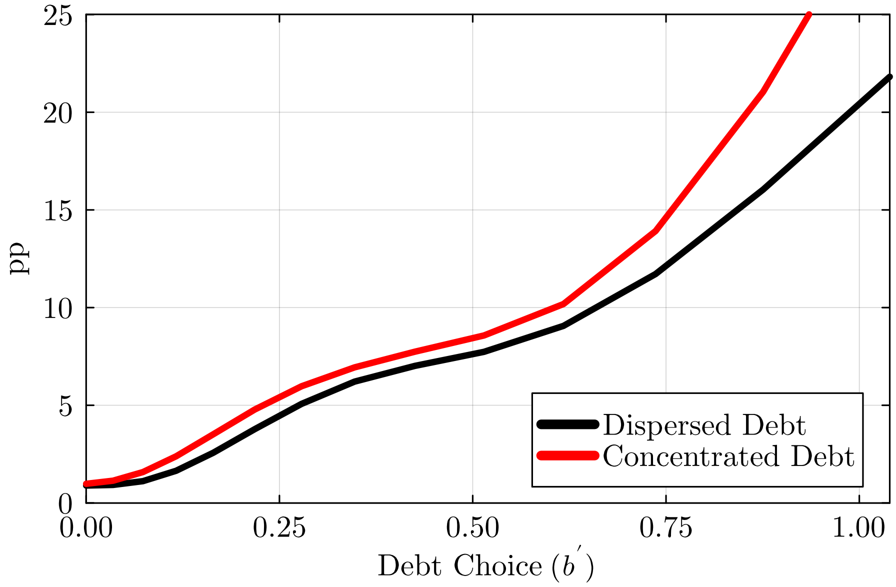
Finally, the prices of dispersed and concentrated debt differ in equilibrium, with $q_D(b'_D, b'_C, y) > q_C(b'_D, b'_C, y)$: dispersed debt is cheaper to borrow (Figure 9). The concentrated bond returns its entire principal at the random maturity date ($\eta = 1$). That is the state in which the firm must roll over a large payment and is most likely to fail, so it leaves the lender little to recover. The dispersed bond instead returns principal gradually, a fraction λ each period, in states where the firm remains solvent and the lender is repaid in full. Because more of the dispersed bond's promised cash flow arrives outside the rollover-failure event, the lender values it more highly and $q_D > q_C$. The price difference thus comes from how repayment lines up with the default state, not from default itself depending on composition. It compounds in equilibrium because a firm can also sustain more debt before defaulting when its debt is dispersed (Figure 8).

Figure 8: Default Choice: Dispersed vs Concentrated Debt



Notes. The model's default decision (1 = default) as a function of the firm's debt, shown separately for a firm holding all-dispersed and all-concentrated debt. A firm can sustain more debt before defaulting when its debt is dispersed, because concentrated debt carries random large principal payments. In equilibrium this reinforces the spread differential: a firm holding concentrated debt defaults in more states, on top of the unfavorable timing of its repayments (Figure 9).

Figure 9: Credit Spreads: Dispersed vs Concentrated Debt



Notes. Model credit spreads (the inverse of the bond price) by debt level for dispersed versus concentrated debt. Concentrated debt carries the higher spread ($q_D > q_C$) because the lender is less likely to be repaid in full when the firm must roll over a large concentrated payment.

To understand the intuition for why it is more costly to borrow b_C than b_D, consider a stylized three-period environment in which a firm borrows $b_D = b_C = B$ in period 1. The firm receives deterministic income y_2 in period 2 and $y_3 = -\infty$ in period 3. As a result, the firm will default with certainty in period 3[28]. Additionally, the lender cannot recover any of the firm's assets ($\chi = 0$). What would the prices of debt $q_D(B, B, y_2)$ and $q_C(B, B, y_2)$ be?

To see that $q_D(B, B, y_2) > q_C(B, B, y_2)$, suppose that y_2 is such that $\delta(B, B, y_2, \eta_2 = 0) = 0$ and $\delta(B, B, y_2, \eta_2 = 1) = 1$. In other words, the firm defaults with probability λ in period 2. In period 1, each bond is priced as the expected repayment the lender expects to get:

$$q_D(B, B, y_2) = \beta(1 - \lambda)(\tilde{c} + \lambda)$$
$$q_C(B, B, y_2) = \beta(1 - \lambda)\tilde{c}$$

It follows that $q_D(B, B, y_2) > q_C(B, B, y_2)$: borrowing b_C is more costly than b_D because the lender expects higher total repayment on the dispersed bond.

The example shows where the wedge comes from. Even holding the firm's debt com-

[28]This assumption is in place to keep the setup simple and allows me to ignore future borrowing decision by the firm. The firm will not borrow anything since prices are 0, or interest rates are infinite; lenders will not receive any cash-flow from the new borrowing since the firm is guaranteed to default.

position and total borrowing fixed ($b_D = b_C = B$), the two bonds have different prices, because their principal repayments arrive in different states. The dispersed bond is repaid in the solvent state, while the concentrated bond comes due in the default state, so lenders are less likely to be fully repaid on concentrated payments and demand a higher interest rate to compensate.

5 Mapping the Model to the Data

The data used for the model estimation is the same as in Section 2. In this section, I describe how I match the quantitative model to the key moments on firm heterogeneity related to maturity walls, the total level of borrowing, the cost of borrowing firms face on bonds, and their default rates. I discuss how these moments help recover the model primitives in Subsection 5.1. I use the estimated model to quantify the importance of maturity walls for firms' credit risk, to examine the implications of a large debt-issuance cost, and to study how maturity walls shape firms' resilience to credit-market freezes.

5.1 Estimation Strategy

The model has 11 parameters: six are calibrated outside the model and the remaining five are estimated by simulated method of moments (SMM) to match data moments. Table 6 summarizes the baseline parameters.

Externally Calibrated Parameters

As in the data, the model period is one year. The discount factor β, common to all agents, is set to 0.96, implying an annualized risk-free rate of 4.0%. The coupon rate equals the risk-free rate, so risk-free bonds are issued at par (a price of one). Following Hennessy and Whited (2007), I set the corporate tax rate $\tau = 0.30$.

The income process is also calibrated outside the model. I assume idiosyncratic productivity follows an AR(1) process:

$$log(y_{t+1}) = \rho_y log(y_t) + \epsilon_{y,t+1}, \quad \epsilon_y \sim \mathcal{N}(0, \sigma_y),$$

where $\rho_y < 1$ is the persistence parameter on the shock. To break up the shock into a discrete grid of points, I follow the method proposed in Tauchen (1986). To estimate the parameters in the process for y, I estimate the following regression:

$$log(Sales_{i,t}) = \rho_y log(Sales_{i,t-1}) + \alpha_i + \alpha_t + \epsilon_{i,t},$$

where α_i and α_t are firm and year fixed effects. This regression yields $\rho_y = 0.66$ and

$\sigma_y = 0.31$. I additionally set $1/\lambda = 8.3$, the average time to maturity of bonds on firms' balance sheets in the data.

Internally Estimated Parameters

The five remaining parameters are estimated by simulated method of moments, chosen to minimize the weighted distance between six model moments and their data counterparts, so the model is over-identified. I weight the moments using the influence-function approach of Erickson and Whited (2002) and correct the standard errors for simulation error. Appendix D states the objective function, the weighting matrix, and the standard-error formula.

Identification requires moments that respond sensitively to the structural parameters. Every model moment depends on all parameters, so there is no one-to-one mapping. Still, some moments are far more informative about a given parameter than others. I describe the six moments and the parameters they discipline below.

The default rate identifies the fixed cost of production, c_f. A higher c_f lowers pre-tax profits and raises the likelihood of default. I estimate $c_f = 0.967$, which implies a free-cash-flow-to-sales ratio of roughly 3% and captures both the fixed and variable costs of production (such as labor) found in the data. The average debt-to-income ratio identifies the convex equity issuance cost α, which I estimate at 0.01. Firms set leverage by trading off the tax benefit of debt against the expected cost of injecting equity. With the tax rate fixed, a higher α raises the marginal cost of equity and makes debt more attractive. The average credit spread identifies the lender recovery parameter χ, which I estimate at 0.093. It is the fraction of the firm's unlevered value recovered in default, and it enters the bond-price equation directly, so a higher value lowers spreads.

Finally, the fixed debt-issuance cost c_I is identified by two moments. The first is the average dispersion of maturity dates, σ_{Mat}. There is a one-to-one mapping between the share of dispersed debt a firm holds and σ_{Mat}, and c_I is the central trade-off shaping that choice, so the average dispersion pins it down. The second is the average underwriter fee, which anchors the implied fixed cost to an observable benchmark: the model delivers a fee of 0.75% against 0.79% in the data, so the estimated fixed cost is of an empirically reasonable magnitude. I estimate $c_I = 0.003$, about 10% of the firm's free cash flow, consistent with the fixed costs firms face when issuing bonds through underwriters. Comparing the two issuance margins, the estimated model implies that the cost of issuing debt is on average 3.3 times that of injecting equity. As Section 4 explains, this gap is what leads so many firms to concentrate their repayments into maturity walls.

I identify the scale of the manager preference shocks, σ_ε, from the cross-sectional standard deviation of the debt-to-income ratio. The shocks add dispersion to firm choices without shifting their average, so the spread of debt-to-income pins down σ_ε. A larger

Table 6: SMM Estimation

This table reports the results of the SMM estimation of the model. Panel A reports the parameters set outside the model. Panel B reports the parameter estimates with SMM standard errors in parentheses. Panel C reports the empirical and simulated moments. The model is over-identified: five parameters are estimated from six moments.

Panel A: Externally calibrated parameters

Parameter	Description	Value	Target/Reference
β	Discount factor	0.960	4% annual risk-free rate
$\tilde{c}$	Per-period coupon payment	$1/\beta - 1$	Risk-free debt issued at par
τ	Corporate tax rate	0.300	Hennessy & Whited (2007)
ρ_y	Persistence: income shock	0.660	Auto-correlation of log sales
σ_y	St. dev: income shock	0.310	Log sales volatility
$1/\lambda$	Average maturity of debt	8.300	Avg. debt maturity

Panel B: Estimated parameters

c_f	α	σ_ε	χ	c_I
0.967	0.011	0.001	0.093	0.003
(0.244)	(0.002)	(0.000)	(0.040)	(0.001)

Panel C: Moments

Moment	Data	Model
Default rate (%)	1.13	1.20
Avg. debt to income	2.22	2.12
St. dev debt to income	5.36	5.34
Avg. credit spread	1.87	1.70
Avg. dispersion maturity dates	2.61	2.62
Avg. underwriter fee (%)	0.79	0.75

Notes. Panel B parameters: c_f the fixed cost of production, α the convex equity issuance cost, σ_ε the scale of the manager preference shock, χ the lender recovery fraction, and c_I the fixed debt issuance cost.

scale spreads the choice probabilities in equation (8) more evenly across debt portfolios of similar value, which widens the distribution of debt the model generates.[29]

To gauge how much noise the shocks add, consider the dispersion of debt choices they generate. Without the shocks, debt choices conditional on the firm's state are degenerate. With them, the average coefficient of variation of debt-to-income is a modest 11.67%[30].

[29] This dispersion is also what makes the shocks computationally useful. In models of long-term debt, very different debt levels often deliver nearly identical firm value, so the optimal policy jumps discontinuously and impedes convergence (Chatterjee and Eyigungor, 2012). The preference shocks smooth these near-ties into the choice probabilities.

[30] At each point in the state space, I compute the standard deviation and mean of debt-to-income

This magnitude is consistent with the shocks standing in for unmodeled determinants of the debt choice, such as firms' investment decisions.

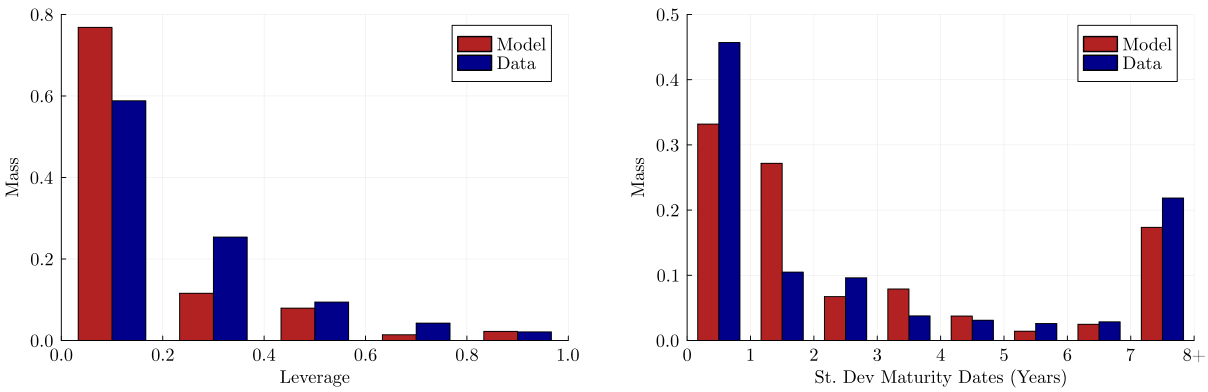
5.2 Model fit: Untargeted moments

I next check how the model does on several properties of the data that are untargeted. I ask how the model matches the general distribution of the market leverage rates and the dispersion of debt maturity dates (σ_{Mat}), presented in figures 10a and 10b. I then turn to two untargeted cross-sectional relationships estimated in the data (the predictors of repayment dispersion, and the relationship between dispersion and credit spreads) and show that the model reproduces the signs and magnitudes observed in the data.

Figure 10: Distributions in Model and Data

(a) Market Leverage

(b) St. Dev Maturity Dates



Notes. Model (red) versus data (blue) distributions, both untargeted. Panel (a): market leverage. Panel (b): repayment dispersion σ_{Mat}. Because the long-term bond's maturity is fixed at $1/\lambda$, model dispersion is mechanically truncated just below 8 years, so the data are likewise truncated at 8 years for comparability. About 50% of firms have σ_{Mat} below 2 years in both model and data.

First, the distribution of market leverage, entirely untargeted, is shown in red (model) against blue (data). The model reproduces its qualitative shape, in particular the long right tail of highly levered firms, though it slightly overstates the fraction of firms with market leverage below 0.2.

Second, the model matches the distribution of repayment dispersion. It generates both the large mass of firms with concentrated payments (about 50% of firms have a σ_{Mat} below two years in model and data alike) and the fraction with very dispersed payments. Because the long-term bond's maturity is fixed at $1/\lambda$, the model's dispersion is truncated just below eight years, so I truncate the data at eight years for comparability[31].

implied by the decision rules, take their ratio, and average over the stationary distribution.

[31] It is likely that a more flexible model with a choice on the average maturity parameter $1/\lambda$, similar to Bocola and Dovis (2019); Dvorkin, Sánchez, Sapriza, and Yurdagul (2021); Poeschl (2023) would allow for a better fit of firms with very dispersed debt payment dates.

Table 7: External Validation
Debt Payment Dispersion Predictors

	St. Dev Maturity Dates	
	Data	Model
St. Dev Maturity Dates$_{t-1}$	0.749	0.890
Leverage	0.182	0.189
Sales	-0.071	-0.033
Additional Firm Controls	Yes	—

Notes. The Table 3-style regression of repayment dispersion σ_{Mat} on its own lag, leverage, and revenue, run in the data and in simulated model data (untargeted); the coefficients on leverage and revenue give the change in σ_{Mat}, in years, per one-standard-deviation increase in the regressor. The model reproduces the persistence of the dispersion choice and the signs and magnitudes on leverage and revenue. The data columns include additional controls (size, age, average maturity, cash, bond share, and credit rating) that are absent from the model.

Table 8: External Validation
Credit Spreads & Debt Payment Dispersion

	Credit Spread (bps)	
	Data	Model
Leverage	29.688	72.798
Sales	-36.929	-46.551
σ_{Mat}	-12.351	-19.794
Additional Firm Controls	Yes	—

Notes. Credit spread (bps) on newly issued bonds regressed on leverage, revenue, and repayment-schedule concentration (σ_{Mat}), run in the data and in simulated model data (untargeted). The model matches the signs and is in the same range as the data: leverage and concentration raise spreads, revenue lowers them. The data columns include the additional controls of Table 7.

Turning to conditional relationships, the model reproduces the cross-sectional predictors of repayment dispersion. Table 7 runs the same regression in the model as in the data. In it, I regress a dispersion of debt payments (σ_{Mat}) on a lagged version of itself, their book leverage choice, and their sales revenue[32]. As is evident from the table, firms' debt maturity dispersion choice is persistent over time and matches the magnitudes observed in the data. Additionally, a one-standard-deviation increase in book leverage raises the dispersion of debt payments by about 0.18 years in the data and 0.19 in the model. Revenue enters negatively in both: a one-standard-deviation increase in sales revenue lowers the dispersion of debt payments by about 0.07 years in the data and 0.03 in the model.

[32] In the data, I additionally control for other factors that are likely to impact a firm's choice to have a maturity wall that are absent from my model. The controls include, size, age, average maturity, cash holdings, the fraction of bond debt, and firm's credit rating.

Finally, the model reproduces the relationship between repayment dispersion and credit spreads in Table 8. In it, I regress a firm's credit spread on a newly issued bond on the firm's choice of book leverage, the dispersion of their debt payments (σ_{Mat}), and their sales revenue[33]. The following observations can be made from the table. First, firms with higher levels of leverage face higher credit spreads: a one standard deviation in firms' book leverage is associated with increased credit spreads by 29 bps in the data and 72 bps in the model. Second, firms with high revenue face lower credit spreads: a one standard deviation increase in revenue is associated with a decreases in spreads by between 36 bps and 46 bps. Finally, firms with more dispersed debt payments face lower credit spreads: a one standard deviation increase in the dispersion of debt payments is associated with a decreases in spreads by between 12 bps and 19 bps.

6 Quantitative Results

The previous section showed that the model replicates key cross-sectional facts about the financing choices of U.S. public firms, so I now use it to quantify the role of maturity walls in the presence of idiosyncratic and aggregate shocks.

6.1 How much do maturity walls contribute to firm default & credit spreads?

In equilibrium, firms default for a variety of reasons. One of them is the inability to roll over a maturity wall. How much of the equilibrium default rate can be attributed to maturity walls? To answer this, I decompose total equilibrium defaults into those that coincide with a wall coming due ($\eta = 1$) and those that do not ($\eta = 0$), and compute the fraction that come from firms failing to roll over a wall. I find that maturity walls account for 14% (0.17 pp) of all defaults observed in equilibrium.

The above decomposition is based on the steady-state values that arise in equilibrium. In the next exercise, I quantify the causal effect of maturity walls on individual firms' default rates and credit spreads. Simply comparing wall and non-wall firms in equilibrium will not pin down this effect. Firms with maturity walls are qualitatively different in their states and choices, so the comparison mixes the wall together with everything else firms jointly choose.

To measure the effect that maturity walls have on firms' default rates and credit spreads, I use the structural model to generate exogenous variation in firms' debt structure, while holding all other choices and states fixed. I solve for a counterfactual economy in which firms make the same total leverage choice as they do in equilibrium, but are restricted to borrow in b_C, the debt with a concentrated payment. In addition, firms

[33] I additionally control for the same variables as in Footnote 32.

optimally choose to default or not, and lenders price all new loans so that they make zero profits in expectation. Finally, I compute new moments under the baseline stationary distribution. This gives the causal, direct effect of a maturity wall on a firm's default choice and its credit spreads[34].

The exercise finds that maturity walls raise firm default risk on average by 30 bps (25%) and credit spreads on average by 36 bps (21%). The mechanism, shown in Figure 11, is that firms lose the equity-smoothing benefits of b_D. Firms that held dispersed debt can no longer sustain as much debt once they are forced into concentrated payments. They now face random, large principal payments, and they find it better to default than to inject costly equity, so lenders raise their spreads to compensate. Firms already holding concentrated debt change little. The effects are therefore largest for firms that held dispersed debt in the baseline, though concentrated-debt firms' spreads also rise slightly on higher long-run default risk. The counterfactual holds each firm's leverage fixed at its equilibrium value, so these magnitudes come from the repayment structure and not from selection. In equilibrium, walls are chosen by lower-leverage, lower-rollover-risk firms. So a wall raises a firm's risk given its leverage, even though it is comparatively safe firms that adopt walls. This premium is what lenders charge in advance for the wall's rollover risk. They charge it for the firm's higher chance of failing just when its concentrated principal comes due, the same force that opens the wedge $q_D > q_C$.

6.2 Are firms less risky if it is cheaper to disperse debt payments?

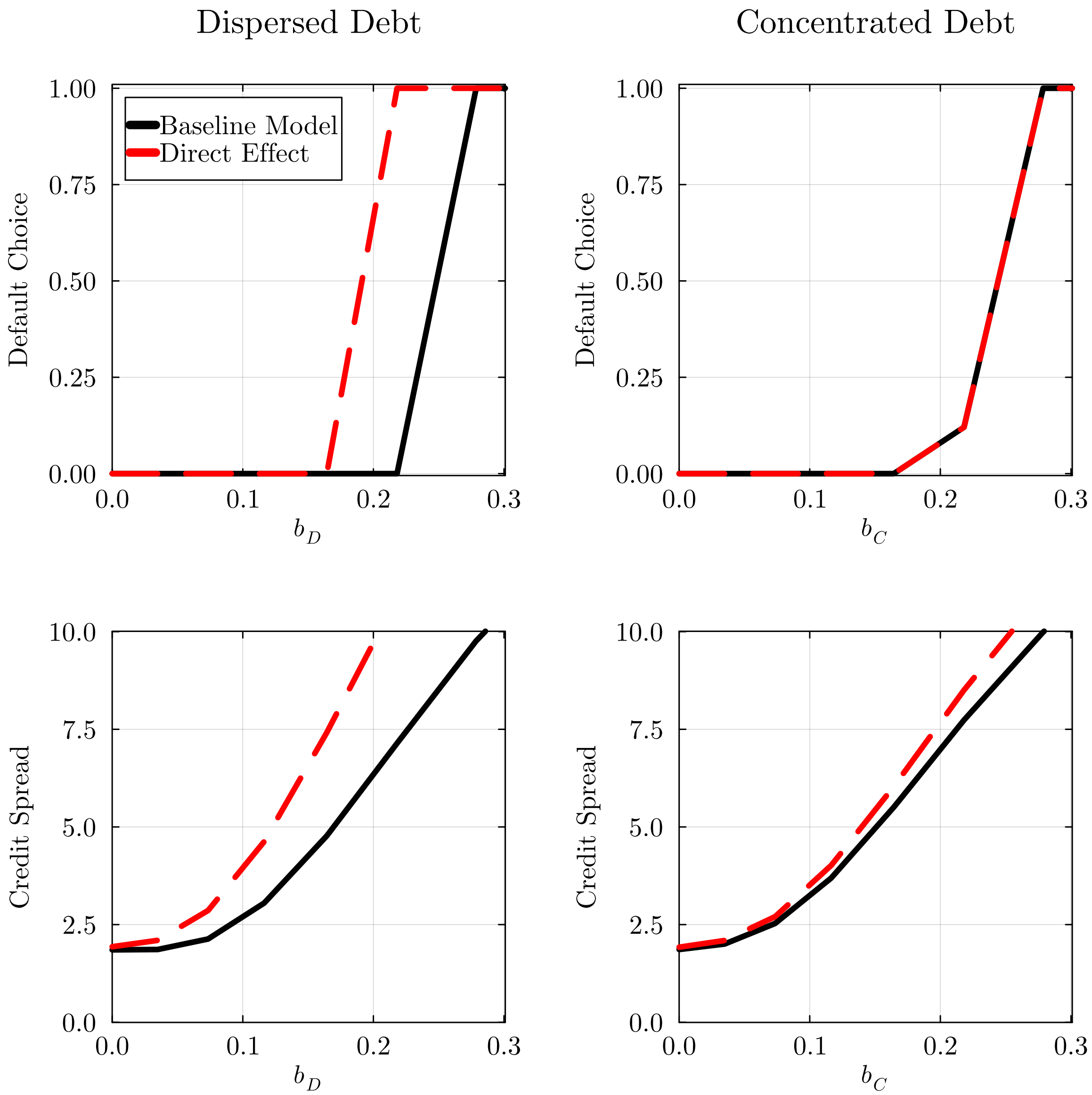
A key trade-off behind the firm's choice of a maturity wall is the debt issuance cost, or its empirical counterpart, the underwriter fee. The fee is in part a transaction cost. The underwriter conducts due diligence and brings the bond to market. But a substantial part reflects rents that underwriters extract through market power. Manconi, Neretina, and Renneboog (2018) document that the most powerful underwriters charge higher fees at the expense of issuers, leading firms to alter their issuance strategies to avoid these rents.

By choosing maturity walls, firms take on rollover and default risk. The previous exercise quantified this as a 25% rise in default risk and a 21% rise in credit spreads. Would firms, then, be less risky if it were cheaper to disperse their debt payments?

I use the model to assess how underwriter market power affects firms' choice of maturity walls, their total borrowing, and their default risk and credit spreads, and to quantify the economic inefficiency it creates. Manconi, Neretina, and Renneboog (2018) estimate

[34] I refer to this as a "direct" effect of maturity walls as firms keep their leverage the same as when there is no restriction on b_C and only adjust their repayment schedule under the new restriction. When firms are also allowed to optimize over their leverage under the new restriction, the "indirect" effect can arise through firms jointly optimizing leverage *and* debt repayment schedule.

Figure 11: Direct Effect of Maturity Walls



Notes. The direct effect of maturity walls, from the counterfactual that holds each firm's leverage fixed but forces all debt into the concentrated bond b_C. Top panels: default decisions for firms holding dispersed and concentrated debt, baseline (solid black) versus counterfactual (dashed red). Bottom panels: the corresponding credit spreads. Firms that held dispersed debt can no longer sustain as much debt and default more, so lenders raise their spreads; firms already holding concentrated debt change little. On average the wall raises default risk 30 bps (25%) and credit spreads 36 bps (21%).

the fraction of underwriter fees attributable to market power, finding that on average it accounts for 16% (12.2 bps) of fees, with maximum rents accounting for 25% (19.4 bps) of the fee[35].

[35]To arrive at this number, I use their estimate on the relationship between *Power* and the underwrite fee issuers face in Table 2.A.1, combined with the fact that the mean (max, in absolute value terms) power is -2.23 (-3.53).

Answering it requires an equilibrium analysis. Holding firms' choices fixed, a lower issuance cost makes them safer, since dispersing payments becomes cheaper. But the payment schedule is chosen jointly with the level of debt. Because non-wall firms already carry more debt in the baseline, a lower fee likely leads firms to borrow even more, which could undo the risk-reduction benefit of dispersion. The net effect on creditworthiness is therefore ambiguous. I solve for counterfactual equilibria in which the debt issuance cost is cut by the mean and maximum estimated rents, approximating the fees that would prevail under competition. Table 9 compares the resulting moments to the baseline.

Table 9: Counterfactual equilibrium: Removing estimated underwriter rents

	Baseline	$0.84c_I$	$0.75c_I$
Share of debt held in b_D	18.25%	42.46%	50.00%
Debt Maturity Dispersion σ_{Mat}	2.62 years	4.85 years	5.62 years
Book leverage	20.72%	38.03%	42.48%
Market leverage	14.67%	24.26%	26.59%
Credit spread on b_D	1.44%	2.54%	2.84%
Credit spread on b_C	1.70%	2.65%	2.89%
Average credit spread	1.69%	2.64%	2.88%
Firm default rate	1.19%	1.96%	2.15%
Δ Market value	—	0.85%	1.01%

Notes. Stationary moments of the baseline economy and two counterfactual equilibria in which the fixed issuance cost is cut to remove the mean ($0.84\,c_I$) and maximum ($0.75\,c_I$) underwriter rents estimated by Manconi, Neretina, and Renneboog (2018). Cheaper issuance leads firms to disperse their repayments (walls largely disappear) and to lever up, so average credit spreads and default rates rise despite the safer schedules. Δ Market value is the average change in firm market value relative to baseline.

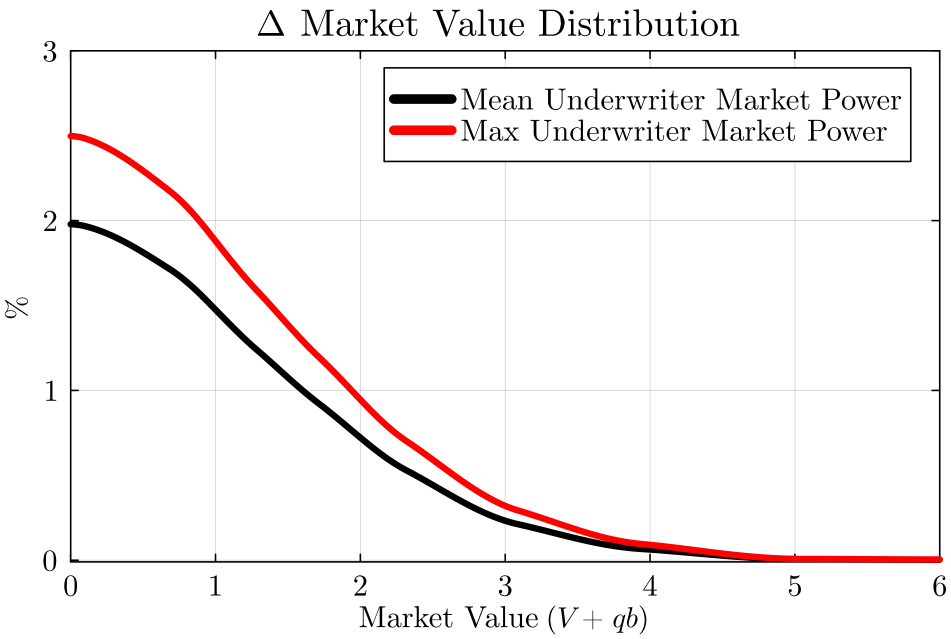
Decreasing the underwriter fee has predictable implications for debt-payment dispersion. As the fee falls, injecting equity becomes relatively more expensive, so firms substitute toward debt with more dispersed payments, raising average dispersion to as much as 5.6 years. Cheaper issuance also leads firms to lever up. Book leverage rises from 20.7% to as high as 42.5%, and market leverage from 14.7% to 26.6%.[36] The two move together for a simple reason. Having dispersed their payments to reduce rollover risk, firms are now safer at any given debt level, so they take on more debt for the larger

[36]The magnitude of this leverage response is model-dependent, but it is not out of line with the data. After the 1999 Gramm–Leach–Bliley repeal of Glass–Steagall allowed commercial banks to enter bond underwriting and lowered average underwriter fees by roughly 13%, aggregate bond debt among public issuers more than tripled and bond-debt-to-income rose 66–80%—an implied elasticity of bond leverage to issuance costs of about −3.6 to −4.1, larger than the −2.3 that this counterfactual implies. The model's leverage response is thus, if anything, on the conservative side. The comparison is suggestive rather than causal: the post-1999 expansion of bond debt also reflects the secular decline in interest rates and the broad shift from bank loans to bonds, so it overstates the share attributable to issuance costs alone.

tax shield it brings.

Because cheaper issuance makes firms both disperse their payments and borrow more, the net effect on default rates and spreads is ex ante ambiguous. Dispersion lowers default risk at a fixed debt level, while higher borrowing raises it. In the model the borrowing channel dominates, so default rates and spreads rise on net rather than falling. The size of this response turns on the model's leverage elasticity, which the historical comparison in the footnote above suggests is, if anything, on the conservative side. Lowering issuance costs need not make firms safer. Higher leverage is only part of the story. With walls gone, all firms now pay the fixed issuance cost more often, and the present discounted value (PDV) of firms' future issuance costs rises by 10%.

Figure 12: Firm Value Growth in Perfectly Competitive Underwriter Market



Notes. Percent change in firm market value when underwriter rents are removed (the issuance cost is cut), plotted against baseline market value. Black: mean rents removed ($0.84\, c_I$); red: maximum rents removed ($0.75\, c_I$). All firms gain weakly, and the smallest firms gain most; average market value rises 0.85–1.01%.

Removing underwriter market power also raises firm value, defined as $V(\mathcal{S}) + q_D(b'_D, b'_C, y)b'_D + q_C(b'_D, b'_C, y)b'_C$. As Figure 12 shows, all firms gain weakly and the smallest firms gain most, with average market value rising 0.85% to 1.01%.

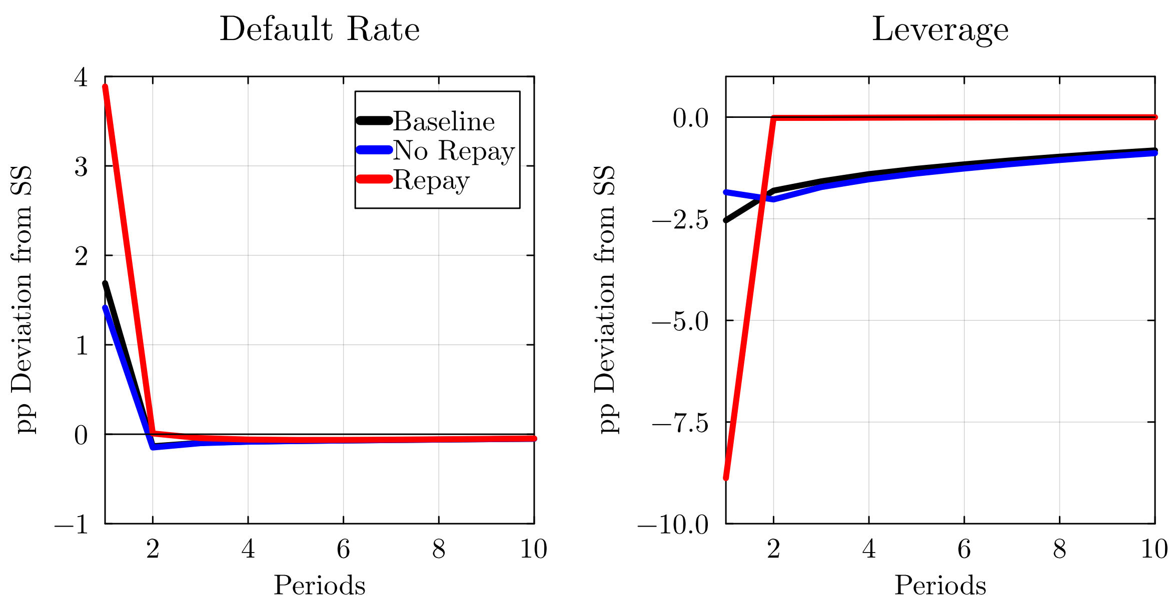
6.3 Maturity walls and rollover risk

So far defaults have been driven by idiosyncratic shocks. I now ask how a firm's exposure to rollover risk, the risk of being unable to refinance maturing debt when it comes due, depends on the concentration of its repayments. The relevant event is a credit-market freeze, as in the 2008 financial crisis, when firms lose access to the bond market and external finance becomes expensive (Acharya, Gale, and Yorulmazer, 2011). A firm that must roll over a large payment just then can neither refinance it nor raise equity cheaply, and it may default. A firm with little coming due is largely insulated (DeFusco, Nathanson, and Reher, 2023). In this exercise, I subject otherwise-identical firms to the same shock and measure how their default risk differs by repayment structure. This is the structural analogue of Almeida, Campello, Laranjeira, and Weisbenner (2009), who find that firms with more debt maturing just after the 2007 freeze cut investment more. Because the interest rate is exogenous, the exercise makes no general-equilibrium claim about aggregate feedback.

I implement this as a one-period, unanticipated credit-market freeze in the estimated economy. The freeze has two components. First, debt markets shut down. Firms can neither issue new debt nor buy it back early, which is equivalent to an infinite interest rate on new issuance, or prices $q_D = q_C = 0$. Second, equity injections become more expensive. I discipline the rise in the equity-injection cost (α) by the increase in defaults observed in the 2008 crisis, which serves only as a benchmark for the severity of the shock.

Exposure by maturity structure

Figure 13: Exposure to a Credit-Market Freeze by Maturity Structure



Notes. Response to a one-period, unanticipated credit-market freeze (no new issuance or buybacks, plus a higher equity-injection cost disciplined by the 2008 rise in defaults), as deviations from steady state. Red and blue: firms that must versus need not roll over a wall at the onset of the freeze; holding fundamentals fixed, a firm forced to roll over a wall is about 4 pp more likely to default than one with little coming due, which is largely insulated. Black: the average default rate and book leverage across firms, which aggregate this exposure: defaults rise 168 bps (140%) on impact and leverage falls 2.5 pp.

Figure 13 shows sharp heterogeneity by maturity structure. The red line plots firms that must roll over a wall at the onset of the freeze. The blue line plots firms that need not. Holding fundamentals fixed, a firm that must roll over a wall when the freeze hits is about 4 percentage points more likely to default than an otherwise-identical firm with little coming due, which is largely insulated. The wall is what makes a firm fragile when bond-market access is lost.

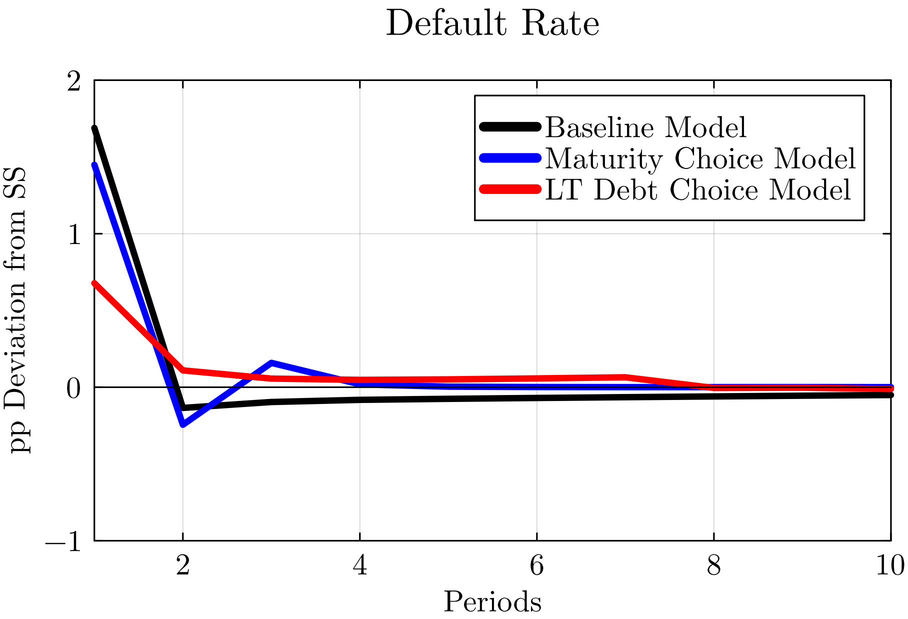
The black line aggregates this exposure into the average response across firms. The default rate rises 168 bps (140%) on impact and book leverage falls 2.5 pp, as many firms cannot roll over their debt and default rather than inject costly equity, while non-defaulting firms can only repay principal. Because the shock lasts one period, the effect is short-lived. Once it dissipates, the default rate dips below steady state (firms are now under-levered) before recovering. This average response is modest only because few firms (about λ) must roll over a wall in any given period. It is the aggregation of the firm-level exposure above, not a separate force.

The credit-spread premium on walls and their fragility in a freeze come from the same exposure: the firm may be unable to roll over a large concentrated payment. The two exercises look at that exposure in different states. In ordinary times it is idiosyncratic. The concentrated principal comes due at a random date, with probability λ, and sometimes that date lands when a weak fundamental has made equity expensive. Lenders anticipate this and charge for it. That is what opens the wedge $q_D > q_C$, and it is what the 36 bps (21%) spread premium on walls measures. The freeze is the same exposure in an aggregate form. Many firms must roll over a concentrated payment at once, and none can. Because the freeze is unanticipated, however, it never enters prices, so it is a stress test rather than a priced risk. What it stresses is the exposure lenders are already being paid to bear.

What standard credit-risk models miss

How much does ignoring repayment concentration distort a firm's measured credit risk? Neither of the standard structural models of long-term debt and default can represent a maturity wall, a payment that is concentrated yet distant. In a long-term-debt-only model, all debt has dispersed payments (b_D). This is the assumption the leading models of corporate capital structure share (Leland and Toft, 1996; Leland, 1998; DeMarzo and He, 2021), and its quantitative counterpart is Chatterjee and Eyigungor (2012), whose formulation I adopt. In a maturity-choice model à la Arellano and Ramanarayanan (2012), firms mix a short-term bullet with a dispersed long-term bond, so the only concentrated instrument is short-dated. I re-estimate each to match the same data moments as my benchmark, so that the differences come from model structure rather than calibration, and then subject each to the same freeze. The environments and parameter estimates are

Figure 14: What Standard Credit-Risk Models Miss



Notes. The default-rate response to the same credit-market freeze in three economies, each re-estimated to match the same data moments: the benchmark model (black), a maturity-choice model à la Arellano and Ramanarayanan (2012) (blue), and a long-term-debt-only model à la Chatterjee and Eyigungor (2012) (red). Models that cannot represent a maturity wall (a payment both concentrated and far in the future) understate a firm's default risk: by 14% (25 bps) for the maturity-choice model, in which a concentrated payment can only be short-dated, and by 60% (100 bps) for the long-term-debt-only model, in which all debt is fully dispersed.

in the appendix. Both alternatives understate the model-implied default risk (Figure 14): by 60% (100 bps) in the long-term-debt-only model and by 14% (25 bps) in the maturity-choice model. The maturity-choice number is the more surprising. Even with an explicit maturity choice, a concentrated payment in this model can only be short-dated, so it cannot reproduce a maturity wall, which is concentration at a distant horizon. Why, then, does each alternative understate the risk?

First, consider the long-term-debt-only model. Because the classical way to model long-term debt is with dispersed payments, this framework leaves firms almost fully insulated from rollover risk, so a freeze has a muted effect. Firms never need to roll over a large principal payment when it hits.

Second, consider the maturity-choice model, in which long-term debt again has dispersed payments. It produces higher default rates than the long-term-only model, because firms with short average maturity must roll over a large share of their debt when the freeze hits. But it still understates exposure. Firms that borrow heavily in short-term debt choose to borrow less of it than firms with maturity walls, since a wall is a concentrated yet distant payment. So even though these firms roll over a sizeable share of their debt during the freeze, the amount is small enough that they are more likely to manage it.

This is not only about the freeze. Even in normal times, with only idiosyncratic rollover risk and no aggregate shock, neither alternative can price repayment concentration. The long-term-debt-only model has no concentrated instrument at all. The maturity-choice model has one, but it is short-dated, so what the model prices is a firm's average maturity rather than how its repayments are spaced. Neither, then, carries a state variable that separates a wall from a dispersed firm holding the same leverage at the same average maturity, so neither can assign the two different spreads at any parameter values. In the benchmark that gap is 36 bps (21%), and it is there before any freeze is considered. So capturing repayment concentration matters not only for measuring a firm's tail exposure. It also matters for pricing credit risk in ordinary times.

7 Conclusion

A maturity wall occurs when most of a firm's debt comes due within a short window of one to two years, which increases the firm's rollover risk. Such concentration is pervasive: 48% of non-financial bond issuers have a wall. This paper argues that for many firms, the concentration is a choice rather than a sign of distress, and lenders price the rollover risk that comes with it. I introduce a continuous measure of repayment concentration, the standard deviation of a firm's weighted maturity dates. I show that, beyond leverage and average maturity, walls are associated with higher default risk and credit spreads. To explain why firms choose them, I build and estimate a dynamic model. In the model, firms jointly choose the level and concentration of their debt, trading off the fixed cost of accessing the bond market against their rollover risk. Firms whose rollover risk is low optimally concentrate their repayments to save on issuance costs, while more levered firms disperse them. This matches the heterogeneity in the data.

Using the estimated model, I quantify the credit-risk consequences of walls. Holding leverage fixed, concentrating a firm's repayments into a wall raises its credit spread by 36 bps (21%) and its default rate by 30 bps (25%). I then ask whether cheaper bond-market access would make firms safer by letting them disperse more cheaply. It does not. Lower issuance costs lead firms to disperse, but also to borrow more. The second effect dominates, so cheaper access raises default risk rather than reducing it. Finally, walls sharply reduce firms' resilience to a credit-market freeze. An otherwise-identical firm is about 4 percentage points more likely to default if it must roll over a wall when markets are shut. Standard debt-structure models that summarize debt by its average maturity, or assume fully dispersed repayments, understate this firm-level exposure by 14% to 60%.

Together, these results show that the timing and concentration of repayments is a distinct dimension of debt structure, separate from how much a firm borrows and its average maturity. Firms choose it, lenders price it, and it has major consequences for credit risk. Measuring a firm's rollover risk, and pricing it correctly, requires modeling the concentration of its repayments directly.

References

ACHARYA, V. V., D. GALE, AND T. YORULMAZER (2011): "Rollover risk and market freezes," *The Journal of Finance*, 66(4), 1177–1209.

ALMEIDA, H., M. CAMPELLO, B. LARANJEIRA, AND S. WEISBENNER (2009): "Corporate debt maturity and the real effects of the 2007 credit crisis," Discussion paper, National Bureau of Economic Research.

ALTINKILIÇ, O., AND R. S. HANSEN (2000): "Are there economies of scale in underwriting fees? Evidence of rising external financing costs," *The Review of Financial Studies*, 13(1), 191–218.

ARELLANO, C., AND A. RAMANARAYANAN (2012): "Default and the maturity structure in sovereign bonds," *Journal of Political Economy*, 120(2), 187–232.

BENVENISTE, L. M., AND P. A. SPINDT (1989): "How investment bankers determine the offer price and allocation of new issues," *Journal of Financial Economics*, 24(2), 343–361.

BENZONI, L., L. GARLAPPI, R. S. GOLDSTEIN, AND C. YING (2022): "Debt dynamics with fixed issuance costs," *Journal of Financial Economics*, 146(2), 385–402.

BOCOLA, L., AND A. DOVIS (2019): "Self-fulfilling debt crises: A quantitative analysis," *American Economic Review*, 109(12), 4343–4377.

BOYARCHENKO, N., A. KOVNER, AND O. SHACHAR (2022): "It's what you say and what you buy: A holistic evaluation of the corporate credit facilities," *Journal of Financial Economics*, 144(3), 695–731.

BRUNNERMEIER, M. K., AND M. OEHMKE (2013): "The maturity rat race," *The Journal of Finance*, 68(2), 483–521.

CHADERINA, M. (2023): "Rollover risk and the dynamics of debt," *Available at SSRN 2530969.*

CHATTERJEE, S., AND B. EYIGUNGOR (2012): "Maturity, indebtedness, and default risk," *American Economic Review*, 102(6), 2674–2699.

CHEMMANUR, T. J., AND P. FULGHIERI (1994): "Investment bank reputation, information production, and financial intermediation," *The Journal of Finance*, 49(1), 57–79.

CHEN, H., Y. XU, AND J. YANG (2021): "Systematic risk, debt maturity, and the term structure of credit spreads," *Journal of Financial Economics*, 139(3), 770–799.

Choi, J., D. Hackbarth, and J. Zechner (2018): "Corporate debt maturity profiles," *Journal of Financial Economics*, 130(3), 484–502.

——— (2021): "Granularity of corporate debt," *Journal of Financial and Quantitative Analysis*, 56(4), 1127–1162.

Crouzet, N. (2018): "Aggregate implications of corporate debt choices," *The Review of Economic Studies*, 85(3), 1635–1682.

Custódio, C., M. A. Ferreira, and L. Laureano (2013): "Why are US firms using more short-term debt?," *Journal of Financial Economics*, 108(1), 182–212.

Dangl, T., and J. Zechner (2021): "Debt maturity and the dynamics of leverage," *The Review of Financial Studies*, 34(12), 5796–5840.

DeFusco, A. A., C. G. Nathanson, and M. Reher (2023): "Real Effects of Rollover Risk: Evidence from Hotels in Crisis," Discussion paper, National Bureau of Economic Research.

DeMarzo, P. M., and Z. He (2021): "Leverage dynamics without commitment," *The Journal of Finance*, 76(3), 1195–1250.

Diamond, D. W. (1991): "Debt maturity structure and liquidity risk," *the Quarterly Journal of economics*, 106(3), 709–737.

Diamond, D. W., and Z. He (2014): "A Theory of Debt Maturity: The Long and Short of Debt Overhang," *Journal of Finance*, 69(2), 719–762.

Dvorkin, M., J. M. Sánchez, H. Sapriza, and E. Yurdagul (2021): "Sovereign debt restructurings," *American Economic Journal: Macroeconomics*, 13(2), 26–77.

Erickson, T., and T. M. Whited (2002): "Two-step GMM estimation of the errors-in-variables model using high-order moments," *Econometric Theory*, 18(3), 776–799.

Fang, L. H. (2005): "Investment bank reputation and the price and quality of underwriting services," *The Journal of Finance*, 60(6), 2729–2761.

Friewald, N., F. Nagler, and C. Wagner (2022): "Debt refinancing and equity returns," *The Journal of Finance*, 77(4), 2287–2329.

Geelen, T. (2019): "Information dynamics and debt maturity," *Swiss finance institute research paper*, (16-78).

Geelen, T., J. Hajda, E. Morellec, and A. Winegar (2024): "Asset life, leverage, and debt maturity matching," *Journal of Financial Economics*, 154, 103796.

Geelen, T. A. (2016): "Debt maturity and lumpy debt," Discussion paper, Swiss Finance Institute.

Gomes, J. F., and L. Schmid (2021): "Equilibrium asset pricing with leverage and default," *The Journal of Finance*, 76(2), 977–1018.

Hatchondo, J. C., and L. Martinez (2009): "Long-duration bonds and sovereign defaults," *Journal of international Economics*, 79(1), 117–125.

He, Z., and K. Milbradt (2016): "Dynamic Debt Maturity," NBER Working Papers 21919, National Bureau of Economic Research, Inc.

He, Z., and W. Xiong (2012a): "Dynamic Debt Runs," *Review of Financial Studies*, 25(6), 1799–1843.

——— (2012b): "Rollover risk and credit risk," *The Journal of Finance*, 67(2), 391–430.

Hennessy, C. A., and T. M. Whited (2007): "How costly is external financing? Evidence from a structural estimation," *The Journal of Finance*, 62(4), 1705–1745.

Hu, Y., F. Varas, and C. Ying (2022): "Debt Maturity Management," Working paper.

Huang, C., M. Oehmke, and H. Zhong (2019): "A theory of multiperiod debt structure," *The Review of Financial Studies*, 32(11), 4447–4500.

Jungherr, J., M. Meier, T. Reinelt, and I. Schott (2024): "Corporate debt maturity matters for monetary policy," Working Paper 2024-30, Federal Reserve Bank of San Francisco.

Jungherr, J., and I. Schott (2021): "Optimal debt maturity and firm investment," *Review of Economic Dynamics*, 42, 110–132.

Leary, M. T., and M. R. Roberts (2005): "Do firms rebalance their capital structures?," *The journal of finance*, 60(6), 2575–2619.

Leland, H. E. (1998): "Agency Costs, Risk Management, and Capital Structure," *Journal of Finance*, 53, 1213–1243.

Leland, H. E., and K. B. Toft (1996): "Optimal capital structure, endogenous bankruptcy, and the term structure of credit spreads," *The Journal of Finance*, 51(3), 987–1019.

Lins, K. V., H. Servaes, and P. Tufano (2010): "What drives corporate liquidity? An international survey of cash holdings and lines of credit," *Journal of Financial Economics*, 98(1), 160–176.

Liu, Y., B. Qiu, and T. Wang (2021): "Debt rollover risk, credit default swap spread and stock returns: Evidence from the COVID-19 crisis," *Journal of Financial Stability*, 53, 100855.

Ma, L., D. Streitz, and F. Tourre (2023): "The art of timing: Managing sudden stop risk in corporate credit markets," *Available at SSRN 4602788*.

Manconi, A., E. Neretina, and L. Renneboog (2018): "Underwriter Competition and Bargaining Power in the Corporate Bond Market," Discussion Paper 2018-034, Tilburg University, Center for Economic Research.

Mota, L., and K. Siani (2023): "Financially Sophisticated Firms," *Available at SSRN*.

Poeschl, J. (2023): "Corporate debt maturity and investment over the business cycle," *European Economic Review*, 152, 104348.

Rust, J. (1987): "Optimal replacement of GMC bus engines: An empirical model of Harold Zurcher," *Econometrica*, 55(5), 999–1033.

Siani, K. (2022): "Raising bond capital in segmented markets," *Available at SSRN 4239841*.

Tauchen, G. (1986): "Finite state markov-chain approximations to univariate and vector autoregressions," *Economics Letters*, 20(2), 177–181.

Train, K. E. (2009): *Discrete Choice Methods with Simulation*. Cambridge University Press, 2 edn.

Appendix

The appendix is organized as follows:

- Section A describes the details of the data construction in Section 2.
- Section B describes additional empirical results noted at the end of Section 2.
- Section C describes the computational algorithm used to solve the model in Section 3.
- Section E describes the environment and estimated parameters for the alternative models considered in 6.

A Data Construction

Bond level data is obtained from Mergent FISD and firm balance sheet data is obtained from Compustat North American Fundamentals Annual running from 1995 - 2019. All data is accessed using WRDS. The choice of firm identifier is `GVKEY`. In section A.3, I describe how I match `GVKEY`s to firm issuers in Mergent FISD, since `GVKEY` is not present there.

A.1 Mergent FISD

I start with all bonds in the Mergent database and proceed with the following cleaning process.

1. I exclude the following types of bonds: Yankee, Canadian, Convertible, Foreign Currency, Asset Backed, Foreign Issue, Perpetual, Rule 144A, Private Placement.
2. I restrict the sample to corporate bonds, including: Corporate Debentures ("CDEB"), Corporate Medium Term Notes ("CMTN"), Corporate Medium-Term Zero-Coupon Note ("CMTZ"), Corporate Zero-Coupon Bond ("CZ"), and US Bonds ("USBN").
3. I require that I can match the bond issuer to S&P's Compustat North America database.
4. I exclude bonds issued by financial and utilities firms (SIC codes 4900 - 4999 and 6000 - 6999).

I use the following variables to construct the amount of debt outstanding in each year.

1. `offering_amt`: Bond issue size (rescaled to be in $M)
2. `offering_date`: The date on which the bond was issued.
3. `underwriter_spread`: `gross_spread/principal_amt`*100 is the per-dollar underwriter fee firms pay to issue a corporate bond.
4. `coupon`: Coupon rate on newly issued bond

5. `treasury_spread`: Credit spread, or difference between yield on bond issued and treasury of comparable maturity.

6. `maturity`: The date which the bond must be paid back.

7. `general_type`: Defined to be one of four possible actions the firm can take on the bond and is constructed from `action_type`. `D` represents a default on the bond issue by the firm; `A` represents scheduled principal payments; `I` represents new bond issuances by the firm; and `P` represents unscheduled payments by the firm. This requires use of the AMOUNT_OUTSTANDING and AMT_OUT_HIST tables from Mergent. See Ma, Streitz, and Tourre (2023) Appendix A.2.2 for more details.

8. `offering_date`: The date on which the change to the issue's amount outstanding became effective.

For each bond and each year, I construct the amount of principal outstanding, taking care to capture any early prepayments, as recorded in `general_type`. To construct the amount of bond debt outstanding in each year, I aggregate up to the firm level. From there, it is straightforward to construct the share of debt due for each maturity-year, average maturity of all bonds outstanding, and $\sigma_{Mat,t}$.

A.2 Compustat

Compustat variables follow the standard definitions used in the literature.

1. Leverage: (`DLTT` + `DLC`)/(`AT` + `PRCC` × `CSHO` - `CEQ` - `TXDB`)

2. Size: log of total assets (`AT`)

3. Age: Number of years between fiscal year and CRSP listing year (`LISTYEAR`).

4. Market-to-Book (Q): (`AT` + `PRCC` × `CSHO` - `CEQ` - `TXDB`)/`AT`

5. Cash: `CH/AT`

6. Profit: earnings before interest, taxes, depreciation, and amortization scaled by total assets, `EBITDA/AT`.

7. Interest Coverage Ratio: EBITDA to interest expense, `EBITDA/XINT`

8. Tangibility: plant, property, and equipment scaled by total assets, `PPENT/AT`.

9. Credit Rating: S&P Credit Rating File

10. Bond Fraction: ratio of total book value of bonds available to total book debt for each firm.

A.3 Merging Mergent FISD with Compustat

I match each bond to its issuing firm in every period over the bond's lifetime. To do so, I construct a mapping from `GVKEY`, the Compustat firm identifier, to the bond-level `CUSIP` in two steps. Each bond is given a unique `CUSIP` that is recorded in Mergent. First, I construct a mapping between `GVKEY` and `COMPANYID` in CapitalIQ. Second, I construct a mapping between `COMPANYID` and security-level `CUSIP` also using CapitalIQ. Each mapping is time-varying and records when the link is valid. From here, I am able to construct a mapping from `GVKEY` to bond level `CUSIP` using this mapping. This accounts for the majority of links between `GVKEY` and bond level `CUSIP`. As a second pass, I use Mergent FISD's `issuer_id` to fill in missing `GVKEY`s. For example, if Bond A is linked to a `GVKEY` and Bond B is not, but both bonds are issued by the same firm, I assign the same `GVKEY` to Bond B.

A.4 Summary Statistics

Table 10: Summary Statistics: Full Sample

	Mean	Std. Dev	P25	Median	P75
Mkt Value ($M)	15,872.595	31,371.247	1,756.910	4,969.641	14,597.764
Size ($M)	12,021.480	22,698.773	1,823.969	4,478.150	11,744.289
Age	28.624	23.535	9.000	23.000	42.000
Q	1.671	0.896	1.111	1.408	1.908
Market Leverage	0.339	0.222	0.165	0.289	0.478
Profit	0.134	0.076	0.093	0.131	0.174
Tangibility	0.346	0.248	0.139	0.284	0.523
Profit Volatility	0.036	0.042	0.014	0.024	0.041
Interest Coverage Ratio	7.366	15.522	1.782	4.087	8.446
Debt and Interest Coverage Ratio	4.873	11.368	1.088	2.424	5.174
Cash	0.068	0.072	0.016	0.044	0.094
Pays Dividend	0.703	0.457	0.000	1.000	1.000
Equity Issuance	0.015	0.042	0.000	0.003	0.009
Prob. Default	0.043	0.146	0.000	0.000	0.001
Number of Bonds Outstanding	4.574	5.719	1.000	2.000	5.000
Bond Debt to Bank + Bond Debt Fraction	0.877	0.231	0.858	1.000	1.000
Bond Debt to Total Debt Fraction	0.599	0.283	0.379	0.618	0.845
Bond Debt Issued ($M)	945.231	1,466.712	250.000	475.000	1,000.000
Bond Debt Outstanding ($M)	1,624.814	2,851.221	246.840	577.943	1,620.605
Bond Buyback	0.156	0.363	0.000	0.000	0.000
Avg. Bond Maturity	7.769	4.011	5.000	7.000	9.742
Coupon Rate	6.416	2.446	4.550	6.450	7.970
Credit Spread (bps)	188.441	133.475	95.000	145.000	237.500
Underwriter Fee	0.783	0.498	0.564	0.650	0.777
St. Dev Maturity Dates	3.030	3.609	0.000	1.494	5.582
Maturity Wall	0.475	0.499	0.000	0.000	1.000

Notes. Summary statistics for the estimation sample (non-financial bond issuers, 1995–2019): 1,392 firms and 17,389 firm-years. Dollar amounts in millions. "St. Dev Maturity Dates" is σ_{Mat} in years and "Maturity Wall" is an indicator for a firm concentrating at least two-thirds of its bond principal within a two-year window. All variables are winsorized at the 0.5% tails.

Table 10 presents summary statistics for my sample. The average firm size is $11.98 billion, which is larger than the average Compustat firm because my sample focuses on bond issuers, who tend to be larger than non-bond issuers. The average market leverage ratio is 0.34, and firms hold around 7% of their assets in cash. Bonds account for the majority of firms' total debt — 59% on average — with the remainder consisting of bank loans, credit lines, commercial paper, and capital leases. Bank debt, which is the main substitute for bond debt, only accounts for 12% of firm's debt.

On average, firms have 5.4 bonds outstanding at any given year, although the distribution is skewed, with a median of 3 bonds. The average bond issuance size in a year is $941 million, while the average total bond debt outstanding is $1.58 billion. The distribution of bond issuance size is skewed toward larger issuances, with the 25th percentile at over $460 million, suggesting the presence of fixed costs associated with corporate bond issuance. Additionally, firms generally hold their bonds to maturity, with only 15% of firms partially or fully repurchasing their debt[37]. This pattern aligns with the high costs associated with recalling bonds.

Regarding bond characteristics, the average bond maturity is 8.3 years. Firms pay an average coupon of 6.43%, an average credit spread of 188 bps on newly issued bonds, and an underwriter fee of 0.79% of the bond issuance.

Table 11 presents summary statistics for firms with and without maturity walls, revealing substantial heterogeneity in firm and bond characteristics based on the dispersion of their repayment schedules. Notably, firms that disperse their debt payments tend to be larger ($25B vs. $5B), older (36 vs. 19 years), and have better investment opportunities ($Q = 1.76$ vs. $Q = 1.55$) compared to those with more concentrated schedules. Firms with maturity walls also carry higher leverage unconditionally (market leverage of 0.40 vs. 0.30); this largely reflects their smaller size, however — conditional on size and other firm characteristics, it is the less-levered firms that adopt walls (Table 3), consistent with the model's mechanism. The fact that larger firms opt for more dispersed repayment schedules suggests the presence of large fixed costs associated with issuing debt, which these firms can better economize on. Indeed, firms with dispersed repayment schedules incur lower bond issuance costs. Measured by the underwriter spread, or the per-dollar cost to issue a bond, firms with dispersed debt payments face an underwriter spread of 72 bps compared to 117 bps for firms with concentrated debt payments.

To shed light on the economic mechanisms behind the above observation, the trend that older firms prefer dispersed repayment schedules indicates that adverse selection may play a role in bond issuance; lenders likely have better information about older, more mature firms. As for firms with better investment opportunities, Choi, Hackbarth, and Zechner (2018) explain that these firms may spread out their debt maturities to protect against rollover risk. In the event of a rollover crisis, a firm may be forced to forgo profitable growth opportunities to meet its debt obligations.

The table also highlights differing financing strategies between firms that disperse and concentrate their debt repayments. Firms with dispersed schedules are more likely to pay dividends and less likely to issue equity, a pattern consistent with dispersed debt payments mitigating the need for costly equity injections during rollover crises, as explored by He and Xiong (2012a).

The decision to disperse or concentrate debt repayment schedules also correlates with bond characteristics. Firms with more dispersed schedules tend to issue a higher number of bonds and at larger amounts. On average, firms with dispersed repayment schedules have 7.4 bonds outstanding, compared to 1.5 for firms with concentrated schedules. The average bond issuance size for firms with dispersed repayments exceeds $1.2 billion, while

[37] A more detailed breakdown shows that 8% of bonds are fully called, 1% are partially called, and 7% are repurchased via tender offers.

Table 11: Summary Statistics: By Maturity Wall

	Maturity Wall		No Maturity Wall	
	Mean	Median	Mean	Median
Mkt Value ($M)	4,774.820	1,933.239	24,585.105	10,386.182
Size ($M)	3,884.725	1,890.238	18,418.998	8,713.354
Age	18.883	13.000	36.244	32.000
Q	1.554	1.330	1.764	1.479
Market Leverage	0.396	0.362	0.296	0.244
Profit	0.125	0.122	0.142	0.137
Tangibility	0.354	0.293	0.340	0.279
Profit Volatility	0.042	0.028	0.031	0.022
Interest Coverage Ratio	5.714	2.655	8.648	5.445
Debt and Interest Coverage Ratio	4.212	1.872	5.384	2.848
Cash	0.069	0.043	0.067	0.045
Pays Dividend	0.580	1.000	0.815	1.000
Equity Issuance	0.021	0.002	0.010	0.003
Prob. Default	0.071	0.000	0.022	0.000
Number of Bonds Outstanding	1.508	1.000	7.376	5.000
Bond Debt to Bank + Bond Debt Fraction	0.809	1.000	0.932	1.000
Bond Debt to Total Debt Fraction	0.528	0.505	0.653	0.682
Bond Debt Issued ($M)	386.630	250.000	1,220.419	600.000
Bond Debt Outstanding ($M)	406.120	254.684	2,729.357	1,418.617
Bond Buyback	0.135	0.000	0.175	0.000
Avg. Bond Maturity	5.849	6.000	9.508	8.516
Coupon Rate	8.118	8.000	5.634	5.664
Credit Spread (bps)	276.011	250.000	173.990	137.500
Underwriter Fee	1.172	0.650	0.719	0.650
St. Dev Maturity Dates	0.333	0.000	5.471	4.946

Notes. Means and medians of firm and bond characteristics for firms with a maturity wall (at least two-thirds of bond principal maturing within a two-year window) versus without. Dollar amounts in millions. Wall firms are smaller, younger, and, unconditionally, more levered, but face higher coupons, spreads, and default risk and pay higher underwriter fees; the conditional (less-levered) relationship is in Table 3. "St. Dev Maturity Dates" is σ_{Mat} in years.

firms with concentrated schedules issue bonds averaging $387 million. This suggests that firms needing larger amounts of financing opt to disperse their debt payments to mitigate rollover risk.

Additionally, firms with dispersed repayment schedules secure more favorable borrowing terms. They pay lower coupon rates, face narrower credit spreads, and have a lower probability of default compared to firms with concentrated debt payments. Notably, firms with concentrated debt structures do not appear to be substituting bond debt for bank debt, as they still hold a significant proportion of bond debt relative to bank debt.

Finally, Table 12 reports summary statistics on how frequently and in what size firms issue bonds, the infrequent, lumpy issuance behavior discussed under Fact 3 in Section 2.

Table 12: Bond Issuance Behavior

	Mean	Std. Dev	P25	Median	P75
Bond Issuance Frequency	0.146	0.353	0.000	0.000	0.000
Number of Bonds Issued	1.709	1.107	1.000	1.000	2.000
Time Since Last Issue (Years)	3.326	2.137	1.929	2.800	4.000
Number of Bonds Issued Last 5 Years	1.181	2.293	0.000	0.000	1.000
Number of Bonds Issued Last 10 Years	2.073	3.637	0.000	1.000	2.000
Number of Bonds Issued Last 20 Years	3.082	5.143	0.000	1.000	4.000
Bond Issuance Size ($M)	448.130	362.719	200.000	350.000	550.000
Asset Amount ($M)	8,842.525	19,061.048	1,129.499	2,859.618	7,912.119
Bond Issuance to Asset Amount	0.103	0.134	0.027	0.060	0.126
Bond Amount Outstanding ($M)	1,474.353	2,737.262	200.000	500.000	1,440.000
Bond Issuance to Amount Outstanding	0.432	0.334	0.147	0.318	0.682
Bond Issuance to Legacy Bond Debt	1.082	8.124	0.141	0.293	0.666

Notes. Summary statistics on the frequency and size of bond issuance across firm-years (Mergent FISD, 1995–2019). "Bond Issuance Frequency" is an indicator for issuing in a given year. Dollar amounts are in millions. "Legacy bond debt" is the bond principal remaining after the year's scheduled repayments; the final row expresses new issuance relative to it. The infrequent, lumpy pattern is consistent with large fixed issuance costs.

B Additional empirical results

This appendix collects supporting results for Section 2. Table 13 shows that, among firms with more than one bond, σ_{Mat} predicts default risk after I control for the Herfindahl index, and Table 14 offers suggestive evidence that the same holds for secondary-market credit spreads. Table 15 shows that this is not a mechanical result of near-term maturing debt, because it holds after I control for the current-debt share and the share of bonds maturing within a year. Table 16 shows that the wall–non-wall gap in credit risk stays positive and significant across alternative σ_{Mat} cutoffs. The strict $\sigma_{Mat} = 0$ definition is therefore conservative, and the result comes from the continuous σ_{Mat} measure rather than from any one cutoff. Table 18 shows that σ_{Mat} and the maturity-wall indicator predict *realized* default and firm failure—bond defaults from Mergent FISD and forced delistings from CRSP—over one- to five-year horizons, so the result does not depend on the model-implied default measure.

The same point holds for the share-and-window definition used in Section 2.3. Table 17 varies both the principal-share threshold (one-half to four-fifths) and the window (one to three years). Prevalence rises smoothly as the definition loosens, from 39% to 73% of issuers, while the risk gaps barely change. Across the whole grid the wall–non-wall gap is about 80–110 basis points in new-issue spreads and 4.2–5.1 percentage points in Merton default probability. The two-thirds, two-year cell used in the main text (48% of issuers; a 102 bps spread gap and a 4.9 pp default gap) is representative of the whole grid.

B.1 Repayment dispersion and the Choi–Hackbarth–Zechner measure

Choi, Hackbarth, and Zechner (2018) measure maturity dispersion by how far a firm's maturity profile lies from a perfectly uniform one. With s_j the share of debt due in

Table 13: Repayment Dispersion versus the Herfindahl Index: Default Risk

	Probability of default (pps)		
	All firms	≥ 2 bonds	≥ 3 bonds
Repayment dispersion (σ_{Mat})	-0.183	-0.604**	-1.040***
	(0.257)	(0.251)	(0.269)
Herfindahl index	1.220***	0.964***	0.179
	(0.266)	(0.306)	(0.308)
Observations	11262	8100	6253
R^2	0.244	0.221	0.200

Notes. Probability of default (from the Merton distance-to-default, in percentage points) on the standardized lags of σ_{Mat} and the Herfindahl index, with the same controls and fixed effects as Table 1 and standard errors clustered by firm. Among multi-bond firms, where the spacing of maturities is a genuine choice, σ_{Mat} predicts default beyond the Herfindahl index. *,**,*** denote $p < 0.10$, 0.05, 0.01.

Table 14: Repayment Dispersion versus the Herfindahl Index: Secondary-Market Spreads

	Secondary-market credit spread (bps)				
	All firms			Multi-bond	
	(1)	(2)	(3)	≥ 2	≥ 3
Repayment dispersion (σ_{Mat})	-32.5***		7.9	-5.5	-15.4*
	(6.3)		(7.1)	(7.3)	(8.2)
Herfindahl index		66.3***	69.8***	82.5***	99.1***
		(6.5)	(7.4)	(9.9)	(12.7)
Observations	8252	8241	8203	5959	4616
R^2	0.627	0.639	0.638	0.617	0.599

Notes. The dependent variable is the firm-year secondary-market credit spread (in basis points), constructed from the WRDS TRACE-based corporate bond panel (2002–2019) as the amount-weighted bond yield less the maturity-matched Treasury yield. The standardized lags of σ_{Mat} and the Herfindahl index enter with the same controls and fixed effects as Table 1 and standard errors clustered by firm. Columns (4)–(5) restrict to firms with at least two and three bonds outstanding. On its own, σ_{Mat} strongly predicts spreads (column 1); in the horse race the Herfindahl index is the stronger predictor, but among firms with at least three bonds σ_{Mat} retains independent, if marginally significant, predictive power. This is suggestive evidence that the spacing content of σ_{Mat} is priced where the spacing of maturities is a genuine choice. *,**,*** denote $p < 0.10$, 0.05, 0.01.

maturity bucket $j = 1, \ldots, N$, their measure is $Disp = 1 - \frac{N}{N-1} \sum_j (s_j - 1/N)^2$, rising toward one as the profile approaches uniform. Built on the same FISD maturity profile that defines σ_{Mat} (buckets of one through five years and beyond five, as in their paper), *Disp* and σ_{Mat} are positively but only moderately related: their rank correlation is 0.70, and *Disp* explains just 31% of the variation in σ_{Mat}.

The two are not substitutes. Like any share-based index, *Disp* depends only on *how*

Table 15: Repayment Dispersion and Near-Term Maturing Debt

	Probability of default (pps)			
	≥ 2 bonds		≥ 3 bonds	
	Base	+ near-term	Base	+ near-term
Repayment dispersion (σ_{Mat})	-0.604**	-0.578**	-1.040***	-1.040***
	(0.251)	(0.264)	(0.269)	(0.277)
Herfindahl index	0.964***	0.991***	0.179	0.201
	(0.306)	(0.311)	(0.308)	(0.311)
Current-debt share		0.136		0.217
		(0.253)		(0.311)
Near-term ($\leq$1yr) bond share		-0.084		-0.045
		(0.159)		(0.177)
Observations	8100	8064	6253	6217

Notes. Probability of default (from the Merton distance-to-default, in percentage points) on the standardized lags of σ_{Mat} and the Herfindahl index, with the same controls and fixed effects as Table 13, estimated among firms with at least two and at least three bonds. The "+ near-term" columns add two measures of imminent rollover: the current-debt share (Compustat debt in current liabilities over total debt) and the share of bonds maturing within one year. Adding them leaves the σ_{Mat} coefficient essentially unchanged and the near-term measures themselves are insignificant, so σ_{Mat} is not a mechanical restatement of near-term maturing debt: it is dispersion holding the average maturity fixed, and a wall can be distant. Standardized regressors; standard errors clustered by firm. *,**,*** denote $p < 0.10$, 0.05, 0.01.

Table 16: Maturity-Wall Threshold: Robustness

σ_{Mat} cutoff (years)	0.5	1.0	1.5	2.0
Share of firms labeled a wall	0.41	0.45	0.51	0.56
Δ Default (pps)	1.99***	2.08***	2.21***	1.75***
	(0.39)	(0.39)	(0.36)	(0.35)
Δ Credit spread (bps)	14.12*	19.25***	24.59***	22.94***
	(7.21)	(6.86)	(6.68)	(6.08)

Notes. For each cutoff c, a firm is labeled a wall if $\sigma_{Mat} \leq c$. Δ Default and Δ Credit spread are the wall-versus-non-wall differentials (the coefficient on the wall indicator) from regressions with the standard firm controls and industry and year fixed effects; standard errors clustered by firm. The differential is positive and significant at every cutoff, which is the robustness this table is meant to show. It does not rise or fall steadily with the cutoff, and there is no reason it should. Raising c moves milder, more-dispersed firms into the wall group and takes the most-concentrated firms out of the comparison group. This lowers the average risk of *both* groups, so the differential is the gap between two falling means, and it is largest where the split best separates them (here $c = 1.5$). The steadily-rising relationship is the one between the continuous σ_{Mat} and credit risk (Table 5), not this differential between two discrete groups. *,**,*** denote $p < 0.10$, 0.05, 0.01.

Table 17: Maturity-Wall Definition: Threshold and Window Robustness

	Prevalence (% issuers)			Spread gap (bps)			Default gap (pp)		
Principal threshold	1yr	2yr	3yr	1yr	2yr	3yr	1yr	2yr	3yr
$\geq 50\%$	57.9	64.4	73.3	90	85	82	4.3	4.9	4.7
$\geq 60\%$	46.7	52.9	60.8	90	93	91	4.4	5.0	4.8
$\geq 2/3$	42.3	47.5	54.7	97	102	99	4.5	4.9	4.9
$\geq 75\%$	40.0	44.5	50.5	93	102	107	4.4	4.9	5.1
$\geq 80\%$	39.0	43.2	48.4	90	100	107	4.4	4.8	5.0

Notes. A firm has a maturity wall if at least the row's threshold share of its bond principal matures within the column's rolling window (the maximum over all windows of that width, so the cluster may sit anywhere on the horizon). "Prevalence" is the share of issuer-years so classified. "Spread gap" and "Default gap" are the wall-minus-non-wall differences in mean new-issue credit spread and mean one-year Merton default probability. Prevalence varies smoothly with the definition while the risk gaps are nearly flat, so no inference rests on the cutoffs. The two-thirds/two-year cell is the main-text definition.

Table 18: Repayment Dispersion Predicts Realized Default and Firm Failure

	Realized default or firm failure within k years (pp)			
	$k=1$	$k=2$	$k=3$	$k=5$
Panel A: continuous repayment dispersion				
σ_{Mat} (resid.)	-0.01	-0.27	-0.68**	-1.49***
	(0.06)	(0.19)	(0.30)	(0.41)
Panel B: maturity-wall indicator				
Maturity wall	0.20	1.59***	2.79***	3.94***
	(0.12)	(0.41)	(0.67)	(0.95)
Base rate (pp)	1.7	3.6	5.4	8.4
Observations	11,239	11,239	11,239	11,239

Notes. Linear probability models. The outcome equals 100 if the firm experiences a realized default or firm failure within k years: a bond default recorded in Mergent FISD (bankruptcy, a missed interest or principal payment, or a covenant default) or a forced delisting in CRSP (delisting code 400–599, a liquidation or distress-driven drop, linked to Compustat through the CCM link). Forward windows are built from the full event series, so they are not truncated at the sample end. Panel A reports the coefficient on the standardized one-year lag of repayment dispersion σ_{Mat} (the part uncorrelated with average maturity); Panel B on a maturity-wall indicator. Each cell is a separate regression with firm controls (leverage, average maturity, size, cash, profitability, and bond share of debt) and industry and year fixed effects; standard errors clustered by firm in parentheses. The contemporaneous ($k=1$) effect is null, as expected of a measure of *future* rollover exposure, and it grows at longer horizons. *,**,*** denote $p < 0.10$, 0.05, 0.01.

much debt falls in each bucket, not on *when* the buckets lie. It is unchanged if a firm's repayments are permuted across dates, and its coarse final bucket lumps all maturities beyond five years together. So *Disp* cannot tell debt bunched in adjacent years from debt spread far apart, while σ_{Mat}, a second moment of the actual maturity dates, can. This shows up in the data. Among firms that *Disp* ranks as maximally concentrated, σ_{Mat} ranges from 0 to nearly 11 years, from single-maturity firms to firms whose debt all matures beyond five years but is itself spread across two decades, which *Disp*'s coarse top bucket cannot see.

Table 19 repeats the credit-rating horse race of Table 1 with *Disp* in place of the Herfindahl index. σ_{Mat} keeps strong, independent predictive power. In the full sample its rating coefficient (0.356) exceeds that of *Disp* (0.209), and both survive among multi-bond firms. The pattern across outcomes is the same as in the Herfindahl horse race. Among multi-bond firms σ_{Mat} still predicts default after I control for *Disp* (coefficients -0.005 and -0.005), though the effect is only marginally significant, while for issued credit spreads the share-based measure is the stronger predictor and absorbs σ_{Mat}. So repayment dispersion as captured by σ_{Mat} is distinct from the Choi, Hackbarth, and Zechner (2018) index, and for judging credit risk the two are complementary.

Table 19: Repayment Dispersion versus the Choi–Hackbarth–Zechner Measure: Credit Ratings

	Credit rating (higher = safer)				
	All firms			Multi-bond	
	(1)	(2)	(3)	≥ 2	≥ 3
Repayment dispersion (σ_{Mat})	0.600***		0.445***	0.346***	0.244***
	(0.067)		(0.070)	(0.079)	(0.090)
CHZ dispersion (*Disp*)		0.379***	0.180***	0.269***	0.323***
		(0.053)	(0.057)	(0.058)	(0.070)
Observations	9580	9476	9476	6752	5105
R^2	0.743	0.742	0.745	0.730	0.720

Notes. As in Table 1, but with the Choi, Hackbarth, and Zechner (2018) dispersion measure *Disp* (higher = more dispersed) in place of the Herfindahl index; both enter with the expected positive sign (more dispersion, safer rating). The dependent variable is the issuer's numerical S&P credit rating (higher = safer); regressors are the standardized lag of σ_{Mat} and/or of *Disp*, with the same firm controls (size, market leverage, profitability, tangibility, cash, average maturity, and bond share of total debt) and industry and year fixed effects; standard errors clustered by firm. Columns (4)–(5) restrict to firms with at least two and three bonds. *,** ,*** denote $p < 0.10$, 0.05, 0.01.

B.2 Maturity walls are a choice, not a constraint

The cross-sectional pattern in Section 2 (walls concentrated among smaller, younger, less-levered firms) could reflect a financing constraint rather than a choice. Three pieces of evidence weigh against that reading.

Revealed preference. A firm bound by a wall should act defensively as a large payment approaches, by hoarding cash, cutting investment, or retiring debt early. It does not.

Table 21 regresses cash holdings, investment, and early debt repurchases on the share of debt coming due over the next one to ten years, and finds no defensive response. Cash and investment do not move with an approaching payment, and firms do not retire debt early to forestall it.

Firms that can disperse. If limited access drove walls, they should vanish among firms that can spread their maturities. Table 20 shows otherwise. Among investment-grade, large, and old issuers a substantial minority still choose walls (about one in five investment-grade or old firms), and within every group the probability of a wall declines with leverage rather than rising with distress.

Table 20: Maturity Walls Among Plausibly-Unconstrained Firms

	All	Inv. grade	Large	Old
Share with a maturity wall	0.48	0.21	0.13	0.21
Change in Pr(wall) per +1 s.d. of leverage	-0.115***	-0.205***	-0.153***	-0.137***
	(0.009)	(0.017)	(0.016)	(0.020)

Notes. "Inv. grade" denotes issuers rated BBB− or better; "Large" and "Old" denote the top quartile of size and age. The first row is the share of firms in each group with a maturity wall (at least two-thirds of bond principal maturing within a two-year window). The second row is the change in the probability of having a wall associated with a one-standard-deviation increase in market leverage, from a linear probability model estimated within each group with firm controls (size, age, credit rating, average maturity, revenue, cash) and industry and year fixed effects; standard errors clustered by firm. It is negative throughout: lower-leverage firms are the ones that choose walls, the model's prediction, not the higher-leverage, more distressed firms. *,** ,*** denote $p < 0.10$, 0.05, 0.01.

The cost of access. A genuine constraint would not respond to the price of market access, but the wall does, and sharply. In the model, even a partial reduction in the issuance cost (removing the estimated underwriter rents, a 25% cut in c_I) raises average repayment dispersion from 2.6 to 5.6 years and lifts the share of debt that firms spread out from 18% to 50% (Table 9). Solving the model across the full grid of issuance costs, walls recede steadily as c_I falls and all but disappear as $c_I \to 0$, with fewer than one percent of firms holding one. As the issuance cost falls, the wall recedes, even though the issuance cost is the friction that makes a wall attractive. A firm that is optimizing would behave this way; a firm that is rationed would not.

Table 21 explores how firm choices depend on large debt payments coming due. I regress firm's cash holdings, investment choice, and a binary variable capturing if a firm repurchased their debt early or not on the fraction of debt coming due in the next 1-10 years and other firm controls. The results suggest that firms are not adjusting their choices in response to large debt payments coming due. Firms do not hoard cash, cut investment, or buy back debt early, in anticipation of large debt payments coming due.

C Computational Algorithm

The model is solved using Julia. The solution algorithm is a value function iteration algorithm similar to Chatterjee and Eyigungor (2012). It proceeds as follows:

1. Define the state-space: Set grids for $b_D \in \mathcal{B}_D$ and $b_C \in \mathcal{B}_C$ such that firm choices fall within the interior set. Discritize firm income (y) following Tauchen (1986).

Table 21: Repayment Schedule Concentration and Firm Actions

	(1) Cash	(2) Investment	(3) Buyback Debt
% Debt Due in 1 Year	-0.002	0.007	-0.241***
	(0.007)	(0.008)	(0.052)
% Debt Due in 2 Years	-0.003	0.002	-0.228***
	(0.008)	(0.008)	(0.051)
% Debt Due in 3 Years	-0.002	0.003	-0.217***
	(0.007)	(0.008)	(0.049)
% Debt Due in 4 Years	-0.006	0.002	-0.253***
	(0.007)	(0.008)	(0.048)
% Debt Due in 5 Years	-0.007	0.002	-0.222***
	(0.006)	(0.007)	(0.048)
% Debt Due in 6 Years	-0.006	0.010	-0.245***
	(0.006)	(0.007)	(0.047)
% Debt Due in 7 Years	-0.010	0.015**	-0.210***
	(0.006)	(0.007)	(0.048)
% Debt Due in 8 Years	-0.009	0.018**	-0.103**
	(0.007)	(0.007)	(0.049)
% Debt Due in 9 Years	-0.011*	0.024***	-0.229***
	(0.006)	(0.008)	(0.048)
% Debt Due in 10 Years	-0.012**	0.020***	0.251***
	(0.006)	(0.007)	(0.055)
Leverage	-0.001	-0.006***	0.119***
	(0.001)	(0.002)	(0.010)
Size	-0.032***	0.015***	0.064***
	(0.004)	(0.004)	(0.024)
Q	0.010***	0.018***	-0.020
	(0.002)	(0.002)	(0.013)
Profit	-0.006***	0.008***	-0.025***
	(0.002)	(0.002)	(0.009)
Fraction of Bond Debt	0.020***	0.009*	-0.142***
	(0.005)	(0.005)	(0.039)
Observations	6657	6676	6793
R^2	0.664	0.640	0.280
Fixed Effects	Firm & Year	Firm & Year	Firm & Year

Notes. Linear regressions of firm cash holdings (1), investment (2), and an early-debt-buyback indicator (3) on the share of debt coming due in each of the next ten years, with firm controls, firm and year fixed effects, and standard errors clustered by firm. The small, mostly insignificant coefficients on near-term maturing shares (for cash and investment) and the absence of pre-emptive buybacks indicate that firms do not take defensive actions as a large payment approaches, consistent with a wall being a choice rather than a binding constraint. *,** ,*** denote $p < 0.10$, 0.05, 0.01.

2. Initalize Value Functions and Bond Prices: Start with a guess for the value function and bond prices. The equilibrium for the infinite horizon model might not be unique. I therefore follow Hatchondo and Martinez (2009) and approximate the infinite horizon value functions by finite horizon value functions for the first period. Therefore, the initial guesses are the terminal value function and the terminal bond prices.

3. Update Value Functions: For each state, (b_D, b_C, y, η) solve for the optimal default choice $\delta(b_D, b_C, y, \eta)$ and debt choices $b'_D(b_D, b_C, y, \eta)$ and $b'_C(b_D, b_C, y, \eta)$ taking as given the bond prices $q_D(b'_D, b'_C, y)$ and $q_C(b'_D, b'_C, y)$, and $\mathbb{E}V(b'_D, b'_C, y', \eta')$.

4. Bond Prices: For each choice the firm can make, (b'_D, b'_C, y) evaluate the right hand side of Equations 10 and 11, taking as given the default choice $\delta(b_D, b_C, y, \eta)$, the firm's choice probabilities $P(\cdot)$, and the continuation prices $q_D(b''_D, b''_C, y')$ and $q_C(b''_D, b''_C, y')$, which enter averaged over next period's portfolio through $\mathbb{E}^P_{\{b''_D, b''_C\}}$.

5. Iterate jointly on Value Functions and Bond Prices until convergence.

D Estimation Details

The five internally estimated parameters $\Theta = \{c_f, \alpha, \sigma_\varepsilon, \chi, c_I\}$ are chosen by simulated method of moments to minimize the weighted distance between the six data moments m^D and their model counterparts $m^M(\Theta)$:

$$J(\Theta) = \min_{\Theta}(m^D - m^M(\Theta))'W^*(m^D - m^M(\Theta)), \tag{12}$$

where $m^M(\Theta)$ is computed on the model's simulated stationary panel. This panel is generated by simulating many firms that are ex-ante identical—each solving the single-firm recursive problem of Section 3—and that become heterogeneous only through the idiosyncratic income and maturity-shock histories they draw; the resulting stationary cross-section is the model counterpart of the firms observed in the data. For the weighting matrix W^* I use the covariance of the empirical moments, constructed using the influence-function approach of Erickson and Whited (2002). Standard errors are given by

$$\left(1 + \frac{1}{K}\right)\left[\left(\frac{\partial m^M(\Theta)}{\partial \Theta}\right)' W^* \left(\frac{\partial m^M(\Theta)}{\partial \Theta}\right)\right]^{-1}, \tag{13}$$

where the factor $\left(1 + \frac{1}{K}\right)$ adjusts for simulation error.

E Alternative Model Environments

E.1 Long-term debt only model

Firms Problem

An incumbent firm enters the period with long-term debt b and idiosyncratic income y. The firm chooses between two discrete actions: (i) to stay in the economy and produce or (ii) to default on its debt payment and exit the economy. In other words, the firm maximizes its value over these two distinct choices:

$$V(b, y) = \max_{\delta \in \{0,1\}} \Big\{(1-\delta)V^{stay}(b, y) + \delta V^{default}(b, y)\Big\}, \tag{14}$$

where $\{V^{stay}, V^{default}\}$ denote the value of the firm if it chooses to stay in the economy and if it chooses to default on its debt.

In the event that its debt obligation is larger than the funds they are able to raise from debt markets or the amount of equity they can inject, the firm chooses to default and obtains a value $V^{default}(b, y) = 0$. I define $\delta(b, y)$ to be default decision rules made by the firm. In the event of default, $\delta(b, y) = 1$. If the firm does not choose to default on its debt obligation, I express the firm's problem of staying in the following recursive form, where $\varepsilon^{(b')}$ denotes the manager preference shock:

$$V^{stay}(b, y) = \int_{\varepsilon} W(b, y, \varepsilon) dF(\varepsilon) \tag{15}$$

$$W(b, y, \varepsilon) = \max_{b'} \Big\{\psi(d) + \varepsilon^{(b')} + \beta \mathbb{E}_{\{y'\}} V(b', y')\Big\} \tag{16}$$

subject to

$$\psi(d) = \begin{cases} d & \text{if } d \geq 0 \\ d - \alpha d^2 & \text{if } d < 0 \end{cases}$$

where

$$d = (y - c_f - \tilde{c}b)(1-\tau) - \lambda b + q(b', y)I - c_I(\mathbb{1}_{I>0})$$

and

$$I = b' - (1-\lambda)b$$

Entrants Problem

A new firm enters the economy when an incumbent firm defaults. I assume here that the entering firms come in with zero debt and draws its idiosyncratic income from the stationary Markov distribution of $\bar{G}_y$.

Lender's Problem

To price debt for firms, the representative lender must forecast the likelihood of default given the firm's debt choices and current idiosyncratic income level. On a given loan to a firm with idiosyncratic income y that chooses long-term debt b', the lender expects to make zero profits. As in Section 3.2, I write $\mathbb{E}^{P}_{\{b''\}}[\,\cdot\,]$ for the expectation over next period's debt choice under the firm's choice probabilities, here $P(b'' \mid b', y')$. The price of a unit of long-term debt then satisfies:

$$q(b',y) = \beta \mathbb{E}_{\{y'\}} \Big\{ (1-\delta(b',y'))(\tilde{c} + \lambda + (1-\lambda)\, \mathbb{E}^{P}_{\{b''\}}[q(b'',y')]) \qquad (17)$$
$$+ \delta(b',y') \min\left[1, \chi \frac{\tilde{V}(y')}{b'}\right] \Big\}$$

Definition of Equilibrium

A recursive Markov equilibrium is a set of value and policy functions $\{V^*, b^*, \delta^*\}$ and debt prices $\{q^*\}$ such that:

1. Given prices q^* firms optimize yielding V^* and b^*.
2. The default decision δ^* is consistent with firm decision rules.
3. Debt prices q^* are such that the representative lender expects to earn zero profits.
4. Stationary distribution of firms is determined by firm decision rules and law of motion for y
    - Mass of defaulting firms are replaced with an equal mass of firms with $b = 0$ and $y \sim \bar{G}_y$.

Estimated Parameters

Estimated parameters are in Table 22

Table 22: Estimated Parameters
— Long-term debt only model —

Parameter	Description	Value	Target/Reference	Data	Model
Externally Calibrated					
β	Discount factor	0.960	4% Annual Risk Free Rate	—	—
$\tilde{c}$	Per-period coupon payment	$1/\beta - 1$	Risk free debt issued at par	—	—
τ	Corporate tax rate	0.300	Hennessy & Whited (2007)	—	–
ρ_y	Persistence: income shock	0.660	Auto-correlation of log sales	0.66	0.66
σ_y	St. dev: income shock	0.310	Log sales volatility	0.31	0.31
$1/\lambda$	Average Maturity of debt	8.300	Avg. debt maturity	8.30	8.30
Internally Estimated					
c_f	Fixed cost of production	0.950	Default rate (%)	1.13	1.42
α	Convex equity issuance cost	0.002	Avg. debt to income	2.22	2.28
σ_ε	St. dev: pref. shock	0.000	St. dev debt to income	5.36	4.36
χ	Lender recovery fraction	0.320	Avg. credit spread	1.87	1.20
c_I	Fixed debt issuance cost	0.069	Avg. underwriter fee (%)	0.79	0.81

Notes. Parameter estimates for the long-term-debt-only alternative, in which all debt is modeled as the dispersed bond b_D (as in Chatterjee and Eyigungor (2012)), re-estimated to match the same data moments as the baseline. Columns report each parameter's value and the targeted moment in data versus model.

E.2 Maturity choice model

Firms Problem

I begin with the problem faced by an incumbent firm. An incumbent firm enters the period with long-term debt b_L, short-term debt b_S, and idiosyncratic income y. The firm chooses between two discrete actions: (i) to stay in the economy and produce or (ii) to default on its debt payment and exit the economy. In other words, the firm maximizes its value over these two distinct choices:

$$V(b_L, b_S, y) = \max_{\delta \in \{0,1\}} \Big\{(1-\delta)V^{stay}(b_L, b_S, y) + \delta V^{default}(b_L, b_S, y)\Big\}, \tag{18}$$

where $\{V^{stay}, V^{default}\}$ denote the value of the firm if it chooses to stay in the economy and if it chooses to default on its debt.

In the event that its debt obligation is larger than the funds they are able to raise from debt markets or the amount of equity they can inject, the firm chooses to default and obtains a value $V^{default}(b_L, b_S, y) = 0$. I define $\delta(b_L, b_S, y)$ to be default decision rules made by the firm. In the event of default, $\delta(b_L, b_S, y) = 1$. If the firm does not choose to default on its debt obligation, I express the firm's problem of staying in the following recursive form, where $\varepsilon^{(b'_L, b'_S)}$ denotes the manager preference shock:

$$V^{stay}(b_L, b_S, y) = \int_{\varepsilon} W(b_L, b_S, y, \varepsilon) dF(\varepsilon) \tag{19}$$

$$W(b_L, b_S, y, \varepsilon) = \max_{b'_L, b'_S} \Big\{\psi(d) + \varepsilon^{(b'_L, b'_S)} + \beta \mathbb{E}_{\{y'\}} V(b'_L, b'_S, y')\Big\} \tag{20}$$

subject to

$$\psi(d) = \begin{cases} d & \text{if } d \geq 0 \\ d - \alpha d^2 & \text{if } d < 0 \end{cases}$$

where

$$\begin{aligned} d = (y - c_f - \tilde{c}(b_L + b_S))(1-\tau) - (\lambda b_L + b_S) + \\ q_L(b'_L, b'_S, y) I_L + q_S(b'_S, b'_S, y) I_S - c_I(\mathbb{1}_{I_L > 0} + \mathbb{1}_{I_S > 0}) \end{aligned}$$

and

$$\begin{aligned} I_L &= b'_L - (1-\lambda) b_L \\ I_S &= b'_S. \end{aligned}$$

Entrants Problem

A new firm enters the economy when an incumbent firm defaults. I assume here that the entering firms come in with zero debt and draws its idiosyncratic income from the stationary Markov distribution of $\bar{G}_y$.

Lender's Problem

To price debt for firms, the representative lender must forecast the likelihood of default given the firm's debt choices and current idiosyncratic income level. On a given loan to a firm with idiosyncratic income y that chooses long-term debt b'_L and short-term debt b'_S, the lender expects to make zero profits. As in Section 3.2, I write $\mathbb{E}^P_{\{b''_L, b''_S\}}[\,\cdot\,]$ for the expectation over next period's portfolio under the firm's choice probabilities, here $P(b''_L, b''_S \mid b'_L, b'_S, y')$. The prices of a unit of short-term and of long-term debt then satisfy:

$$\begin{aligned} q_S(b'_L, b'_S, y) = \beta \mathbb{E}_{\{y'\}} \Big\{ &(1 - \delta(b'_L, b'_S, y'))(\tilde{c} + 1) \\ &+ \delta(b'_L, b'_S, y') \min \left[1, \chi \frac{\tilde{V}(y')}{b'_L + b'_S} \right] \Big\} \end{aligned} \tag{21}$$

$$\begin{aligned} q_L(b'_L, b'_S, y) = \beta \mathbb{E}_{\{y'\}} \Big\{ &(1 - \delta(b'_L, b'_S, y'))(\tilde{c} + \lambda + (1 - \lambda)\, \mathbb{E}^P_{\{b''_L, b''_S\}}[q_L(b''_L, b''_S, y')]) \\ &+ \delta(b'_L, b'_S, y') \min \left[1, \chi \frac{\tilde{V}(y')}{b'_L + b'_S} \right] \Big\} \end{aligned} \tag{22}$$

The short-term bond repays its principal in full next period, so q_S carries no continuation term and needs no such expectation.

Definition of Equilibrium

A recursive Markov equilibrium is a set of value and policy functions $\{V^*, b^*_L, b^*_S, \delta^*\}$ and debt prices $\{q^*_L, q^*_S\}$ such that:

1. Given prices q^*_L and q^*_S firms optimize yielding V^*, b^*_L, and b^*_S.
2. The default decision δ^* is consistent with firm decision rules.
3. Debt prices q^*_L and q^*_S are such that the representative lender expects to earn zero profits.
4. Stationary distribution of firms is determined by firm decision rules and law of motion for y
   - Mass of defaulting firms are replaced with an equal mass of firms with $b_L = 0$, $b_S = 0$, and $y \sim \bar{G}_y$.

Estimated Parameters

Estimated parameters are in Table 23

Table 23: Estimated Parameters
— Maturity choice model —

Parameter	Description	Value	Target/Reference	Data	Model
Externally Calibrated					
β	Discount factor	0.960	4% Annual Risk Free Rate	—	—
$\tilde{c}$	Per-period coupon payment	$1/\beta - 1$	Risk free debt issued at par	—	—
τ	Corporate tax rate	0.300	Hennessy & Whited (2007)	—	–
ρ_y	Persistence: income shock	0.660	Auto-correlation of log sales	0.66	0.66
σ_y	St. dev: income shock	0.310	Log sales volatility	0.31	0.31
$1/\lambda$	Average Maturity of debt	8.300	Avg. debt maturity	8.30	8.30
Internally Estimated					
c_f	Fixed cost of production	0.961	Default rate (%)	1.13	1.26
α	Convex equity issuance cost	0.017	Avg. debt to income	2.22	1.42
σ_ε	St. dev: pref. shock	0.000	St. dev debt to income	5.36	3.62
χ	Lender recovery fraction	0.721	Avg. credit spread	1.87	1.22
c_I	Fixed debt issuance cost	0.007	Avg. share short-term debt	0.04	0.05
			Avg. underwriter fee (%)	0.79	0.93

Notes. Parameter estimates for the maturity-choice alternative, in which firms choose the average maturity of their (dispersed) debt (as in Arellano and Ramanarayanan (2012)), re-estimated to match the same data moments as the baseline with the average short-term debt share added as a target. Columns report each parameter's value and the targeted moment in data versus model.