Who You Owe Matters: Corporate Debt Structure and Employment Recovery*

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Abstract

Since the 1990s, U.S. economic recoveries have become jobless. Over the same period, firms have shifted from relationship-based bank lending toward arm's-length market financing. This paper proposes a financial channel linking these two trends. Using firm-level data I exploit predetermined maturity schedules across crisis recoveries to separate maturing bond from maturing loan debt. It is not refinancing pressure *per se* that suppresses hiring, but the type of debt: firms with maturing bond debt experience lower and more persistent recovery employment growth than firms with comparable maturing loan debt. The results are consistent with a mechanism of rollover rigidity: dispersed bondholders face coordination failures that preclude renegotiation, forcing firms to cut labour rather than restructure debt — the *rollover-rigidity channel*. This channel is rationalized in a simple stylized model of employment adjustment under debt rigidity. The findings in this paper identify a corporate finance channel behind the worsening of employment recoveries as market-based financing has expanded.

Keywords: Corporate debt structure, bonds vs loans, rollover rigidity, employment dynamics, crisis recoveries

JEL Codes: E24, G32, G33, J23

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1 Introduction

Since the early 1990s, U.S. economic recoveries have become jobless: aggregate output rebounds relatively quickly after recessions, while employment recovers slowly. On average, employment now takes nearly two years to begin improving in post-1990 recoveries, compared with just four months in earlier cycles. This delay has transformed the first year of recovery from a period of payroll expansion into one frequently marked by further job losses.[1] Because delayed employment recoveries prolong the costs of recessions for workers, understanding what holds back rehiring once output recovers matters for the design of post-crisis policy. This paper asks whether part of the answer lies on firms' balance sheets: does the type of debt a firm owes affect how quickly it rehires after a crisis?

The question arises because the shift in employment dynamics coincides with a transformation in corporate finance. Over the same period, firms have moved away from relationship-based bank lending toward arm's-length market finance, particularly corporate bonds.[2] The share of loan debt in total corporate debt decreased by almost 10 percentage points between the 1980s and 2000s, while the share of bond debt increased by approximately 9 percentage points. Today, corporate bonds account for half of all nonfinancial corporate debt, while loans account for 10 percent.[3]

However, the two developments have largely been studied in isolation. Existing explanations for slow employment rebounds focus on the real side of the economy: technological automation, real or nominal wage rigidities, and sectoral labour reallocation.[4] Yet even within the same industry and year, and conditional on firm characteristics, firms' employment recoveries differ systematically with their debt structure. Research on corporate debt structure, in turn, has focused mainly on the acute crisis window itself. How a firm's pre-existing debt structure shapes the recovery that follows has received little attention, even though this is precisely the phase in which an employment gap arises.

This paper investigates how corporate debt composition — specifically, the reliance on corporate bonds versus loans — influences firm-level employment during economic recoveries.[5] The central finding is that it is not refinancing pressure *per se* that suppresses hiring during a recovery, but specifically bond debt. The mechanism combines two ingredients: firms must finance labour costs

[1] See Schreft et al. (2003); Jaimovich and Siu (2020).

[2] Several developments likely contributed to this transition, including the prolonged monetary easing cycle of the early 1990s, advances in information technology that reduced banks' informational advantages, and the SEC's introduction of Rule 144A in 1990, which lowered the costs of debt issuance. See Thomas and Wang (2004); Carow et al. (1999); McCauley et al. (1999), and Appendix A for more details.

[3] Figures A1 and A2 in Appendix A illustrate these shifts.

[4] See Jaimovich and Siu (2020); Cortes et al. (2017); Shimer (2012); Chodorow-Reich and Coglianese (2020).

[5] Throughout the paper, I use the term *bond debt* (debt securities) for market-based debt and *loan debt* for corporate loans.

before revenues are realised, and debt instruments differ in their renegotiability. In a crisis, banks can renegotiate debt, but dispersed bondholders cannot, so bond-financed firms must repay in full and use up the cash they need to rehire. I refer to this as the *rollover-rigidity* channel. The paper does not offer a general theory of jobless recoveries. Instead, it provides firm-level evidence on a financial channel that operates alongside technological and labour-market factors.

The focus on bonds versus loans is deliberate: during a downturn, the relevant financing constraint is not how much debt a firm carries, but whether its *existing* debt can be restructured. Equity markets are effectively closed to distressed firms in a crisis, and cash holdings are affected by endogenous liquidity-management decisions. Since bonds and loans make up more than 90% of total debt for the median firm in the sample, differences in their renegotiability become the economically relevant margin of financial flexibility.

Identifying this effect is challenging because firms do not choose their debt structure at random. Bond issuers tend to be larger, older, and of higher credit quality, which may itself shape how they adjust employment. Firms may also change their debt structure in anticipation of a downturn, and slow rehiring may simply reflect weak product demand. A simple correlation between bond financing and weak employment recoveries could therefore reflect *who* issues bonds, rather than *what* bonds do. To address these concerns, I exploit variation in long-term debt maturing during the recovery period, using firm-level data from Compustat and Capital IQ, outlined in Section 2. Since these debt obligations were issued prior to the crisis, their maturity schedules are plausibly predetermined with respect to contemporaneous economic conditions (Almeida et al., 2012). Crucially, I distinguish between maturing bond debt and maturing loan debt, allowing a direct test of whether otherwise similar refinancing needs have different employment consequences depending on the underlying debt instrument. I compare firms within the same industry and year, which absorbs industry-specific demand shocks and trends in automation, and control for standard firm characteristics, including size, credit rating, leverage, and liquidity.

I document three core empirical results in Section 3. First, firms with predetermined maturing bond debt suffer a persistent drop in cumulative employment growth during the recovery period, whereas firms with comparable maturing loan debt do not. In the baseline regression, a one-standard-deviation increase in maturing bond debt relative to pre-crisis assets reduces cumulative employment growth over the three-year recovery window by 1.7 percentage points, lowering the median firm's recovery employment growth by about 15%. By contrast, the effect of maturing loan debt on recovery employment growth is economically negligible and not statistically significant. Second, this effect is specific to crisis periods. During normal times, maturing debt has no significant effect on employment growth for either debt type. Placebo tests assigning hypothetical crisis and recovery windows to non-recessionary periods yield zero differential drag, consistent with the

mechanism binding only when debt service must be funded out of internal liquidity. Third, the recovery drag extends beyond labour to physical capital: a one-standard-deviation increase in maturing bond debt reduces cumulative capital expenditure during the recovery period by 1.2 percentage points and suppresses net capital stock growth by 3.9 percentage points, while maturing loan debt has no significant effect.[6] Firms with maturing bond debt thus shrink both inputs rather than replacing workers with machines, which is evidence against a pure labour-for-capital substitution story. Maturing bond debt also lowers revenue growth, which is hard to reconcile with the view that the employment cuts are a deliberate, profit-maximising strategy rather than the result of a binding constraint.

To understand why bond debt, but not loan debt, holds back recovery employment, Section 4 develops a tractable, stylised three-period model with working-capital frictions and asymmetric debt renegotiation. The model serves three purposes: it makes the mechanism explicit, it delivers additional testable predictions, and it provides a framework to aggregate the firm-level estimates. When an unanticipated crisis reduces productivity and freezes credit markets, firms must service maturing debt out of liquid cash reserves. Because loans are held by a single relationship creditor (bank), the borrower and lender engage in Nash bargaining.[7] The bank internalises the deadweight loss of liquidation and grants debt relief, allowing the borrower to preserve internal liquidity and restore employment to its optimal level once productivity rebounds. Bonds, by contrast, cannot be renegotiated. Dispersed holders face coordination failure, and bond-financed firms must meet their obligations in full by shedding workers.

This generates two forces that suppress hiring during the subsequent recovery. First, bond-financed firms enter the recovery with depleted balance sheets, which caps their ability to finance upfront labour. This is the internal-funds channel. Second, residual maturing bond tranches must be rolled over in post-crisis credit markets that charge an elevated risk spread, further crowding out working capital. This is the refinancing-risk channel. Consequently, even after productivity returns to its pre-crisis level, bond-financed firms remain financially constrained and operate below their optimal scale. The data support the model's key intermediate prediction: firms with more bond debt maturing during the crisis experience a significantly larger decline in internal funds, measured by net operating working capital and retained earnings.

Finally, Section 5 provides a simple back-of-the-envelope calculation to quantify the macroeconomic relevance of the rollover-rigidity channel. In a counterfactual analysis, I hold the model's calibrated growth wedge between bond- and loan-financed firms fixed while reversing the post-1990

[6] The effect of loan debt is larger during the Global Financial Crisis, but the interaction term with a GFC dummy is not statistically significant.

[7] Some loans in the sample are syndicated. Syndicates, however, are governed by a lead arranger and comprise few creditors relative to dispersed bondholders.

rise in the aggregate bond share back to its pre-1990 level, when bonds and loans were roughly balanced. This exercise implies an aggregate loss of approximately 111,000 jobs, or roughly 4% of the average jobless gap across the three most recent U.S. recessions — a modest but non-trivial contribution.

These findings show that bond markets are not a frictionless substitute for bank credit during stress. How much a firm owes matters for its recovery, but more important is to whom it owes it. The channel also points to concrete policy actions: lowering stressed-period bond spreads relaxes the refinancing-risk channel, while facilitating creditor coordination at the crisis trough preserves the internal funds that bond-financed firms need to rehire.

Related literature. This paper connects three strands of the literature: the real effects of financial frictions on employment, the consequences of corporate debt heterogeneity, and the macroeconomics of employment dynamics during post-crisis recoveries.

A large body of corporate finance evidence establishes that financial constraints amplify employment losses during downturns (Benmelech et al., 2021; Matsa, 2018; Nishesh et al., 2022). Credit supply contractions hit bank-dependent firms hardest: Chodorow-Reich (2014) and Duygan-Bump et al. (2015) show that the withdrawal of bank credit during the 2008 crisis disproportionately reduced employment at small and medium-sized firms, while large firms insulated themselves by accessing bond markets. In a similar vein, Becker and Ivashina (2014) show that access to corporate bond markets provides a vital ex-ante hedge, allowing large firms to substitute away from bank credit supply contractions during crises. I build on these insights by shifting the focus from the acute phase of crises to their medium-term aftermath. Rather than examining how debt structure affects firms during the downturn itself, I study its implications during the recovery. By focusing on this period, I highlight how structural differences between bank and market debt can shape workforce adjustment, even among firms generally viewed as financially insulated.

Beyond credit availability, the contractual structure of debt itself transmits shocks to labour. Covenant violations shift control to creditors who impose immediate cost cuts (Falato and Liang, 2016), and high leverage amplifies the employment response to local demand shocks (Giroud and Mueller, 2017).[8] A prominent identification strategy in this literature exploits the pre-determined maturity schedule of long-term debt as an exogenous shock to rollover risk (Almeida et al., 2012). Under this design, Benmelech et al. (2019) show that firms with more debt maturing during the Great Depression cut employment significantly more than peers, and Benmelech et al. (2021) confirm the same pattern across the full postwar period, consistent with the view that labour carries quasi-fixed financing needs that firms cut when liquidity is scarce. This paper adopts this frame-

[8] See also Michaels et al. (2019) and ElFayoumi (2020) for further evidence that debt structure and leverage shape employment adjustments across different institutional settings.

work but decomposes total maturing debt into its *bank loan* and *bond* components—a distinction the existing literature has not exploited.

The second strand concerns corporate debt heterogeneity. Firms specialise in particular debt instruments, and the bank-bond choice reflects underlying differences in credit quality, information asymmetry, and renegotiation capacity (Rauh and Sufi, 2010; Colla et al., 2013; Denis and Mihov, 2003).[9] The key theoretical distinction is the flexibility-cost trade-off: banks monitor and can renegotiate efficiently in distress, while dispersed bondholders face coordination frictions that make restructuring very costly (De Fiore and Uhlig, 2015; Crouzet, 2018).[10]

These structural models largely abstract from labour adjustment, focusing instead on creditor bargaining, precautionary deleveraging, and physical capital allocation. The closest to my theoretical framework is Crouzet (2018), who develops a quantitative model of corporate debt choice in which the flexibility of bank debt in distress comes at a higher financing cost, and shows that bond-reliant firms engage in deeper precautionary deleveraging during downturns, suppressing investment. My framework builds on the same asymmetry in creditor renegotiability, but differs in three respects. First, it focuses on the labour-market margin rather than on physical capital. Second, it studies the recovery rather than the acute crisis trough, showing that debt maturity walls leave lasting scars on employment after output has recovered. Third, while Crouzet (2018) solves the dynamic ex-ante capital structure problem, my model reduces the debt choice to a simple sorting rule and treats debt composition as predetermined when the crisis hits, in order to isolate the ex-post transmission to payroll. The model in Section 4 is therefore a stylised analytical device that formalises this labour-market mechanism, rather than a more tractable version of Crouzet's framework.

Direct empirical evidence supports this flexibility asymmetry. The empirical literature documents a high frequency of dynamic contract modifications in private debt compared to the stark rigidity of bonds (Demiroglu and James, 2015; Campello et al., 2019; Bidder et al., 2023).[11] Concentrated bank loans frequently undergo smooth maturity extensions and rate restructurings, whereas widely dispersed bonds remain structurally rigid. This rigidity has measurable real consequences. Darmouni et al. (2021) document a "bond lending channel" of monetary policy, and the same

[9] High-credit-quality firms rely primarily on senior unsecured bonds; lower-quality firms layer secured bank debt and subordinated instruments (Rauh and Sufi, 2010). Most firms concentrate in a single dominant debt type at any point in time (Colla et al., 2013).

[10] This view builds on classic theories of intermediation (Berlin and Mester, 1992; Chemmanur and Fulghieri, 1994), which argue that bank debt's informational advantage allows creditors to intervene and restructure before liquidation becomes necessary. Bolton and Scharfstein (1996) formalise the coordination and holdout problems that make renegotiation costly for dispersed bondholders, while Bolton and Freixas (2000) model banks' monitoring and screening advantage in distress.

[11] This active line of research builds on pioneering work demonstrating that creditor dispersion and holdout problems impede out-of-court renegotiations (e.g., Gilson et al., 1990; Asquith et al., 1994).

mechanism appears during the Covid crisis when bond issuance crowded out hiring (Darmouni and Siani, 2025).[12] I complement this literature by showing how the joint determination of debt maturity and instrument type interacts with ex-post renegotiation frictions to make labour a primary margin of adjustment when firms face rigid refinancing walls.[13]

Third, the macroeconomic literature on employment dynamics during crisis recoveries documents that output has rebounded faster than employment in every U.S. recession since 1990 (Jaimovich and Siu, 2020). While the dominant explanations emphasise technological change and labour market frictions,[14] the role of financing conditions has received considerably less attention. In particular, far less is known about whether the *composition* of corporate debt shapes firms' employment responses to aggregate shocks. This paper proposes a complementary capital-structure mechanism that works at the micro-level: when firms with rigid bond debt face rollover pressure during a downturn, they are forced to deleverage rather than preserve labour, and this constraint on rehiring persists into the recovery.

2 Data: corporate debt structure & employment dynamics

The paper uses firm-level data from Compustat and debt composition data from Capital IQ. The focus is on U.S. non-financial firms and covers the years 1998–2024 with an annual frequency.[15] The main variables are firm-level employment and the composition of corporate debt, specifically bond and loan debt.

2.1 Data construction

The Compustat universe consists primarily of publicly listed U.S. firms, and covers approximately 25–30% of all U.S. non-farm corporations. These firms represent a substantial share of the U.S. economy, accounting for roughly 40–50% of overall economic activity, and employing approximately 30% of the U.S. workforce. In terms of aggregate outstanding debt, the sample represents 13.3%

[12] See also Benmelech et al. (2011) and Karagiannis and Thomakos (2020) on the real effects of bond financing under stress.

[13] Li (2025) show that bank and bond debt interact strategically as complements rather than simple substitutes. Debt maturity and instrument type are jointly determined: firms seeking longer maturities tilt toward bond finance to reduce refinancing risk in normal times (Nguyen and Wald, 2022; Chen et al., 2021), but this same feature exposes them to rollover risk when bond markets freeze (Jungherr et al., 2024; Fabiani et al., 2024).

[14] A prominent explanation is the routine-biased technological change (RBTC) hypothesis. The argument is that recessions facilitate organisational restructuring and technology adoption, allowing firms to replace routine tasks and older production methods. As output recovers but labour demand remains subdued, employment lags the broader recovery, generating persistent employment shortfalls and job polarisation (Goos et al., 2014).

[15] The reason for yearly data is the fact that employment data is only available at an annual frequency.

and 51.8% of total U.S. loan and bond debt as of 2024.[16]

The Capital IQ debt structure dataset provides detailed instrument-level information for each U.S. firm filing, including outstanding drawn balances, instrument type, contractual maturity, seniority, and interest rate characteristics.[17] I also treat non-USD instruments with missing exchange rate information as missing and exclude them from aggregate calculations.

I merge the Capital IQ debt data with Compustat firm-level data using the GVKEY identifier, restricting the analysis to firms within the Compustat annual universe. Following standard literature, firms in the financial, utility, and public administration sectors (Standard Industrial Classification (SIC) codes 4900–4949, 6000–6999, and $\geq$ 8999) are excluded, as these industries are subject to distinct regulatory and capital requirements that distort financing and employment dynamics. To ensure the integrity of the core analysis, I require non-missing data for primary variables, specifically total debt and employment. Following Colla et al. (2013), I drop firm-year observations where total debt reported in Compustat deviates from Capital IQ by more than 10%, effectively purging the dataset of significant reporting inconsistencies. The sample is further restricted to established firms by requiring more than 10 employees, at least 1 million USD in total assets, and an annual asset growth rate below 100%. These filters ensure the results are not driven by micro-entities or volatile startups. Finally, observations with book or market leverage ratios outside the [0, 1] range are removed to eliminate accounting noise. The final unbalanced panel consists of 6,554 firms and 52,451 firm-year observations.[18]

The main debt variables are constructed as follows. *Loan debt* is defined as the sum of revolving credit facilities (drawn balances only), term loans, bank overdrafts, and mortgage loans. Undrawn loan facilities, including the unused portions of revolving credit facilities and term loan commitments, are excluded as they do not represent realised debt obligations. Instead, they are captured in a separate series on undrawn loan facilities.[19] Commercial paper is excluded from this measure because its regulatory 270-day maturity ceiling makes it a short-term financing instrument, whereas the analysis focuses on long-term debt. *Bond debt* comprises bonds and notes — including debentures and notes payable — together with mortgage bonds, which account for under one per-

[16]The aggregate numbers are 690,543 million USD of loan debt and 4,417,448 million USD of debt securities, and come from the Federal Reserve's Z.1 release (FRED series NCBLL and NCBDBIQ027S).

[17]The main information sources the Capital IQ data is based on are the company's 10-K and 8-K reports.

[18]Tables A1, A2, and A3 in Appendix A provide more detail on the number of firms over time and by sector, while Figure A3 in Appendix A shows the entry and exit dynamics of firms in the sample. Mergers and acquisitions are not taken into consideration.

[19]Note that the debt data are classified by *instrument* type rather than *lender* type. Consequently, some loans, particularly syndicated loans that can subsequently be traded on secondary markets, may ultimately be held by non-bank institutions rather than depository institutions. Since my analysis focuses on the contractual characteristics of debt instruments, especially their renegotiability, rather than lender-specific effects, this distinction is not central. The results should therefore be interpreted as reflecting the properties of the debt instruments themselves rather than those of the institutions that hold them.

cent of total bond dollar volume in this sample. Both the loan and bond measures exclude capital leases, trust-preferred securities, and a residual "other borrowings" category, as well as financial-institution-specific liabilities (letters of credit, repurchase agreements, Federal funds borrowings, and Federal Home Loan Bank advances).

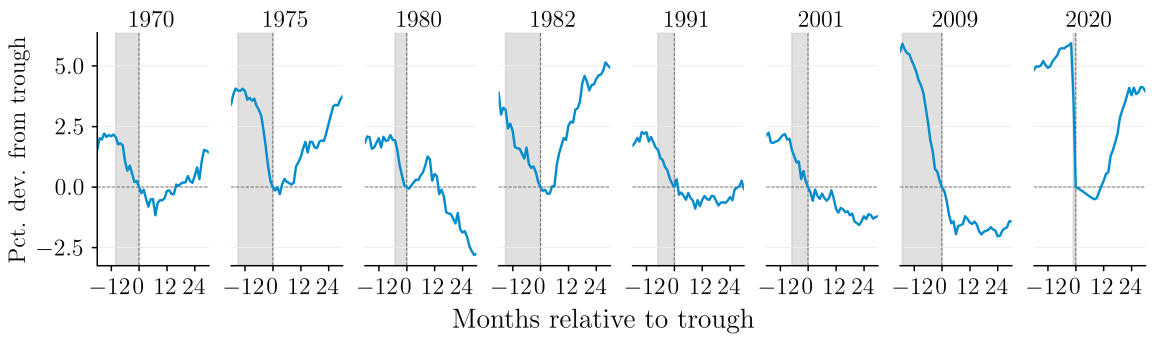
2.2 Employment recovery and debt composition: two structural shifts

Both the employment recovery after recessions and the debt composition of firms underwent a structural shift in the 1990s, with markedly slower employment recoveries observed in recent decades and bond debt playing an increasingly important role. The upper panel in Figure 1 shows the employment-to-population ratio around all National Bureau of Economic Research (NBER) defined recession periods starting in the 1970s. While in the 1970s and 1980s employment recovered relatively quickly after recessions and caught up to pre-crisis level (V-shape), this has changed since the 1990s, with a much slower recovery of employment and a lower new steady state post-crisis. The phenomenon of the slow employment recovery is referred to as a "jobless recovery" and represents a delinking of aggregate output and employment dynamics during the post-trough phase of the business cycle. The lower panel in Figure 1 shows the *bond-debt* to *loan-debt* ratio, measured as the debt securities to loans ratio. While the ratio between bonds and loans has on average been slightly below one (0.9) before the 1990s, i.e. balanced, it jumped to 1.5 for the post-1990 period. The slow recovery in employment is also observed in the firm-level data, implying that the macro-phenomenon is present at the micro-level.[20]

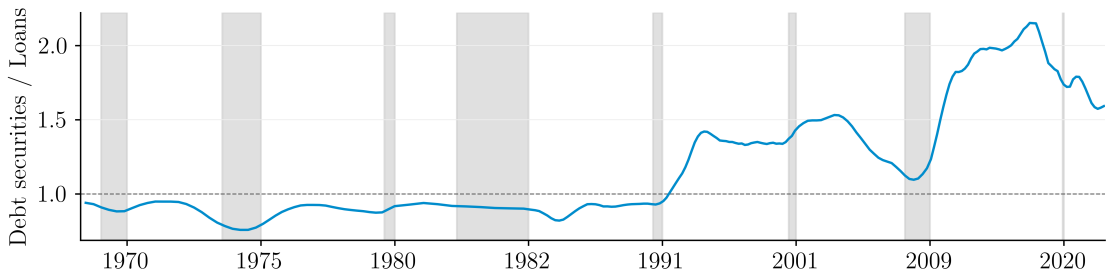
The comovement of these two trends raises the question of whether the shift from loan to bond debt financing can help explain the change in employment dynamics. Figure 2 shows that firms with a higher share of loan debt experience stronger employment growth, whereas firms with a greater reliance on bond debt exhibit weaker growth. A natural first explanation is that younger firms — typically more dependent on loan financing due to limited access to bond markets — also tend to grow faster. However, this explanation appears incomplete. Although firm age is somewhat negatively correlated with the loan-debt share, the bond-debt share remains largely stable across firm-age quintiles. Additional patterns further clarify this relationship: both small and large firms rely more heavily on debt securities (bonds) than on corporate loans, and higher-rated firms predominantly issue bonds, while lower-rated firms depend more on loans.[21]

[20] A replication of the macro-level jobless recovery graph with the annual micro-level data can be found in Figure A4 in the appendix. Figure A5 shows the total debt and its composition over time based on the micro data.

[21] See Figure A6 for the relationship between debt composition and firm age, Figure A7 for differences by firm size, and Figure A8 for variation by credit rating, all in Appendix A.



(a) Employment development around recession periods



(b) Debt securities / Loans ratio

Figure 1: Structural shift in employment recovery and debt composition around the 1990s

Notes: The figure depicts employment dynamics around all NBER-defined recession episodes since the 1970s. The upper panel shows the percentage deviation of the employment-to-population ratio from its respective crisis trough, with grey shaded areas indicating NBER recession periods. Note that the downward slope in the 1980 recovery refers already to the 1982 crisis. The Covid-19 crisis is cut from below for visibility. The lower panel displays the debt securities / loans ratio, where loans include all corporate loan liabilities, while debt securities comprise corporate bonds (FRED series: NCBDBIQ027S / NCBLL). The time axis is adjusted to align with the crisis-centred panels above. The employment dynamics for the Covid-19 period are cut from below for visibility. *Source(s):* U.S. Bureau of Labor Statistics; Fed Board (Z.1 Financial Accounts); author's calculations.

2.3 Corporate bonds versus loans: micro-level characteristics

Corporate bonds and loans are the most important source of external financing for U.S. non-financial firms. Panel A in Table 1 shows summary statistics of different types of debt as a share of total capital. Besides equity (62% of total capital), loans and bonds make up the largest share of total capital, with 15% and 19% respectively. The share varies substantially across firms, with some firms financing themselves with more than 60% loan debt, or 70% bond debt. The table also shows that the average bond debt share is higher than the average loan debt share, suggesting that bond debt financing is more prevalent among firms in my sample. Classifying firms according to their primary source of debt financing — defined as either bond debt or loan debt accounting for more than 50% of total debt — reveals that over 60% of firms rely on a combination of both financing sources, with the secondary debt type still representing a substantial share (more than 10% of total debt). 17% of firms in the sample rely predominantly on bond financing, and 11% on

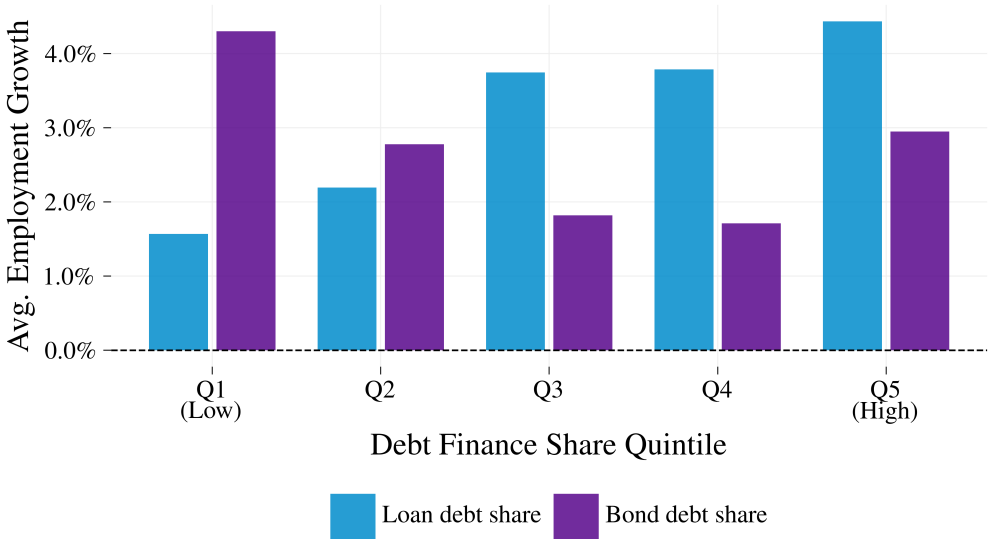


Figure 2: Employment growth by debt composition quintiles

Notes: The figure shows the contemporaneous relationship between firm-level year-on-year employment growth and debt composition, where bond and loan debt shares are defined as bond and loan debt, respectively, divided by total firm debt. These shares are not perfectly negatively correlated because firms can also hold other liabilities, including commercial paper, capital leases, and other borrowings. Nonetheless, such debt categories represent only a minor share of total firm debt. The data starts in 1998. *Source(s):* Compustat; Capital IQ; author's calculations.

loan financing. Hence, most firms are not purely bond- or loan-financed, which is why the empirical analysis focuses on the type of debt that matures rather than on a firm's overall financing type.[22] On the asset side, Panel B of Table 1 shows that the average firm holds 14% of its assets in cash, 26% in net property, plant, and equipment (PPE), and 20% in intangible assets.

Table 2 presents a simple correlation analysis between different firm-level characteristics and corporate debt, focusing on bonds and loans. The results are in line with the literature: more profitable firms rely less on debt. However, the two debt types diverge along several dimensions. Tangibility and being rated matter more for bond debt, reflecting the importance of hard collateral and credit-market access for bond debt issuance. Firm size shows opposite signs across the two types. Larger firms hold fewer loans but more bond debt (sales), consistent with firms "graduating" from relationship-lending to corporate debt markets as they grow. Together, these patterns suggest that loans and bonds are not simply substitutes, but are shaped by distinct firm characteristics — relationship factors for loans, and collateral and market-access factors for bonds.

[22] See Table A5 in Appendix A for a more detailed breakdown of the sample by financing type. Table A6 in Appendix A shows a cross-correlation table between liability and asset types.

Table 1: Summary statistics of corporate debt and asset structure

	Mean	5th Perc.	Median	95th Perc.
Panel A: Debt structure (share of total capital)				
Total Capital	3503.45	6.05	405.85	13402.30
Equity (Book value)	0.62	-0.02	0.66	1.00
Total Debt	0.39	0.01	0.35	1.02
Loan Debt	0.15	0.00	0.06	0.62
Revolving Credit	0.06	0.00	0.00	0.33
Term Loans	0.08	0.00	0.00	0.51
Bond Debt	0.19	0.00	0.05	0.71
Senior Bonds and Notes	0.16	0.00	0.01	0.66
Subordinated Bonds and Notes	0.03	0.00	0.00	0.21
Commercial Paper	0.00	0.00	0.00	0.00
Capital Leases	0.03	0.00	0.00	0.17
Other/Remainder	0.02	-0.02	0.00	0.09
Panel B: Asset structure (share of total assets)				
Total Assets	3906.01	10.84	560.28	19539.59
Cash	0.14	0.00	0.08	0.51
PPE	0.26	0.02	0.18	0.77
Receivables	0.14	0.00	0.11	0.37
Inventories	0.12	0.00	0.07	0.40
Intangible Assets	0.20	0.00	0.12	0.65

Notes: *Panel A* shows the debt types as a share of total capital. *Equity* going negative represents leveraged/distressed firms. Since *Total Debt* is the direct mechanical counterpart of equity, i.e. $TotalDebt = TotalCapital - TotalEquity$, it can exceed 100% of total capital. For the *Other/Remainder* there can be small rounding errors. *Panel B* shows the asset types as a share of total assets. *PPE* is net property, plant, and equipment. *Source(s):* Compustat; Capital IQ.

3 Empirical strategy & results

The descriptive patterns presented in Section 2 suggest that firms with a larger share of bond debt experience weaker employment growth during recovery periods. This section develops an empirical strategy to isolate the causal effect of debt structure on employment dynamics. The central testable hypothesis is:

> *Conditional on facing the same shock, firms financed predominantly through bond debt exhibit larger and more persistent employment adjustments than similar firms financed through loans.*

Figure 3 looks at the relationship between employment growth and debt composition in a simple correlation analysis across economic cycles after the 1990s. The figure shows the year-on-year firm-level employment growth during recession and recovery periods, plotted against the bond and loan debt shares. The left panel focuses on recession periods, while the right panel looks at the three years following each recession, i.e. the recovery periods. The first observation is that debt composition

Table 2: Determinants of debt structure

	(1)	(2)	(3)
	Total debt	Loans	Bond debt
Log firm age	-0.020***	-0.013***	-0.007***
	(0.003)	(0.002)	(0.002)
Rated (dummy)	0.101***	0.015***	0.089***
	(0.006)	(0.004)	(0.005)
Log employment	-0.005*	-0.007***	-0.005**
	(0.003)	(0.002)	(0.002)
Log sales	-0.006**	-0.009***	0.010***
	(0.002)	(0.002)	(0.002)
Tobin's Q	0.005***	-0.002**	0.006***
	(0.001)	(0.001)	(0.001)
Operating profitability	-0.066***	-0.014***	-0.056***
	(0.008)	(0.005)	(0.006)
Tangibility	0.116***	-0.004	0.061***
	(0.013)	(0.010)	(0.011)
Industry-Year FE	Yes	Yes	Yes
N obs	51393	51393	51393
N clusters	6373	6373	6373
R^2 (within)	0.026	0.024	0.001

Notes: The dependent variable is indicated in the column headers. *Total debt* is the sum of all debt types, while *Loans* is defined as the sum of revolving credit facilities (drawn balances), term loans, bank overdrafts, and mortgage loans and *Bond debt* comprises bonds and notes (incl. debentures and notes payable), as well as mortgage bonds. Shown is the contemporaneous relationship between debt and controls. *Rated* is a dummy variable indicating whether a firm has a credit rating. *Tobin's Q* is the ratio of market value of assets to book value of assets. *Operating profitability* is defined as revenues minus cost-of-goods-sold divided by total assets. *Tangibility* is the ratio of net property, plant, and equipment to total assets. All control variables are winsorised at the 1st/99th percentiles. Asterisks indicate significance at the 1%, 5%, and 10% level (***$p < 0.01$; **$p < 0.05$; *$p < 0.1$). Standard errors in parentheses and clustered at the firm-level. The constant term is omitted from the table. *N obs* indicates the number of firm-year observations, while *N clusters* indicates the number of clusters. *Source(s):* Compustat; Capital IQ; author's calculations.

does not appear to matter much during recessions, as firms experience negative employment growth regardless of their bond or loan debt share. The recovery period, however, reveals a clearer pattern. Firms with higher loan debt shares tend to experience stronger employment growth, while those with higher bond debt shares show weaker employment growth, suggesting that the composition of corporate debt has an impact on employment dynamics at the firm level. This pattern motivates the focus on recoveries: during the crisis, all firms cut employment in response to the common shock, whereas in the recovery firms want to rehire, which is when financing constraints bind. As this graph is descriptive rather than causal, the next section presents a formal econometric analysis.

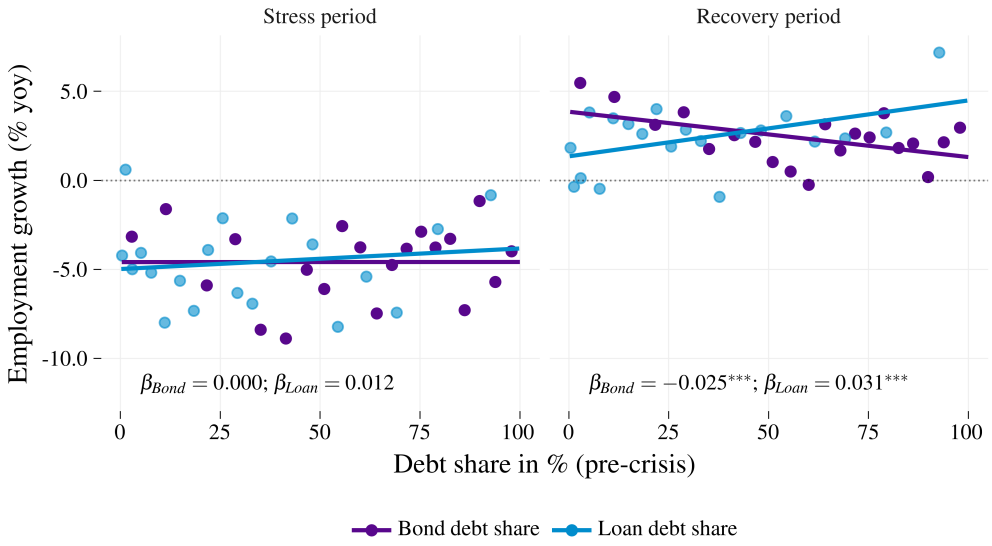


Figure 3: Debt composition and employment sensitivity

Notes: This figure plots mean employment growth against 20 quantile-based bins (ventiles) of bond and loan debt shares. Each point shows the average employment growth for firms in that bin. Regression slopes are calculated on the unbinned firm-level data. The data excludes unrated firms, and focuses on the *Dot-com bubble*, the *GFC*, and the *Covid-19* crisis. Left and right panels distinguish between stress and recovery regimes, where *stress* periods are NBER defined recession years and *recovery* periods are the three years following each recession. Debt shares are a snapshot in the respective year prior to the crisis year. Data since 1998. *Source(s):* Compustat; Capital IQ; author's calculations.

3.1 Identification strategy

The data sample spans three crisis episodes: Dot-com (2001), Global Financial Crisis (GFC) (2008–2009), and Covid-19 (2020). The main identifying variation comes from cross-sectional differences in firms' debt structures. Table 3 defines pre-crisis, crisis, and recovery windows for each episode. The recovery period is defined as the three years following the crisis-trough.[23] While all three episodes were followed by recoveries characterised by relatively weak employment growth, they differed in the extent to which firms' financing conditions came under pressure. The Dot-com downturn was concentrated in technology and equity markets, whereas the GFC and the Covid-19 recession generated broader disruptions to corporate financing and refinancing conditions. The Covid-19 episode prompted support for corporate credit markets, including the Federal Reserve's interventions in corporate bond and lending markets (more details in Section 3.2). At the same time,

[23]The turnaround literature generally views recovery as a multi-year process. Earlier studies often use a two-year window, while broader turnaround-cycle approaches extend this to four years. For example, Sudarsanam and Lai (2001) define recovery as returning to a positive Z-score within two years after distress, whereas Smith and Graves (2005) classify firms as recovered if they transition from two distressed years to two healthy years over a four-year cycle. More recent work, such as DesJardine et al. (2019), adopts a dynamic perspective, measuring recovery as the time required for a firm's stock price to return to its pre-crisis level, reinforcing the multi-year nature of the process. For this study, the baseline is set to three years, as on aggregate it takes the firms in my sample approximately 2–3 years to return to pre-crisis sales and earnings. Robustness tests use windows of two and four years.

Table 3: Crisis episodes

	Pre-crisis	Crisis	Recovery
Dot-com	2000	2001	2002–2004
Global financial crisis	2007	2008–2009	2010–2012
Covid-19	2019	2020	2021–2023

Notes: Pre-crisis years (also referred to as *snap*shot years) are the last year before the crisis onset, used to record predetermined debt structure. Crisis periods follow NBER recession dates. Recovery periods are defined as the three years following the end of each crisis period.

these episodes span a period during which market-based debt financing had become increasingly important relative to traditional bank lending, providing a useful setting to study how differences in debt structure shape firms' employment decisions during recoveries.

The analysis exploits firms' pre-determined long-term debt maturity schedules as a source of plausibly exogenous variation in refinancing needs to estimate the effect of debt structure on employment dynamics. Firm-level debt composition could be endogenous to employment outcomes. For instance, firms anticipating a severe downturn or a need to shed workers might alter their debt structure beforehand. To rule out this reverse causality, the empirical design relies on long-term debt issuance decisions made several years in advance. Because the amount of debt coming due during the crisis and recovery periods is largely predetermined, it is unlikely to reflect contemporaneous investment opportunities, local demand conditions, or anticipatory balance sheet adjustments. Short-term debt and new issuances undertaken in anticipation of these episodes are therefore excluded from the analysis.[24]

While exploiting pre-determined maturity schedules addresses the endogeneity of overall debt levels around the crisis, estimating the differential impact of debt *type* requires a further identifying assumption. Specifically, I assume that the composition of the maturing long-term debt — namely, the reliance on bonds versus loans — is uncorrelated with unobserved factors that determine the firm's post-crisis employment recovery. In other words, the "treatment" of facing a maturity wall composed of bonds rather than loans is assumed to be exogenous conditional on observable firm characteristics and fixed effects. This identification strategy builds on the methodology proposed by Almeida et al. (2012) and used in various subsequent studies (e.g., Benmelech et al., 2019, 2021; Jungherr et al., 2024).

Crucially, unlike prior studies that aggregate all maturing liabilities to measure financial constraints (e.g., Benmelech et al., 2021), this paper decomposes the refinancing shock into *maturing*

[24]The empirical setup defines maturing debt based on a pre-determined snapshot year, which implicitly assumes that debt is held to maturity rather than repaid early. In practice, debt maturity schedules tend to be sticky because prepayment is costly, and during crises refinancing opportunities become severely constrained. Consequently, the pre-crisis maturity structure provides a reasonable proxy for firms' rollover burden.

bonds versus *maturing loans*.[25] This allows a direct test of whether employment recovery is affected specifically by the renegotiation frictions and coordination failures inherent in dispersed market debt (Crouzet, 2018; De Fiore and Uhlig, 2015). If bonds force rigid repayment while loans can be rolled over or renegotiated, firms with large maturing bond obligations should cut employment significantly more, while firms with large maturing loans should not face the same constraint.

3.2 Setup & regression specification

The primary outcome variable is firm-level employment, measured using the symmetric growth rate.[26] The main independent variable measures firms' debt composition. The model is

$$\text{EmploymentGrowth}_{i,t} = \beta\, \text{DebtStructure}_{i,t} + \Gamma\, X_{i,t} + FE_{j,t} + \text{Error}_{i,t},$$

where *DebtStructure* is defined below, X is a set of control variables, and FE are industry-year fixed effects.

Maturing debt. The main specification of *DebtStructure* focuses on the *amount of maturing debt* during the crisis and recovery periods, which captures the *intensity* of the refinancing shock. The two key variables are the amount of maturing bonds — $BondsMaturing_{i,t}$ — and maturing loans — $LoansMaturing_{i,t}$ —, defined as the total amount of long-term bond debt and loans coming due in year t. Only debt issued at least a year before the crisis onset is included to ensure the timing of issuance predates the crisis decision window. These are then normalised by total assets to capture the refinancing burden relative to firm size. τ is the snap-year, i.e. the year prior to the crisis period. The two variables are defined as

$$MB_{i,t} = \frac{\text{BondsMaturing}_{i,t}}{\text{TotalAssets}_{i,\tau}} \quad \text{and} \quad ML_{i,t} = \frac{\text{LoansMaturing}_{i,t}}{\text{TotalAssets}_{i,\tau}}.$$

Bond-debt share. A second variable is the *Bond-debt share* ($\lambda_{i,t}$), defined as the share of bonds in the firms' long-term debt portfolio relative to the sum of bonds and loans. The denominator is purposefully chosen not to include other types of debt, so that λ captures the *composition* between the two instruments abstracting from leverage level and other liabilities. λ is defined as

$$\lambda_{i,t} = \frac{\text{BondDebt}_{i,t}}{\text{BondDebt}_{i,t} + \text{LoanDebt}_{i,t}}.$$

[25] See Table A5 in Appendix A for a balancedness table. See also Table A7 in Appendix A

[26] The *symmetric growth rate* is defined as $e^g_{i,t} = (Emp_t - Emp_{t-1})/[0.5 \times (Emp_t + Emp_{t-1})]$. The advantage of the symmetric growth rate over the log-difference is that it bounds extreme values and accommodates firm exit organically (Chodorow-Reich, 2014). In a robustness exercise the log-difference is used to measure employment growth — the results do not change. For information on actual firm exit, see Table A3 and Table A4 in Appendix A.

Regression specification and identification concerns. Estimating the causal effect of debt structure on employment dynamics needs a careful empirical set-up, as several possible identification challenges exist.

Controls. A primary concern is that firms accessing the bond market are fundamentally different from those relying on loans. Firms financed primarily with corporate bonds tend to be larger, older, and more capital-intensive. If older or larger firms naturally adjust their headcount differently during recoveries — for instance, because young firms grow faster — the estimates could be biased. To address this, the regressions control for pre-crisis firm age, total assets, and additional pre-crisis firm-level controls listed below. Furthermore, because credit quality can dictate access to bond markets, unrated firms might be different from rated firms. I mitigate this by including a credit-rating dummy which is equal to one if the firm is covered by S&P Ratings.[27] The baseline specification controls are *log total assets*, *log firm age*, *rating-dummy*, *log employment*, *sales growth*, *book leverage*, *Tobin's q*, *liquidity*, and *profitability*.[28] These controls capture key firm characteristics relevant for employment adjustment: leverage measures indebtedness; Tobin's q proxies for investment opportunities; liquidity captures firms' ability to buffer refinancing shocks; sales growth reflects demand conditions; and profitability measures operating performance.[29]

Fixed-effects. The baseline specification includes 3-digit SIC industry-year fixed effects (FE). These FE control for all time-varying industry shocks, exploiting the variation in the debt structure across firms within the same industry and year. The economic rationale for relying on industry-year FE rather than firm FE is that the corporate debt structure is highly persistent over time (Lemmon et al., 2008). Firms generally do not undergo a complete shift from loan-debt financing to bond-debt financing, or vice versa.[30] Firm fixed effects would therefore be too restrictive and absorb the vast majority of the identifying variation, and lead to noisy estimations.

Strategic self-selection. Because this persistence rules out firm fixed effects, it also raises a sharper version of the selection concern: debt composition itself could reflect a firm's broader strategic orientation, with firms inherently inclined toward flexible labour adjustment simply choosing more flexible financing to match. Under profit maximisation, however, this story implies that the

[27] The category in which the rating dummy equals one comprises firm-year observations classified as "Not Rated", as empirically this seems to be more important than the actual rating itself, e.g., having a rating above or equal to investment grade.

[28] All variables are winsorised at the 1st and 99th percentiles. Book leverage is measured as total debt over total assets; Tobin's q is defined as the sum of market value plus total debt over total assets; liquidity is cash and short-term investments over total assets; and profitability is measured as revenues minus cost-of-goods-sold over total assets.

[29] Table B2 in Appendix B.3 introduces the control variables step-by-step.

[30] The *firm debt-type* persistence is above 80% year-on-year in the data. This within-firm persistence is compatible with the large rise in the aggregate bond share shown in Figure 1. First, year-on-year persistence still allows gradual shifts over longer horizons. Second, the aggregate shift took place mainly in the 1990s, largely before the start of the sample in 1998. Third, the aggregate composition also changes through the extensive margin, as firms enter and exit or graduate from loans to bonds as they grow.

resulting employment cuts should be part of an efficient, performance-preserving strategy. Instead, maturing bond debt has a significant negative effect on revenue growth during the recovery relative to loan debt, which is difficult to reconcile with the view that employment cuts reflect an optimal strategic choice rather than a binding constraint (see Table B7 in Appendix B.3).

Credit demand versus credit supply. A classic identification challenge is disentangling credit supply from credit demand. Does employment grow slowly because the firm faces depressed demand for its products, or because it demands credit but is denied by rigid markets? Because the comparison here is the loan-debt versus bond-debt margin rather than total debt levels, pure aggregate demand shocks are absorbed by industry-year fixed effects and controls for pre-crisis sales growth.

Floating versus fixed interest rates. Loans and bonds can differ mechanically in their interest rate structures. Loans are more likely to carry floating interest rates, whereas bonds are predominantly issued at fixed rates. During economic downturns and recoveries, central banks generally lower interest rates. Consequently, firms holding loan debt may experience an automatic cash-flow boost as interest expenses fall, while those holding bond debt remain locked into high, fixed coupons (Ippolito et al., 2018; Darmouni et al., 2021). To ensure the employment recovery gap is not driven by this mechanical "floating-rate channel", additional specifications control for the share of debt that carries a floating interest rate. While the coefficient is slightly positive, it is statistically indistinguishable from zero. The main results remain unchanged, and the inclusion of that control only modestly attenuates the estimated coefficient on maturing debt, implying a somewhat smaller effect in magnitude (Table B1 in Appendix B.3).

Fed credit facilities. During the Covid-19 crisis, three types of emergency credit programmes were implemented: the *Paycheck Protection Program* (PPP), administered by the Small Business Administration with liquidity support from the Federal Reserve, the Federal Reserve's *Main Street Lending Program* (MSLP), and its corporate bond purchasing programmes: the *Primary Market Corporate Credit Facility* (PMCCF) and the *Secondary Market Corporate Credit Facility* (SMCCF).[31] Since the corporate bond facilities would attenuate the negative employment effects of maturing bonds, they do not threaten the identification. However, the MSLP could potentially amplify the positive employment effects of maturing loans, because the borrowers were mandated to make "commercially reasonable efforts" to retain employees. This mandate could artificially inflate the employment growth trajectories of loan-financed firms. To account for this channel, I conduct a robustness analysis by including a dummy variable identifying firms eligible for the MSLP during the Covid recession and interacting it with the loan-debt variable. The coefficient on the

[31] The PPP was for small businesses with less than 500 workers, the MSLP for firms with less than 15k employees or annual revenues below $5 billion, and the PMCCF and SMCCF for investment grade bonds and recently downgraded bonds, the so-called *fallen angels*. More details on the programmes are in Appendix B.

interaction term is slightly positive but statistically insignificant, suggesting that MSLP eligibility did not materially affect the relationship between maturing loans and employment growth.

Timing. Because the data are annual, crises that begin mid-year can create measurement error when firms have different fiscal year-ends. 72% of firm-year observations report in December and less than 16% in the first half of the year. As a result, both debt maturity measures and employment growth may be misaligned with the timing of the crisis. I address this concern with two robustness checks: first, by constructing debt maturities on a calendar-year rather than fiscal-year basis, and second, by interacting the debt variables with an indicator for December reporting.[32]

Routine-Biased Technological Change (RBTC) and capital substitution. The jobless recovery literature emphasises that slow employment rebounds are driven by the automation of routine tasks, a process known as *Routine-Biased Technological Change* (Jaimovich and Siu, 2020). If bond-debt heavy firms are disproportionately concentrated in routine-intensive industries, they may shift from labour to capital during recessions for technological, rather than financial, reasons. The inclusion of industry-year fixed effects largely absorbs this concern by absorbing industry-specific, time-varying trends in automation and routine task intensity. As a result, the estimates are not driven by differential exposure to RBTC across sectors, but instead reflect within-industry-year variation in financial conditions. Section 3.3.2 looks at capital more closely.

3.3 Empirical results

The dataset for the empirical analysis is a *snapshot* design, where the data is collapsed to a single cross-sectional observation per firm and crisis episode. For each crisis k, the pre-crisis snap year defines baseline debt structure and firm controls. For each episode, cumulative employment growth is measured either over the full crisis-and-recovery window — from the year preceding the crisis onset, through the end of the recovery period — or over the recovery window alone — from the crisis period through to the end of the recovery period.

3.3.1 Employment response to maturing debt

This section presents the main empirical results of the paper. All controls are kept constant at their respective snap-year value to ensure they are predetermined. The model is

$$e^{g}_{i,k} = \beta_1 MB_{i,k,\tau} + \beta_2 ML_{i,k,\tau} + X_{i,k,\tau}\Gamma + \alpha_{j,\tau} + \varepsilon_{i,k}. \tag{1}$$

For each crisis k, $e^{g}_{i,k}$ is the cumulative employment growth and $MB_{i,k,\tau}$ and $ML_{i,k,\tau}$ are the sum of debt maturing during the stress window scaled by pre-crisis assets. $X_{i,k,\tau}$ is a vector of control

[32] Table B3 in Appendix B.3 contains the results for all these different additional specifications.

variables, and $\alpha_{j,\tau}$ are industry-year fixed effects. Given this set-up, the year is essentially capturing the crisis, since there is a maximum of one observation per firm-year. Tables 4 and 5 show the results for total maturing debt, and the bond and loan debt separately.

For each of the two tables, columns (1) and (2) show the results for cumulative employment growth over the entire crisis episode (*Episode*), while columns (3) and (4) show the results for cumulative employment growth over the recovery period only (*Recovery*). Moreover, columns (1) and (3) use the amount of maturing debt summed up over the crisis episode (*LT debt due, episode*), while columns (2) and (4) use the amount of predetermined debt maturing in the recovery period only (*LT debt due, recovery*), which will be the preferred specification.

Table 4 confirms previous results from the literature, showing that a higher amount of predetermined maturing debt is associated with lower cumulative employment growth. The effect is stronger when looking at cumulative employment growth over the entire crisis episode. This pattern suggests that the effect of maturing debt on employment growth is more pronounced during the stress period than during the recovery period, which is in line with the idea that firms are more likely to cut employment in response to refinancing pressures during periods of acute financial distress. The coefficients are interpreted as follows: a one-unit increase in maturing debt, i.e., a 100% increase in maturing debt relative to assets, is associated with an approximately 26-percentage-point decline in cumulative employment growth over the entire crisis episode, and an approximately 11-percentage-point decline over the recovery period alone.[33]

Table 5 shows the results for the split between maturing bond debt and maturing loans. Maturing bond debt has a significant negative effect on cumulative employment growth in the recovery period (columns (3) and (4)), while maturing loans do not have a significant effect, with the coefficient being slightly negative but very close to zero. A one-unit increase in maturing bonds — that is, a 100% increase in bond debt relative to assets — is associated with an approximately 21-percentage-point decline in cumulative employment growth over the recovery period. While equality of the coefficients cannot be rejected for the entire crisis episode, the bond-debt coefficient is significantly more negative than the loan-debt coefficient for debt maturing during the recovery period ($p < 0.05$).

When considering employment growth over the entire crisis period (columns (1) and (2)), the effect becomes even larger in magnitude and remains significant for loans as well. This pattern is consistent with the broader literature, which shows that high leverage and debt overhang generally have a negative impact on employment during economic downturns. The economic magnitude,

[33] The symmetric growth rate is bounded in $[-2, 2]$ and is interpreted as a log-growth rate; for larger values, it is therefore somewhat smaller in magnitude than the exact percentage change. It additionally takes the value -2 for firm exit and $+2$ for firm entry, where the standard percentage change is undefined. The standard deviation of the debt shares is around 0.1, so a one-standard-deviation increase in maturing debt is associated with a 2.6-percentage-point and 1.1-percentage-point decline in cumulative employment growth, respectively.

Table 4: Total predetermined debt

	Cumulative employment growth			
	(1)	(2)	(3)	(4)
	Episode	Episode	Recovery	Recovery
LT debt due, episode	-0.267***		-0.113*	
	(0.078)		(0.058)	
LT debt due, recovery		-0.270***		-0.104*
		(0.079)		(0.060)
Industry-Year FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
N obs	2977	2977	2772	2772
N clusters	2197	2197	2066	2066
R^2 (within)	0.147	0.147	0.089	0.088

Notes: The dependent variable is cumulative employment growth, measured as the symmetric growth rate. The column titles indicate over which period the cumulative employment growth is measured — *Episode* indicates the entire crisis episode, while *Recovery* indicates the recovery period. *LT debt due* is the amount of predetermined long-term debt maturing during the crisis episode and recovery period, scaled by pre-crisis (snapshot-year) total assets. *LT* denotes long-term, *episode* and *recovery* indicate the period over which the cumulative sum is computed. The estimated model is defined in Equation (1). Controls include log total assets, log firm age, rating-dummy, log employment, sales growth, Tobin's Q, liquidity, profitability, and book leverage. All control variables are measured as of the snapshot year τ and winsorised at the 1st/99th percentiles. Asterisks indicate significance at the 1%, 5%, and 10% level (***$p < 0.01$; **$p < 0.05$; *$p < 0.1$). Standard errors in parentheses and clustered at the firm-level. The constant term is omitted from the table. *N obs* indicates the number of firm-year observations, while *N clusters* indicates the number of clusters. *Source(s):* Compustat; Capital IQ; author's calculations.

however, is smaller for loan debt compared to bond debt. This difference highlights that it is not simply the need to refinance that forces firms to shed workers, but depends on the debt type — consistent with the rigidity and lack of renegotiability inherent in arm's-length bonds. Since most firms hold both types of debt (Section 2), the effect reflects the type of debt maturing at a given time rather than a categorical difference between bond- and loan-financed firms.

Note that these estimates likely represent a lower bound of the true causal effect. This underestimation stems from two distinct sources of sample selection. First, the estimates are conditional on firm survival. High levels of total corporate debt can force firms into severe financial distress, leading them to file for bankruptcy, liquidate, or be acquired, thereby dropping out of the sample entirely. Because these discontinued firms experience the most extreme extensive-margin employment losses (i.e. a -100% drop in workforce), excluding them attenuates the estimated negative effect. Second, the corporate finance literature establishes a clear pecking order based on credit quality. Firms that successfully access the bond market are, on average, of higher credit quality than those reliant on loans. While the set of covariates absorbs a significant portion of the structural differences between bond- and loan-financed firms, it is impossible to definitively rule out all unob-

Table 5: Predetermined bond- and loan-debt

	Cumulative employment growth			
	(1)	(2)	(3)	(4)
	Episode	Episode	Recovery	Recovery
Bond debt due, episode	-0.320***		-0.180**	
	(0.112)		(0.082)	
Loans due, episode	-0.232**		-0.054	
	(0.093)		(0.070)	
Bond debt due, recovery		-0.350***		-0.210**
		(0.117)		(0.088)
Loans due, recovery		-0.224**		-0.025
		(0.092)		(0.069)
Industry-Year FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
p(Bond < Loan)	0.248	0.172	0.095	0.029
N obs	2977	2977	2772	2772
N clusters	2197	2197	2066	2066
R^2 (within)	0.147	0.147	0.088	0.088

Notes: The dependent variable is cumulative employment growth, measured as the symmetric growth rate. The column titles indicate over which period the cumulative employment growth is measured — *Episode* indicates the entire crisis episode, while *Recovery* indicates the recovery period. *Bond debt due* and *Loans due* measure the amount of predetermined long-term debt maturing during the crisis episode and recovery period, scaled by pre-crisis (snapshot-year) total assets; *episode* and *recovery* indicate the period over which the cumulative sum is computed. The estimated model is defined in Equation (1). Controls include log total assets, log firm age, rating-dummy, log employment, sales growth, Tobin's Q, liquidity, profitability, and book leverage. All control variables are measured as of the snapshot year τ and winsorised at the 1st/99th percentiles. The row p(Bond < Loan) reports the one-sided p-value from a Wald test of $H_0 : \beta_{\text{Bond debt due}} \geq \beta_{\text{Loans due}}$ against $H_1 : \beta_{\text{Bond debt due}} < \beta_{\text{Loans due}}$. Asterisks indicate significance at the 1%, 5%, and 10% level (***$p < 0.01$; **$p < 0.05$; *$p < 0.1$). Standard errors in parentheses and clustered at the firm-level. The constant term is omitted from the table. *N obs* indicates the number of firm-year observations, while *N clusters* indicates the number of clusters. *Source(s):* Compustat; Capital IQ; author's calculations.

served confounding factors. However, the selection bias inherently works against finding a negative employment effect for bond-financed firms because higher-quality firms typically exhibit greater resilience and better employment trajectories during macroeconomic recoveries. The fact that the data nevertheless reveal a significant employment drag from maturing bond debt implies that the true friction imposed by bond debt might be even stronger than the point estimates suggest.

Another dimension of corporate liquidity during crises is the reliance on undrawn credit lines. Undrawn credit lines represent a form of off-balance-sheet bank credit that provides contingent liquidity when cash flows dry up. Theoretically, this "shadow liquidity" should insulate firms from refinancing shocks. When controlling for the cumulative amount of undrawn facility capacity expiring in a given window, scaled by assets — i.e., exposure to losing access to backstop liquidity — the results remain robust. The variable is slightly positive, indicating a beneficial effect for

employment growth, but is statistically insignificant.[34]

Local projection. To show the dynamics over time, I estimate the employment response using a local projection framework (Jordà, 2005). The set-up follows Equation (1), but looks at different horizons individually rather than at cumulative employment growth over the entire crisis episode. Using h to index the horizon, the model is estimated as

$$e^{g}_{i,k,\tau+h} = \beta_{1,h}\, MB_{i,k,\tau} + \beta_{2,h}\, ML_{i,k,\tau} + X_{i,k,\tau}\,\Gamma_h + \alpha_{j,\tau} + \varepsilon_{i,k,\tau+h}. \tag{2}$$

The sequence $\{\hat{\beta}_{1,h}\}_{h=0}^{H}$ and $\{\hat{\beta}_{2,h}\}_{h=0}^{H}$ trace the dynamic employment response to maturing bonds and loans respectively, allowing us to test whether the employment penalty from maturing bond debt is larger and more persistent than that from maturing loan debt. Figures 4 and 5 show the results. All impulse responses show a one-standard-deviation increase in the respective debt variable.

Figure 4 shows that maturing loans have no significant effect on employment growth during the recovery period, whereas maturing bonds exert a significant and persistent negative impact.[35] The underlying model in Figure 5 replaces $MB_{i,k,\tau}$ and $ML_{i,k,\tau}$ in Equation (2) with the bond-debt share variable $\lambda_{i,k,\tau}$, defined as the ratio of bonds to the sum of bonds and loans. This specification allows to test whether a larger bond-debt share is associated with slower employment growth during the recovery period, regardless of the absolute amount of maturing debt. The figure shows the differential effect a larger bond share has on employment growth over the recovery period, showing a significant negative effect over the recovery period.

Robustness and limitations. To ensure the validity of these findings and to isolate the specific channel of debt rigidity, I conduct several robustness tests. First, to rule out the possibility that the results are driven by pre-existing trends in labour demand, I include past employment growth as an additional control variable. Second, since a higher equity or liquidity buffer can absorb shocks and reduce the need for labour adjustments, I explicitly control for the firms' equity levels and use alternative measures of profitability. Third, I directly control for the firms' overall bond-debt share to ensure the effect is driven by the *maturing* portion of the debt rather than a general, time-invariant penalty of being a bond issuer (see Table B3 in Appendix B.3).

Beyond controlling for firm-level characteristics, I run the regression with alternative definitions of the snap-year and recovery period. Instead of using a one-year snap period, I define the snap year as the average of the two years preceding the crisis onset. For the recovery period, I use windows

[34] See also Darmouni and Siani (2025) who show that during Covid credit lines were barely used.

[35] Figure B1 in Appendix B shows the IRF using the sum of debt maturing over the entire episode instead of only the recovery period. The result is the same.

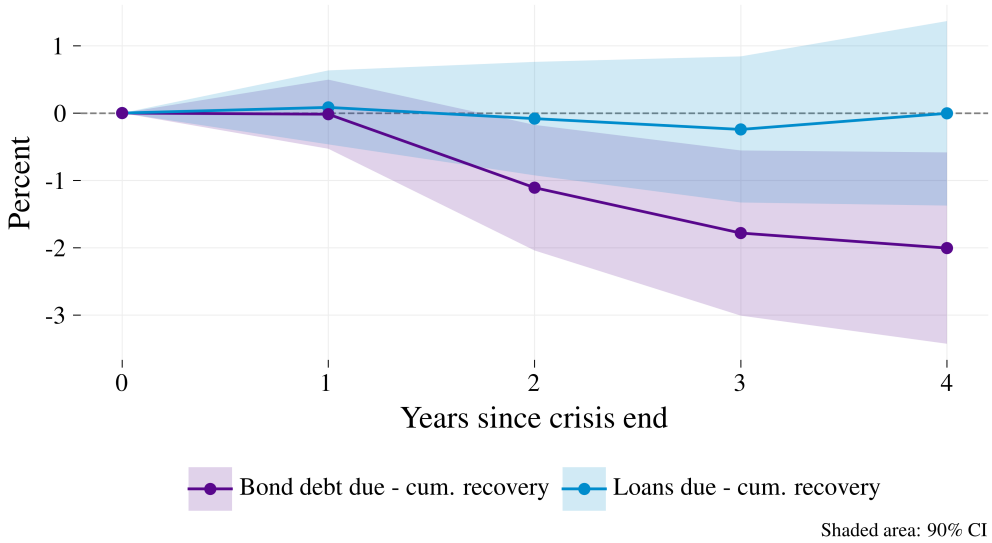


Figure 4: Employment IRF - debt maturing during the recovery period

Notes: The figure reports impulse response functions of cumulative employment growth estimated via local projections. The horizon covers the recovery years following the crisis trough. The response corresponds to a one-standard-deviation increase in the debt variable. Maturing debt is defined as the total debt coming due over the recovery period and is normalised by firm-specific assets measured in the pre-crisis snap year. Shaded areas indicate confidence intervals. The estimated model is defined in Equation (2) and includes the same control sequence as results in Table 5 columns (3) and (4), i.e. log total assets, log firm age, rating-dummy, log employment, sales growth, book leverage, Tobin's Q, liquidity, and profitability. *Source(s):* Author's calculations.

of two and four instead of three years following the crisis trough (Table B4 in Appendix B.3).[36] I also conduct placebo tests, which involve randomly assigning the snap year and recovery period. The placebo tests consistently yield null results, reinforcing the causal interpretation of the main findings (Table B5 in Appendix B.3). The results remain robust across these variations. Finally, Table B6 in Appendix B.3 contains results with different fixed-effect specifications.

The results should nevertheless be interpreted in light of the data's coverage, which begins in 1998, to understand what they *can* and *cannot* tell us. First, while the macroeconomic jobless recovery phenomenon is typically defined by a divergence between output and employment dynamics, the analysis is conducted at the firm level and focuses exclusively on employment outcomes. Second, the sample does not cover the period before the structural shift in debt composition or earlier crises that lacked jobless recoveries. As a result, while the findings show that different *types* of debt affect employment differently, they cannot speak to how corporate debt more broadly shaped recessions across the two eras.

Instead, the estimates isolate how different debt types affect employment dynamics across firms within the same industry and year, with identification relying on cross-sectional variation in debt

[36] Analysing longer horizons, and hence how the effect evolves with the distance from the crisis, is not feasible with the available data. Since all variables are measured in the pre-crisis snap year, longer windows would require firms to be observed continuously over many years, which would substantially reduce the sample.

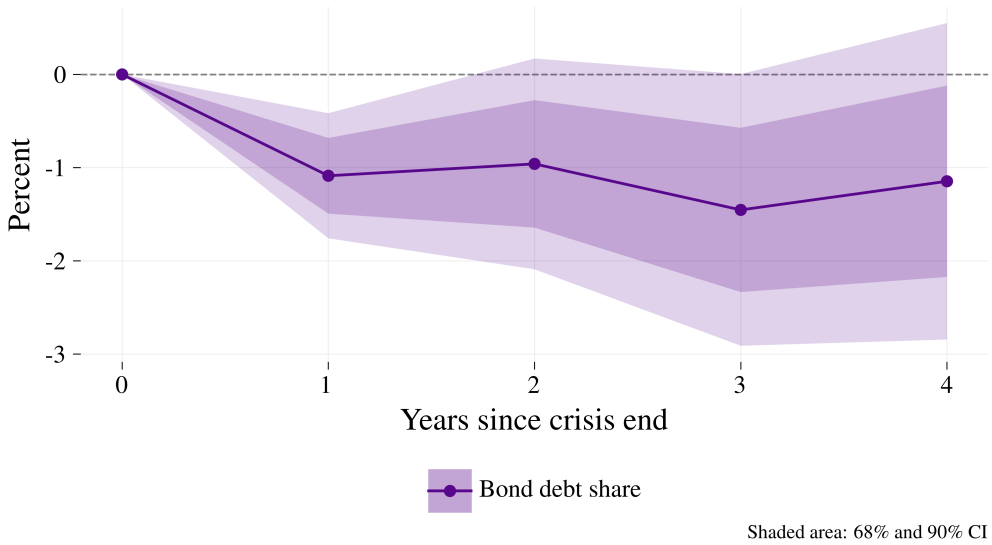


Figure 5: Employment IRF - bond-debt share

Notes: The figure reports impulse response functions of cumulative employment growth estimated via local projections. The horizon covers the recovery years following the crisis trough. The response corresponds to a one-standard-deviation increase in the bond-debt-share variable. The bond-debt share is defined as total bonds in the pre-crisis snap year divided by the sum of bonds and loans. Shaded areas indicate confidence intervals. The estimated model is defined in Equation (2) and includes the same control sequence as in the baseline regressions, i.e. log total assets, log firm age, rating-dummy, log employment, sales growth, book leverage, Tobin's Q, liquidity, and profitability. *Source(s):* Author's calculations.

structure. Under the assumption that these micro-level employment sensitivities to debt types were structurally similar prior to 1990, the secular shift toward bond financing may help explain the emergence of weaker employment recoveries in more recent crises. Section 4 provides a theoretical framework that formalises the mechanism, showing how *rollover-rigidity* can rationalise the observed micro-level employment patterns.

3.3.2 Capital expenditure & investment

An alternative interesting outcome variable to consider is the firms' capital accumulation and expenditure during the recovery period, as it has direct macroeconomic consequences. This specification addresses the question of whether firms facing refinancing pressure reduce not only employment, but also investment in productive capacity. Moreover, it directly targets the routine-biased technological change and automation story. If firms facing refinancing pressure reduce labour but increase investment in productive capital, this would be consistent with an automation story. In contrast, if these firms reduce both employment and capital accumulation, this would suggest that they are not substituting labour with capital, but rather reducing both inputs.

The results in Table 6 provide evidence that refinancing pressure from maturing bonds affects not only employment, but also firms' capital accumulation during the recovery period. Firms with

Table 6: Cumulative capital stock and flow - recovery period

	Capital stock and capex - recovery	
	(1)	(2)
	Capital stock	Capital expend.
Bond debt due, recovery	-0.371**	-0.114***
	(0.155)	(0.042)
Loans due, recovery	-0.124	-0.018
	(0.124)	(0.037)
Industry-Year FE	Yes	Yes
Controls	Yes	Yes
p(Bond < Loan)	0.084	0.028
N obs	2973	3541
N clusters	2193	2634
R^2 (within)	0.141	0.126

Notes: The dependent variable is either cumulative capital stock growth (measured as the symmetric growth rate) or cumulative capital expenditures during the recovery period, scaled by pre-crisis (snapshot-year) total assets. *Capital stock* is measured as property, plant, and equipment (net of accumulated depreciation). *Capital expenditures* are cash outflows for additions to property, plant, and equipment, excluding acquisition-related expenditures. *Bond debt due* and *Loans due* measure the amount of predetermined long-term debt maturing during the crisis episode and recovery period, scaled by pre-crisis (snapshot-year) total assets; *recovery* indicates the period over which the cumulative sum is computed. The estimated model is defined in Equation (1). Controls include log total assets, log firm age, rating-dummy, log employment, sales growth, Tobin's Q, liquidity, profitability, and book leverage. All control variables are measured as of the snapshot year τ and winsorised at the 1st/99th percentiles. The row p(Bond < Loan) reports the one-sided p-value from a Wald test of $H_0 : \beta_{\text{Bond debt due}} \geq \beta_{\text{Loans due}}$ against $H_1 : \beta_{\text{Bond debt due}} < \beta_{\text{Loans due}}$. Asterisks indicate significance at the 1%, 5%, and 10% level (***$p < 0.01$; **$p < 0.05$; *$p < 0.1$). Standard errors in parentheses and clustered at the firm-level. The constant term is omitted from the table. *N obs* indicates the number of firm-year observations, while *N clusters* indicates the number of clusters. *Source(s):* Compustat; Capital IQ; author's calculations.

larger maturing bond debt experience significantly lower growth in their capital stock (Net property, plant, and equipment) and significantly lower cumulative capital expenditures during the recovery period. In contrast, maturing loan debt is economically smaller and statistically insignificant. This capital-expenditure decline mirrors the employment results and is consistent with the central mechanism of the paper: the problem is not refinancing pressure per se, but what type of debt is maturing. Similarly, the decline in cumulative capital expenditures indicates that refinancing stress constrains real investment activity during the recovery period.

Finally, the question is whether the effects on employment and investment also translate into slower revenue growth. Put differently, do firms merely scale back hiring and investment while maintaining revenue growth, or do these adjustments ultimately constrain firm performance? The results show that maturing bond debt is associated with significantly lower cumulative revenue growth during the recovery period, whereas maturing loan debt has no statistically significant effect. This finding suggests that firms facing refinancing pressure from maturing bonds not only

reduce employment and investment, but also lag behind in revenue growth during the recovery phase (see Table B7 in Appendix B.3).

4 Model

The empirical analysis shows that maturing bond debt depresses employment during recoveries, whereas comparable maturing loan debt does not. The model proposes a mechanism for this result, the *rollover-rigidity channel*, and serves three purposes. First, it makes explicit the conditions under which the type of debt, rather than the refinancing need itself, generates an employment gap that persists after productivity has recovered. Second, the mechanism implies predictions beyond the employment regressions, in particular that maturing bond debt depletes firms' internal funds, which are taken to the data in Section 5.1. Third, it provides the structure for the aggregate counterfactual in Section 5.2: under the conditions of the model, the estimated growth wedge between bond- and loan-financed firms translates into a composition effect, so that the long-run shift towards bond finance can be related to the weakness of employment recoveries. The model also distinguishes two channels, internal funds and refinancing risk, which the empirical analysis cannot separate and which respond to different policy instruments.

The model builds on Crouzet (2018), where debt types differ in their flexibility in distress, and adds the labour margin: creditor coordination problems make bond debt harder to roll over, amplifying employment losses after adverse shocks. Relative to quantitative debt-choice models, it is deliberately stylised.[37] Rather than solving the ex-ante capital structure problem, it takes debt composition as predetermined when the crisis hits, consistent with the snapshot design of the empirical analysis.[38]

4.1 Mechanism

The central mechanism in the tractable partial-equilibrium model rests on the asymmetric flexibility of loans and bonds during economic distress, unfolding over three distinct phases: pre-crisis sorting, a crisis liquidity shock, and a constrained recovery.

Pre-crisis ($t = 0$). In normal times, high-quality firms rationally prefer to issue bonds to avoid the intermediation premium charged by banks. However, this cost advantage comes at the expense

[37] In these models, firms solve an infinite-horizon problem to choose their debt composition ex ante, trading off cheaper bond issuance against liquidation and restructuring costs in default, with real effects operating through physical capital.

[38] Debt composition follows a simple sorting rule at $t = 0$ (Section 4.2.1). Since the crisis is unanticipated, this choice involves no trade-off between cost and flexibility.

of flexibility. While a single bank can renegotiate its claim bilaterally with a firm, dispersed bondholders suffer from coordination failures, rendering the bond contract effectively rigid.

Crisis trough ($t = 1$). When an aggregate shock impairs cash flows, financial markets freeze. Firms are unable to issue new debt and must service their maturing obligations using only cash on hand. Because labour acts as a quasi-fixed factor requiring upfront working capital, any cash diverted to debt service directly crowds out the firm's ability to pay wages. Loan-financed firms absorb the shock by negotiating a *rollover*. The bank accepts a reduced cash payment today and defers the maturing principal to the future. This rollover preserves the firm's internal liquidity and leaves its workforce largely intact. Bond-financed firms, unable to coordinate their dispersed creditors, are forced to honour their rigid contracts and pay in full. Their workforce becomes their margin of adjustment, and they cut labour to free up the necessary cash.

Recovery ($t = 2$). As aggregate productivity rebounds and credit markets reopen, firms seek to rehire. However, two compounding channels suppress hiring by bond-financed firms. First, the *internal-funds channel*: having drained their liquidity to survive the crisis, bond-financed firms enter the recovery with depleted net worth. Because new intraperiod credit is capped by pledgeable revenue, this cash shortage limits the scale of new hiring. Second, the *refinancing risk channel*: the remaining debt that matures during the recovery must be refinanced in markets that now charge a post-crisis risk premium ($\psi > 0$). This elevated interest expense further crowds out labour expenditure. Loan-financed firms face neither constraint, as they preserved their net worth and can roll over debt at normal relationship rates.

4.2 Theoretical framework

Environment. The three periods $t \in \{0, 1, 2\}$ represent the pre-crisis phase, the crisis trough, and the recovery. There is a continuum of risk-neutral firms of mass one, heterogeneous in their initial net worth e_0 taken as given, each producing output using labour as the sole variable input with a fixed capital stock normalised to unity. Output is

$$y_t \;=\; z_t\, n_t^{\alpha}, \qquad \alpha \in (0, 1), \tag{3}$$

where z_t is productivity. Since $\alpha < 1$ the production function exhibits decreasing returns to scale. Operating profit is $\pi_t(n) = z_t n_t^{\alpha} - w\, n_t$, with the output price normalised to one. The wage $w > 0$ is exogenous and constant.[39] Unconstrained labour demand and the associated maximal operating

[39] Risk neutrality rules out a precautionary motive to hold extra liquidity buffers, so there is no risk-based reason to prefer a debt type. The model is fully *real*, so that a constant wage is a natural assumption.

profit at productivity z are

$$n^*(z) \;=\; \left(\tfrac{\alpha z}{w}\right)^{\frac{1}{1-\alpha}}, \qquad \pi^*(z) \;=\; (1-\alpha)\, z \left(n^*(z)\right)^{\alpha}, \tag{4}$$

with the shorthand $n^* \equiv n^*(z_0)$, $n_1^* \equiv n^*(z_1)$, $\pi_1^* \equiv \pi^*(z_1)$ (derivations in Appendix C). In any period the economy may be hit by a negative shock that lowers productivity z_t, triggering an unexpected crisis.

Assumption 1 (Working-capital friction)**.** *The wage bill wn_t must be paid at the beginning of the period, before revenues $z_t n_t^{\alpha}$ are realised at the end of the period.*

Because revenues are realised only after production, firms must finance the wage bill using internal liquidity and short-term intraperiod credit. Creditors are willing to advance funds against at most a fraction $\phi \in (0,1)$ of contemporaneous revenue, reflecting limited pledgeability of future cash flows (Holmstrom and Tirole, 1997).[40]

Debt. Firms can issue debt d in $t=0$ with a staggered maturity profile. A fraction $m \in (0,1)$ of the principal matures at $t=1$ and the remaining fraction $1-m$ at $t=2$. Firms choose between bank debt, i.e. loans ($j=L$), and market debt, i.e. bonds ($j=B$). Risk-neutral dispersed investors price bonds competitively at the risk-free rate r. Bank lending requires an intermediation cost $c>0$ per unit, passed through to the borrower (see, e.g., Philippon, 2015). Since crisis periods are unanticipated, neither contract prices any crisis event. This is in line with the empirical strategy that relies on predetermined debt. The contractual debt service in $t=1$ is the maturing share of the principal plus interest on all outstanding principal

$$R_1^B \;=\; (m+r)\, d, \qquad R_1^L \;=\; (m+r+c)\, d \;>\; R_1^B, \tag{5}$$

and the continuing tranche $(1-m)\, d$ falls due at $t=2$. Bank debt is strictly more expensive than bond debt in normal times, but they are perfect substitutes in production.

The firm's budget constraint in any period t is

$$\underbrace{wn_t}_{\text{wage bill}} \;+\; \underbrace{R_t^j}_{\text{debt due}} \;\le\; \underbrace{e_{t-1}^j}_{\text{internal funds}} \;+\; \underbrace{\phi\, z_t\, n_t^{\alpha}}_{\text{pledgeable revenue}}, \tag{6}$$

where e_{t-1} is the firm's internal liquidity carried into period t, i.e. at the end of period $t-1$.[41]

[40] The pledgeability cap reflects standard limited-enforcement reasoning: managers can divert or misreport the unpledgeable share $1-\phi$ of revenue, so lenders advance funds only against the verifiable share. The intraperiod wage credit is repaid from end-of-period revenue.

[41] e_t also denotes the firm's net worth. Since capital is fixed and never separately valued period-by-period, *net worth* and *net liquid funds* coincide exactly in the model, so e_t is both.

The two debt types crucially differ in their creditor structure, which is important for debt restructuring. Bond debt R^B is held by a large number of dispersed investors, whereas bank debt R^L is held by a single lender. Let N denote the number of creditors. The more creditors there are, the harder it is to coordinate. Define a function $\gamma(N) \in (0, 1]$ that depends on the number of creditors and captures the coordination success of creditors.[42] To maintain tractability, each firm issues a single debt type only. A simple functional form is

$$\gamma(N) \;=\; e^{-\xi(N-1)}, \qquad \xi \geq 0, \tag{7}$$

where ξ is a coordination-friction parameter. Thus, $1 - \gamma(N)$ represents the probability of coordination failure.

Dispersed holders face a classic free-rider problem: because any individual bondholder's participation has a negligible impact on the firm's outcome, each has an incentive to rely on the actions of others.[43] As this logic applies to all creditors simultaneously, coordination becomes difficult when debt is held by many investors. If coordination succeeds, the firm and the creditor can renegotiate the debt contract as a Nash bargaining problem. Therefore, the two debt instruments differ crucially in their *renegotiability*: bonds are cheap but rigid, bank loans costly but flexible.

However, not all firms have equal access to bond markets. Access requires the scale, disclosure standards, and credit reputation that only established firms possess (Faulkender and Petersen, 2006).

Assumption 2 (Bond-market access)**.** *While all firms can borrow from banks, only firms with initial net worth $e_0 \geq \bar{e}$ can issue bonds.*

Since bonds are cheaper, every firm with access issues bonds and every firm without access borrows from its bank. The aggregate share of bond-financed firms is then

$$\lambda \;=\; \Pr(e_0 \geq \bar{e}) \;\in\; (0, 1).$$

Finally, firms face default in period t with probability $\rho(e; R)$, which is decreasing in internal funds e and increasing in the debt burden R. For tractability, the analysis assumes two default-risk states, ρ_H and ρ_L, which are taken as fixed within the bargaining problem. Appendix C gives a logistic default specification for $\rho(e; R)$ and derives the condition under which debt payment relief

[42] $\gamma(N)$ could also be interpreted as representing the fraction of the debt claim held by creditors who successfully coordinate.

[43] An example is the following. Consider a restructuring proposal that reduces creditors' claims. Creditors who consent to the restructuring accept the reduction, while non-consenting creditors generally retain their original contractual claims. As a result, an individual creditor prefers to withhold consent and benefit from the concessions made by others while preserving its own claim.

lowers default risk. I assume that relief does so, i.e. $\rho_L < \rho_H$.[44] Should the firm be pushed into bankruptcy, creditors can recover

$$L_t \;=\; \chi\,\pi^*(z_t), \qquad \chi \in (0,1),$$

while equity holders receive nothing. Because $\chi < 1$, default destroys real value, capturing the bankruptcy deadweight costs and fire-sale discounts.

4.2.1 Period $t = 0$: debt structure

To operate, each firm must purchase one unit of capital at cost I at $t = 0$. Thereafter capital is fixed and helps generate the stream of operating profits in Equation (3). Since $I > e_0$, the firm has to raise external debt

$$d \;=\; I - e_0.$$

Since crisis periods are unanticipated, flexibility has no ex-ante value and bonds are strictly cheaper. Under Assumption 2 the safest, highest-net-worth firms sort into bonds.

4.2.2 Period $t = 1$: crisis

At the start of $t = 1$, productivity falls unexpectedly to $z_1 = (1-\delta)\,z_0$, $\delta \in (0,1)$. Frictionless labour demand falls to $n_1^* < n^*$ for every firm. This fall is the *common* component of the crisis contraction, driven by the shock itself. Depending on the debt structure, there is an additional financial component which operates through the interaction of maturing debt with the following crisis feature.

Assumption 3 (Crisis financing freeze)**.** *At $t = 1$ no new external finance is available. The intraperiod credit available in normal times dries up, banks do not lend to firms outside an existing relationship, and new bond issuance is prohibitively costly.*

The freeze on bond issuance reflects extreme adverse selection and information asymmetry, making the time and verifiable disclosure required for bond issuance infeasible. Under Assumption 3, the firm can spend at $t = 1$ only its liquid internal funds. Let $A_1 > 0$ denote the liquid assets with

[44] Under the logistic specification, $\rho_L < \rho_H$ holds if and only if the avoided output loss from preserving employment exceeds the accrued interest on the rollover, $\pi_1^* - \pi_1(\hat{n}_1^L) > \Delta^R r$ (derivation in Appendix C, following Equation (13)). This is a restriction on parameters.

which the firm enters the crisis.[45] The $t = 1$ budget, compared to Equation (6), requires

$$w\, n_1 \;+\; P_1^j \;\leq\; A_1, \tag{8}$$

where P_1^j is the realised payment made to creditors at $t = 1$. Note the timing: because wages are prepaid and no new funds can be raised, crisis revenues $z_1 n_1^\alpha$ are *not* available for the wage bill or debt service as they accrue at the end of the period. This timing is what makes labour the primary margin of adjustment. Each worker less frees w of scarce cash (liquidity) today.

In case of full repayment, i.e. $P_1^j = R_1^j$, there is an elevated probability of bankruptcy at $t = 2$ because the firm has depleted its internal funds to pay creditors. Due to the potential deadweight loss from liquidation, there is a joint surplus to be generated by modifying the $t = 1$ debt payment. Achieving this surplus depends on whether the creditors manage to create a unified negotiating committee, which they do with probability $\gamma(N)$.

No coordination forces the firm to pay the full claim R_1^j. If coordination is achieved, the creditor(s) and the firm agree to a reduced payment $\tilde{R}_1 < R_1^j$ through Nash bargaining. The firm's expected debt payment at $t = 1$ is therefore the probabilistically weighted sum of the renegotiated and rigid payment

$$P_1^j \;=\; \gamma(N)\, \tilde{R}_1 \;+\; \big(1 - \gamma(N)\big)\, R_1^j, \tag{9}$$

where $\tilde{R}_1 = R_1^j - \Delta^R$ is the reduced payment agreed in renegotiation, and Δ^R is the rollover amount (see Appendix C for details on the derivation). Creditor dispersion ($N \to \infty$) systematically shifts the total payment from the negotiated level to the rigid contractual level.

4.2.3 Period $t = 2$: recovery

Productivity rebounds fully, $z_2 = z_0$, so every firm wishes to return to the first-best workforce level n^*. Credit markets reopen and intraperiod finance up to the pledgeable share ϕ of end-of-period revenue is again available. As at $t = 1$, debt falls due at the *start* of the period: the continuing tranche $(1 - m)d$ matures on its original terms, i.e. principal plus one period of interest. Firms cannot repay it from internal funds alone and roll it over through the reopened credit market. Because the market remains scarred, rolling over bonds carries a post-crisis premium $\psi > 0$ per unit of maturing principal, while relationship banks roll over maturing loans at their normal terms, with the intermediation premium c already part of the original contract. I assume that $\psi > c$, making

[45] A_t denotes gross liquid funds available at the *start* of period t, before that period's wage bill and debt service are paid. Net worth e_t and gross liquid assets A_t are related recursively: $e_t = A_t - (\text{outflows}) + (\text{revenue})$. Since e_0, the firm's initial net worth, is entirely absorbed by the period-0 investment ($d = I - e_0$), the firm carries no cash forward. Therefore, A_1 consists purely of subsequent operating cash flow. Operating under a no-dividend convention over a pre-crisis phase of length $\tau \geq 1$ periods at the frictionless optimum, $A_1 = \tau\, \pi^*(z_0)$.

bonds more expensive than loans in stress periods. The baseline recovery-phase debt obligations are

$$R_2^B = \underbrace{(1-m)(1+r)\,d}_{\text{original contract}} + \underbrace{\psi\,(1-m)\,d}_{\text{rollover premium}} = (1-m)(1+r+\psi)\,d, \qquad R_2^L = (1-m)(1+r+c)\,d, \tag{10}$$

where R_2^L may have been renegotiated in period $t = 1$, as discussed below. The only difference between the two periods is thus credit availability: frozen at $t = 1$, available against pledgeable revenue at $t = 2$.

4.3 Model results and implications

This section analyses the implications of the model for loan- and bond-financed firms. In order to focus on an economically relevant case and align theory and empirics, I will impose a few restrictions outlined below. To isolate the role of debt repayment obligations, I focus on an economy in which both firm types are financially unconstrained in period $t = 0$. Specifically, I restrict attention to the parameter region $\phi \geq \alpha$, which ensures that unconstrained labour demand can always be financed through the intraperiod credit market when debt repayments are absent.[46] Consequently, the working-capital friction binds only when liquidity is reduced by debt service or when credit conditions tighten, which is precisely the mechanism studied in the crisis period.

Crisis. In $t = 1$ the economy is hit by a productivity shock. Credit markets freeze (Assumption 3), and firms face a temporary liquidity shortage.

Condition 1 (Solvent but illiquid)**.** *Parameters satisfy* $R_1^j \leq A_1 < R_1^j + w\,n_1^*$.

Condition 1 characterises firms with sufficient cash to meet outstanding debt obligations R_1^j, but insufficient funds to simultaneously repay creditors *and* finance the frictionless crisis wage bill wn_1^*. These firms can avoid immediate bankruptcy by fully servicing their debt, i.e. $A_1 \geq R_1^j$, but doing so requires a reduction in employment relative to the frictionless benchmark, i.e. $n_1^j < n_1^*$. Firms therefore face a strategic trade-off between preserving employment and maintaining financial solvency.

Because firms are solvent under Condition 1, creditors can technically enforce full contractual repayment.[47] However, extracting every available dollar today severely depletes the firm's end-of-period net worth carried into the recovery, e_1. A lower e_1 forces the firm to operate at a constrained,

[46] Given that the wage bill at the optimum is $wn^*(z) = \alpha z(n^*(z))^\alpha$, and the pledgeable share of revenues is $\phi z(n^*(z))^\alpha$, $\phi \geq \alpha$ guarantees that the wage bill can be financed through the intraperiod credit market since $\alpha z(n^*(z))^\alpha \leq \phi z(n^*(z))^\alpha$.

[47] Crisis cash flows are *observable* — known to both parties — but *not verifiable* by a court, precluding complete state-contingent contracts (Grossman and Hart, 1986; Hart and Moore, 1994). Creditors can therefore enforce only

suboptimal scale at $t = 2$, which exposes the firm to liquidity shortfalls and reduces the expected repayment value of the continuing debt tranche due to the higher default risk.

Loan-financed firms. With $N = 1$, the probability of coordination is $\gamma(1) = 1$, and there is no friction. The single relationship bank holds 100% of the claim and perfectly internalises the continuation externality. The renegotiated debt payment in $t = 1$ is $P_1^L = \tilde{R}_1 < R_1^L$, with a realised debt relief of Δ^R. Renegotiation dampens the liquidity shock substantially and safeguards firm health while also lowering the default risk to ρ_L. I focus on the case in which loan renegotiation fully relaxes the crisis-period liquidity constraint.

Condition 2 (Effective relief)**.** *The debt relief is sufficiently large that the negotiated payment allows optimal crisis hiring:* $\tilde{R}_1 \leq A_1 - w\, n_1^*$.

Condition 2 ensures the budget constraint in Equation (8) is slack at n_1^*, so

$$n_1^L \;=\; n_1^*, \qquad e_1^L \;=\; A_1 - \tilde{R}_1 - w n_1^* + z_1 (n_1^*)^\alpha \;=\; A_1 - \tilde{R}_1 + \pi_1^*.$$

This leads to the loan-financed firm's employment falling only by the common productivity component, and its balance sheet being preserved.

Bond-financed firms. With $N = N \to \infty$, $\gamma(N) \to 0$. The firm must service the full contractual claim to the creditors, $P_1^B = R_1^B$.

Under Condition 1 this is possible, but only by shedding labour. Constraint (8) binds and

$$n_1^B \;=\; \frac{A_1 - R_1^B}{w} \;<\; n_1^*, \qquad \hat{e}_1^B \;=\; z_1 (n_1^B)^\alpha. \tag{11}$$

As a result, debt service crowds out working capital dollar-for-dollar: $\partial n_1^B / \partial R_1^B = -1/w$, meaning firms with more debt maturing into the freeze cut employment more drastically. Moreover, the bond-financed firm carries only $\hat{e}_1^B$ into the recovery, which is below the loan-financed firm's e_1^L (Equation (12) below). Finally, the remaining debt tranche is exposed to the higher default risk ρ_H in period $t = 2$.

Comparing balance sheets between the two firms at the crisis trough

$$e_1^L - \hat{e}_1^B \;=\; \underbrace{\left(R_1^B - \tilde{R}_1\right)}_{\text{payment relief}} \;+\; \underbrace{\left(\pi_1^* - \pi_1(n_1^B)\right)}_{\text{avoided output loss}} \;>\; 0, \tag{12}$$

a "hard" contractual claim (Hart and Moore, 1994), not an efficient surplus-maximising outcome, leaving room for ex-post renegotiation whose success depends on creditor coordination rather than contractual rights (Bolton and Scharfstein, 1996).

shows that the loan-financed firm exits the crisis with a higher net worth than the bond-financed firm. The two firm types thus exit the crisis with a modest employment gap but a significant difference in internal funds, setting the stage for diverging recovery paths at $t = 2$.

No switching: In principle a bond-financed firm could approach a bank at $t = 1$. This margin is shut down for three reasons. First, the firm has no pre-existing lending relationship, which cannot be built in a crisis. Second, banks are themselves capital constrained in crises and prioritise existing borrowers. Third, the empirical debt-composition shares are highly persistent, consistent with these frictions being strong in practice.

Recovery. The firms enter the recovery period at $t = 2$ with different debt burdens, R_2^L and R_2^B. The loan-financed firm has rolled over Δ^R from period 1, while the bond-financed firm has not. Due to the rollover, the loan-financed firm's debt burden from Equation (10) changes to

$$R_2^{L,ext} \;=\; (1-m)(1+r+c)\,d + \Delta^R(1+r). \tag{13}$$

Although $R_2^{L,ext}$ can exceed the bond-financed firm's R_2^B, under Condition 2 the rollover raises the loan-financed firm's $t = 2$ net burden by only the accrued interest $\Delta^R r$, not by the full Δ^R.[48] The deferred principal is exactly offset by the correspondingly higher net worth the firm carries out of the crisis (details in Appendix C).

To isolate the recovery-period effects of maturing bonds, I maintain the assumption that the loan-financed firm remains unconstrained at $t = 2$. Because debt rollover increases the loan-financed firm's repayment obligations, this requires the additional condition stated in Condition 3(i).

Condition 3 (Recovery financing conditions)**.**

(i) The loan-financed firm's funds satisfy $e_1^L \;\geq\; R_2^{L,ext} - (\phi-\alpha)\,z_0(n^*)^\alpha$.

(ii) The bond-financed firm's net burden lies in the window: $(\phi-\alpha)\,z_0(n^*)^\alpha \;<\; R_2^B - \hat{e}_1^B \;<\; (1-\alpha)\,\phi^{\frac{1}{1-\alpha}}\,z_0(n^*)^\alpha$.

Consistent with the empirical evidence that maturing bond debt depresses employment growth during the recovery period, Condition 3(ii) restricts attention to bond-financed firms that remain solvent but are financially constrained. The left inequality requires the firm's net debt burden, $R_2^B - \hat{e}_1^B$, to exceed the pledgeable revenue net of the wage bill at the first-best scale n^*, implying that internal and pledgeable resources are insufficient to finance unconstrained employment. The right inequality ensures that the net burden remains strictly below the largest net burden that

[48] The bank forgoes its own intermediation margin c on the deferred amount, consistent with the concession being priced at the risk-free rate in the bargaining derivation.

pledgeable revenue net of the wage bill can finance at any scale (Appendix C), so the firm can still operate at $t = 2$ while remaining financially constrained.

Loan-financed firms. The budget constraint in Equation (6) is slack at n^* by Condition 3(i). Loan-financed firms rehire frictionlessly to the optimum, $n_2^L = n^*$.

Bond-financed firms. Because they drained their internal funds during the crisis ($\hat{e}_1^B < e_1^L$), bond-financed firms do not have the liquidity to reach the optimal scale n^*. Their budget constraint in Equation (6) binds. The firm's problem simplifies to choosing the maximum feasible workforce n_2^B that exactly satisfies its binding liquidity constraint

$$w n_2^B + R_2^B = \hat{e}_1^B + \phi z_0 (n_2^B)^\alpha. \tag{14}$$

Because this binding constraint forces the firm to halt hiring before the marginal product of labour equals the wage, the firm operates at a constrained scale (details in Appendix C)

$$n_2^B < n_2^L = n^*. \tag{15}$$

Proposition 1 (Employment recovery gap)**.** *Following the unanticipated temporary shock at $t = 1$, in the recovery: $n_2^B < n_2^L = n^*$, although $z_2 = z_0$. The bond-financed firm's employment shortfall is increasing in the post-crisis spread ψ and decreasing in its internal funds $\hat{e}_1^B$, cf. (19).*

Two channels operate through the bond-financed firm's net burden $R_2^B - \hat{e}_1^B$. The first is the *internal-funds channel*: bond-financed firms enter the recovery with lower net worth than loan-financed firms ($\hat{e}_1^B < e_1^L$), which reduces their ability to finance the frictional wage bill and forces them to operate at a constrained scale. This is where the creditor-coordination failure at $t = 1$ enters. The second is the *refinancing-risk channel*: bond-financed firms face a higher debt rollover cost than loan-financed firms, which raises R_2^B and further depresses recovery employment. Both channels lower n_2^B, cf. (19). Crucially, this shortfall arises even though productivity has *fully* recovered: the firm is held back purely by its financial position, not by fundamentals — the microeconomic mechanism contributing to a drag on employment recovery, or the so-called *rollover-rigidity channel*.

Corollary 1 (Growth rates)**.** *Trough-to-recovery employment growth satisfies $\Delta \ln n_{1\to 2}^B < \Delta \ln n_{1\to 2}^L$ if and only if $n_2^B/n^* < n_1^B/n_1^*$, i.e. whenever the recovery shortfall (in proportional terms) exceeds the additional trough cut. A sufficient condition is a common trough, in which case the inequality is strict whenever $n_2^B < n^*$.*

Proof. See Appendix C. □

Discussion and limitations. The employment gap in Proposition 1 is not driven by the refinancing need itself — both firm types face the same maturity wall $m\,d$ — but by how that obligation is resolved. Because wages must be paid before revenue is realised (Assumption 1), liquidity used to service debt cannot be used to finance employment. A relationship bank can internalise the cost of forcing the firm into this constraint and grant relief. Dispersed bondholders, in contrast, face a coordination problem and the resulting penalty is therefore not a debt penalty per se, but a creditor-coordination penalty. The maturity creates the refinancing event, while creditor structure determines how costly it is.

The internal-funds and the refinancing-risk channel differ in their policy sensitivity. The refinancing-risk channel operates through the debt financing cost parameter ψ: reducing stressed-period bond spreads, or the policy rate through the same $1 + r + \psi$ term, raises recovery employment for constrained bond-financed firms. This margin is asymmetric across firm types, since loan-financed firms are already unconstrained at n^* (Condition 3(i)) and therefore do not respond at the margin to either instrument. The internal-funds channel, by contrast, operates through the net worth gap, which depends on the coordination failure at $t = 1$. Policies that instead facilitate creditor coordination raise $\gamma(N)$ and allow firms to retain more liquidity at the trough.

Three limitations are worth noting. First, the model is partial equilibrium. Wages and interest rates are exogenous, and the framework does not capture general-equilibrium effects or aggregate credit-market responses. Second, $\gamma(N)$ is a reduced-form coordination technology, and the model abstracts from the institutional details of bond restructuring. Third, the model focuses on solvent firms and therefore does not capture the extensive margin of bankruptcy or firm entry and exit. The model should thus be viewed as a formalisation of the rollover-rigidity channel and a framework for quantifying its potential aggregate importance, rather than as a complete model of firms' adjustment during recoveries.

5 Model to empirics, and macroeconomic implications

This section takes a closer look at the model's implications, and uses the model to quantify the aggregate employment effect of the shift in debt composition.

5.1 Empirical implications of the model

Empirically, the model's maturing debt parameter m is mapped to the pre-crisis exposures $MB_{i,k,\tau}$ and $ML_{i,k,\tau}$, while the bank-bond partition corresponds to the firm's pre-crisis debt structure. The "no switching" assumption provides a theoretical rationale for using pre-crisis debt structure as the source of identifying variation: firms cannot create a new lending relationship once the shock has

occurred. Furthermore, while the theoretical model holds capital fixed for simplicity, the empirical finding that maturing bond debt depresses capital expenditure offers complementary support for the proposed mechanism, as firms reduce both labour and capital rather than substituting one for the other.

Two testable implications serve to validate the model. First, the model predicts that firms exposed to maturing bond debt R^B ($MB_{i,t}$) experience a larger depletion of internal funds than firms exposed to maturing loan debt R^L ($ML_{i,t}$). In the model, this is driven by an intraperiod timing friction where wages must be advanced before revenues are realised. To evaluate this prediction, I regress changes in internal funds over the crisis-recovery window on maturing bond and loan debt. Consistent with the model, the results indicate that bond debt maturing over the crisis episode leads to a significantly larger decline in internal funds, measured by net operating working capital. Likewise, higher exposure to bond debt maturing during the crisis is associated with a stronger reduction in retained earnings over the recovery period (see Table B8 in Appendix B.3). By contrast, I find no significant effect on cash holdings. This is not at odds with the mechanism: cash measured during a crisis largely reflects firms' liquidity management, in particular drawdowns of credit lines and precautionary hoarding, and is therefore endogenous.[49] Cash holdings thus do not capture the internal funds available to finance labour, which is why I rely on net operating working capital and retained earnings instead. The results suggest that firms respond to refinancing shortfalls by depleting broader measures of internal financial capacity while preserving a precautionary cash buffer.

The second prediction relates to the post-crisis output-per-worker ratio (y/n). Given the standard concave production function in Equation (3), the output-per-worker ratio, denoted as Y_L, is

$$Y_L = \frac{y}{n} = \frac{zn^{\alpha}}{n} = zn^{\alpha-1} \qquad \text{with} \qquad \frac{\partial Y_L}{\partial n} = z(\alpha-1)n^{\alpha-2} < 0.$$

Because $\alpha - 1 < 0$, the output-per-worker ratio is strictly decreasing in labour, holding capital fixed. Under this single-input model, unconstrained loan-financed firms hire up to their optimal headcount n^* during the recovery, whereas constrained bond-financed firms under-hire ($n_2^B < n^*$). The model predicts a *higher* output-per-worker ratio when moving up the static marginal-product-of-labour curve, hence a larger output-per-worker ratio for bond-financed firms than for loan-financed firms, having capital fixed. Empirically, this channel can be tested by looking at the change in the revenue-per-worker ratio (Table B9 in Appendix B.3). The results indicate a statistical null effect for maturing bonds, while maturing loans drive a statistically significant increase in revenue-per-worker ($\beta_{Loan} = 0.153^*$). The null hypothesis of equality of the bond and loan coefficients can

[49] Controlling for open credit lines in the cash regression does not change the null result.

however not be rejected at conventional levels ($p = 0.11$).

This empirical finding is not necessarily at odds with the proposed mechanism. Rather, it likely reflects the baseline model's limitation that capital is held fixed. In practice, firms facing an un-renegotiable bond maturity wall may respond through a broader contraction, reducing capital expenditure alongside employment, consistent with the evidence presented above. As output and labour decline jointly, rather than labour adjusting along a fixed production frontier, output per worker need not change materially, offering an explanation for the insignificant coefficient on β_{Bond}. For loan-financed firms, the positive impact on labour productivity is instead consistent with banks playing a more active role in monitoring and restructuring distressed borrowers, a *relationship-monitoring* mechanism. Rather than triggering disruptive scale reductions, loan rollovers may be accompanied by operational adjustments that improve resource allocation and reduce organisational inefficiencies, resulting in higher ex post labour productivity.

5.2 Aggregate implications & the financial channel in the employment gap

The firm-level results establish that maturing bond debt depresses employment growth during recoveries. The remaining question is how this firm-level effect translates to the macro level: to what extent does it aggregate into an economy-wide drag, versus being attenuated by reallocation across firms. At the macro level, however, only the *composition* of nonfinancial corporate (NFC) debt is observed, not the amount actually maturing in a given year. The model provides the structure to relate the two: it translates the estimated growth wedge between bond- and loan-financed firms into a composition effect that depends on the bond-financed share of firms, λ. Calibrating λ to the observed shift in aggregate debt composition then yields the implied aggregate employment effect, holding other factors constant.

The calculation that follows is a partial-equilibrium exercise that isolates the microeconomic contribution of rollover rigidity, not a precise accounting of aggregate employment effects. It asks how much of the aggregate employment drag is attributable specifically to the secular rise in bond finance since 1990: holding the model's estimated growth wedge between bond- and bank-financed firms fixed, how much lower does today's debt composition make aggregate recovery employment growth, relative to a counterfactual in which the pre-1990 composition had persisted. This is benchmarked against an independent empirical estimate of the post-crisis employment shortfall.

Aggregation. Define aggregate recovery employment growth as the cross-sectional average of firm-level log growth[50]

$$\overline{\Delta \ln n}_{1\to 2} \;=\; \lambda\, \Delta \ln n^{B} \;+\; (1-\lambda)\, \Delta \ln n^{L}. \tag{16}$$

Under the conditions of Corollary 1, the aggregate growth measure in Equation (16) is strictly decreasing in the bond-share parameter λ. The secular rise in bond finance (the increasing λ observed since the 1990s) therefore generates a partial-equilibrium composition effect that acts as a structural drag on aggregate employment rebounds, isolating a microeconomic mechanism: a financial channel contributing to the employment drag observed in jobless recoveries.

Calibration. Equation (16) is evaluated at two values of the bond-share parameter λ, calibrated directly from the Financial Accounts of the United States (Z.1), using debt securities and loan liabilities of the NFC sector.[51] The pre-1990 baseline is $\lambda_{\text{pre}} = \overline{\lambda}_{1965\text{–}1989} = 0.47$. The post-1990 value $\bar{\lambda} \approx 0.62$ is the average NFC bond share over the three-year recovery window of each of the three crisis episodes.[52] Since the crisis-specific shifts are nearly identical ($\lambda_k - \lambda_{\text{pre}} \in \{0.13, 0.17, 0.15\}$), a single pooled shift is used, $\bar{\lambda} - \lambda_{\text{pre}} \approx 0.15$, rather than resimulating the model for each crisis.

Counterfactual. The model's firm-level growth paths $\Delta \ln n^{B}$ and $\Delta \ln n^{L}$ are kept fixed at their calibrated baseline values (Table C1 in Appendix C). Only the aggregate composition λ is varied: the growth wedge is held fixed, and the current, crisis-era composition $\bar{\lambda}$ is reversed back to its pre-1990 baseline λ_{pre}. This isolates the incremental cost of the *secular rise* in bond finance since then. Both $\bar{\lambda}$ and λ_{pre} are realised, historical compositions, not a hypothetical frictionless benchmark: the exercise only requires the model to get the comparative static of Equation (16) right between two states the economy has actually occupied. The resulting difference reduces to the growth wedge times the historical shift in composition

$$\begin{aligned}
\text{NetDrag} &= \overline{\Delta \ln n}_{1\to 2}(\bar{\lambda}) - \overline{\Delta \ln n}_{1\to 2}(\lambda_{\text{pre}}) \\
&= \left[\bar{\lambda}\, \Delta \ln n^{B} + (1-\bar{\lambda})\, \Delta \ln n^{L}\right] - \left[\lambda_{\text{pre}}\, \Delta \ln n^{B} + (1-\lambda_{\text{pre}})\, \Delta \ln n^{L}\right] \\
&= (\bar{\lambda} - \lambda_{\text{pre}}) \times (\Delta \ln n^{B} - \Delta \ln n^{L}).
\end{aligned}$$

[50] $\Delta \ln n^{B}$ and $\Delta \ln n^{L}$ are the model's own equilibrium-implied growth rates, obtained by solving the three-period model at the calibration in Table C1 in Appendix C. Their difference, the growth wedge $\Delta \ln n^{B} - \Delta \ln n^{L}$, is calibrated (via ψ) to match a moment built from those coefficients.

[51] For a timeseries graph see Figure A2 in Appendix A.

[52] Recovery windows: 2002–2004 (Dot-com), 2010–2012 (GFC), 2021–2023 (Covid-19), matching the windows used for the firm-level regressions in the empirical section. Episode-level averages: $\lambda_{\text{Dot-com}} = 0.60$, $\lambda_{\text{GFC}} = 0.64$, $\lambda_{\text{Covid}} = 0.62$. $\bar{\lambda}$ is their simple average.

At the model's calibration, $\Delta \ln n^B - \Delta \ln n^L = -0.0052$: bond-financed firms' recovery growth trails loan-financed firms' by roughly half a log point. The growth wedge is calibrated to match the empirical estimates reported in the previous section.[53] Hence

$$\text{NetDrag} = 0.15 \times (-0.0052) \approx -0.08\text{pp of employment growth.}$$

Employment base and scaling. Converting a growth-rate drag into a job count requires an employment base. For this exercise the economy-wide total nonfarm payroll employment (BLS, ≈ 140.7 million) is used as the base, though a more conservative choice would be to restrict the base to the estimation sample itself.[54] The implied job count is then

$$\text{MissingJobs} \approx -111 \text{ thousand jobs.}$$

This implicitly extrapolates the Compustat-estimated growth wedge to the entire economy, including government and non-corporate employment with no bond/loan financing choice of the kind modelled here, and should be read as an upper bound under that extrapolation.

Partial vs. general equilibrium. The partial equilibrium nature of the counterfactuals makes a full general-equilibrium (GE) prediction impossible, and GE forces could push the true aggregate effect in either direction. Two channels could *amplify* the benchmark. First, local aggregate demand spillovers: as bond-constrained firms cut employment and payroll, local demand for other firms' goods and services falls, propagating job losses to firms with no direct bond exposure (Mian and Sufi, 2014). Second, input-output linkages: suppliers to bond-constrained firms face reduced orders, transmitting the shock along production networks. A channel possibly *attenuating* it could be that displaced workers are reabsorbed by unconstrained, bank-financed firms, particularly if real wages adjust downward, and firm entry can substitute for the output lost at constrained incumbents. Because the amplifying and attenuating forces work in opposite directions, the net GE bias is a priori ambiguous, and the partial-equilibrium calculation above is best read as an informative central benchmark rather than as a lower or upper bound on the true aggregate effect.

To put this number in context, it is related to an independent benchmark, the economy-wide *jobless gap* estimated and reported in Appendix D.[55] Given the back-of-the-envelope nature of

[53] ψ is root-found so that the model exactly reproduces the estimated recovery-period growth effect of bond-debt exposure, evaluated at the sample's average bond exposure, minus the estimated recovery-period growth effect of bank-debt exposure, evaluated at the sample's average bank exposure ($\beta_{Bond}\bar{x}_{bond} - \beta_{Loan}\bar{x}_{bank}$), taken from Table 5. The resulting $\psi = 0.076$ lands close to the literature-based excess bond premium (0.077; Gilchrist and Zakrajšek, 2012).

[54] This calculation implicitly assumes that the estimated growth effect does not vary systematically with firm size.

[55] The jobless gap measures the shortfall between actual post-crisis employment and the level implied by the

the exercise, the number is compared at the pooled level against the simple average jobless gap across the three episodes ($\approx$ 2.6 million jobs). The historical shift in debt composition accounts for roughly 4% of the average jobless gap. This is a modest but not negligible share: the rollover-rigidity channel documented at the firm level does not by itself explain the bulk of the aggregate jobless-recovery phenomenon, but it contributes a quantifiable, non-trivial slice of it, consistent with being one mechanism among several rather than the primary driver.

6 Conclusion

This paper documents a robust link between corporate debt structure and employment recoveries following major economic downturns, rationalised through a rollover-rigidity channel arising from creditor composition. Exploiting predetermined corporate debt maturity schedules across major U.S. downturns, I document that firms facing maturing bond debt experience significantly lower and more persistent employment growth during recoveries than comparable firms with maturing loans. This behaviour is rationalised by a model where dispersed bondholders face coordination failures that impede debt restructuring. To satisfy these rigid bond claims, cash-constrained firms aggressively cut payrolls during a crisis, entering the recovery phase financially scarred and liquidity-constrained.

These findings have implications for macroeconomic modelling and the design of stabilisation policies. By demonstrating that ex-post debt renegotiability shapes hiring, this paper highlights a corporate balance-sheet channel that links capital structure choices to labour demand. The results indicate that bond markets are not frictionless substitutes for bank credit during stress. Instead, the rigid contract architecture of market-based debt creates a persistent refinancing trap that drags down employment. Consequently, policy interventions and emergency credit facilities should not only evaluate the volume of credit flow being supported, but also the renegotiation design of the targeted debt instruments.

Several limitations should be noted. The empirical design does not directly observe renegotiation outcomes or creditor bargaining. Consequently, while the evidence is consistent with a debt-rigidity mechanism, it does not identify the exact contractual channel through which employment is affected. In addition, the analysis focuses on publicly traded U.S. firms, a selected segment of the corporate sector that is generally larger, older, and of higher credit quality than loan-dependent firms. To the extent that this selection attenuates the negative employment effects of bond financing, the estimated employment penalty should be viewed as a lower bound. Finally, the analysis is partial

historical (pre-1990) co-movement between GDP and employment, and is positive when employment recovers less than past GDP growth would predict. See Appendix D for the construction. Episode-level estimates (Table D1) are 3.6, 3.3 and 0.95 million jobs for Dot-com, GFC and Covid-19, respectively.

equilibrium and restricted to surviving incumbent firms, limiting its ability to capture broader labour market adjustments or extensive-margin job losses arising from firm exit, bankruptcy, or acquisition.

Finally, the analysis covers a small number of major crisis episodes, so the results should be interpreted as evidence on debt structure during severe aggregate downturns rather than as a characterisation of normal business-cycle fluctuations. Future research could extend the analysis in several directions: to privately held firms, to other institutional environments with different restructuring frameworks, and to economies outside the U.S., especially Europe. Such cross-country comparisons face a difficult selection problem, however, since the depth of bond markets and the flexibility of labour markets are likely related across countries, so that differences in the jobless nature of recoveries across countries cannot be attributed to debt structure alone. More granular work could also examine the holders of corporate debt more closely, shifting the focus from debt instrument type to debt holder type. For example, the degree of rollover rigidity may depend on whether syndicated loans are held mainly by banks or by nonbank institutions, and bondholder composition may matter as well, since different investors such as pension funds may vary in their willingness or ability to renegotiate.

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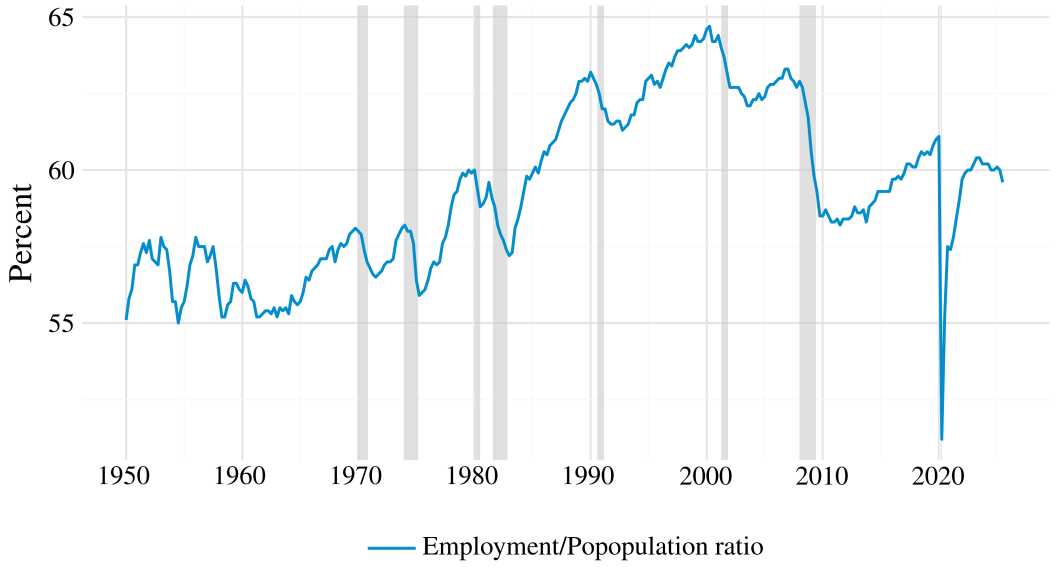
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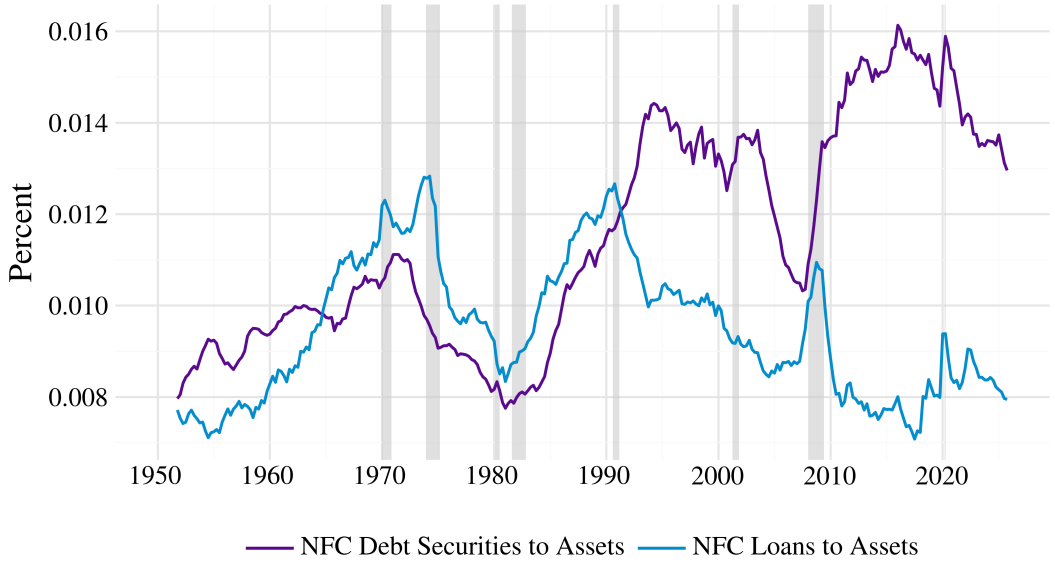
Appendix

A Additional descriptives



Appendix Figure A1: Labour market dynamics and labour share of income

Notes: The figure shows the employment-to-population ratio over time, clearly showing that employment immediately caught up to pre-crisis levels pre-1990, while since then the recovery slowed down and more recently barely catches up anymore. *Source(s):* U.S. Bureau of Labor Statistics.



Appendix Figure A2: Non-financial corporate liabilities to assets

Notes: The figure shows the aggregate bond- and loan-debt as a share of total assets of non-financial corporations in the U.S. over time. *Source(s):* Fed Board (Z.1 Financial Accounts).

Figure A2 shows the structural change in corporate finance in the 1990s. While not a lot of research exists on the exact reasons for this structural shift from bank lending to bond finance, there are three coinciding factors that may have contributed. First, the 1990s were characterised by a Federal Reserve easing cycle that pushed the federal funds rate to its lowest levels since 1963. This allowed U.S. corporations to refinance older debt at significantly lower rates (McCauley et al., 1999). Second, this coincided with the information technology revolution. Corporate data became cheap and widely available, allowing corporations to bypass banks and access capital markets directly, leading to an erosion of the traditional bank specialness (Thomas and Wang, 2004; Calomiris and Ramirez, 1996; Edwards, 1996).[56] Lastly, the shift was further supported by the SEC's introduction of *Rule 144A* in 1990, which decreased the time and cost barriers of debt issuance, supporting the shift from intermediated bank credit toward more market-based corporate financing (Carow et al., 1999; Thomas and Wang, 2004).[57]

Appendix Table A1: Number of firms by corporate debt composition

	2000	2010	2020
Bond-financed firm	100	954	740
Loan-financed firm	81	890	715
Mixed	3204	295	900

Notes: The table shows the number of firms by financing type (Loan-financed firms, Bond-financed firms, Mixed) in 2000, 2010, and 2020. The financing type is defined as the primary source of external financing for each firm. *Source(s):* Compustat; author's calculations.

[56] "Bank specialness" refers to the historical comparative advantage banks held in monitoring borrowers and gathering proprietary information, a barrier that eroded during the 1990s as the information technology revolution made corporate data cheap and widely available (Thomas and Wang, 2004).

[57] Rule 144A is a regulatory safe harbor adopted by the SEC in 1990 that allows the private resale of unregistered, restricted securities among Qualified Institutional Buyers (QIBs) without requiring public registration. This supported the shift from bank lending to market-based financing by significantly lowering the time and cost barrier for corporations to issue tradable debt.

Appendix Table A2: Number of firms by SIC1 industry

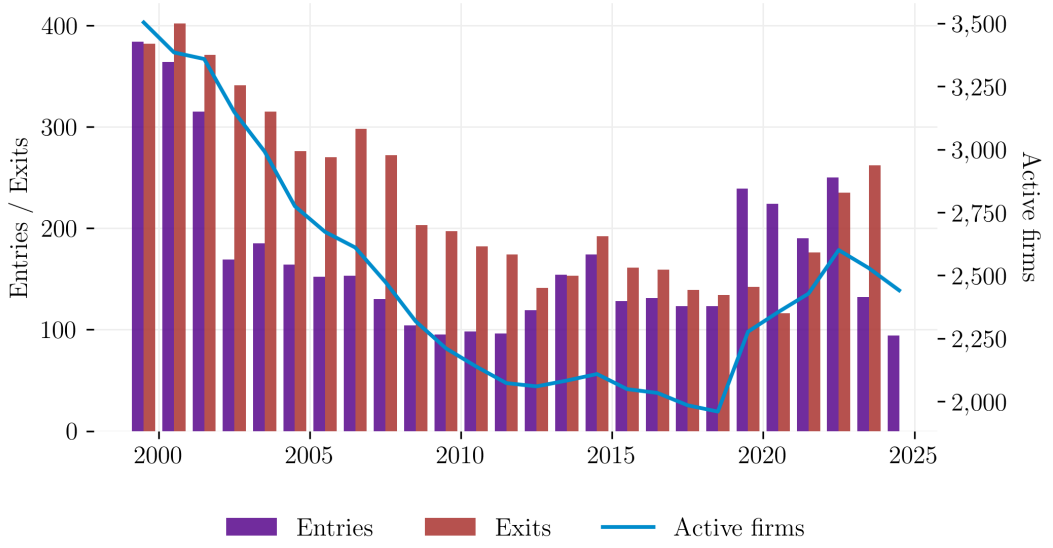
	2000	2010	2020
Agriculture	16	13	8
Construction	583	397	579
Health, Legal, Education	174	119	114
Manufacturing	1091	657	655
Mining	187	174	145
Services	588	335	461
Transport, Utilities	262	179	129
Wholesale, Retail Trade	484	265	264

Notes: The table shows the number of firms by 1-digit SIC (industry) in 2000, 2010, and 2020. *Source(s):* Compustat; author's calculations.

Appendix Table A3: Number of firms in sample

	Pre year	Post year	N pre	N post	Survivors	Exited	Entered	Net
Dot-com Bubble	2000	2004	3385	2775	1949	1436	826	-610
Financial Crisis	2007	2012	2474	2060	1459	1015	601	-414
Covid-19 Pandemic	2019	2023	2277	2529	1743	534	786	252

Notes: The table shows the number of firms entering and exiting the sample for each crisis episode. *N* stands for the number of firms. *Source(s):* Compustat; author's calculations.



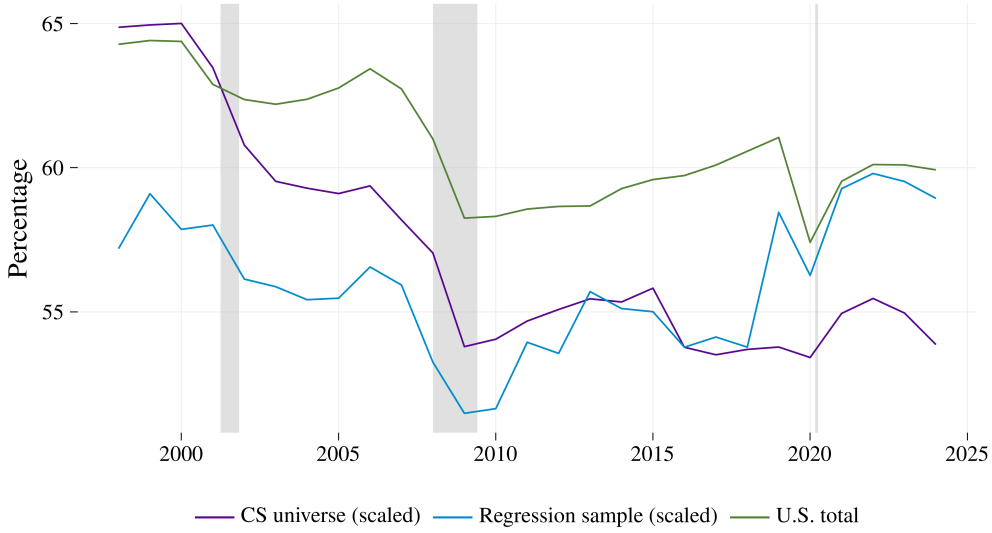
Appendix Figure A3: Firm entry and exit over time

Notes: The figure shows firm entry and exit over time. *Source(s):* Compustat; author's calculations.

Appendix Table A4: Exit reasons by episode

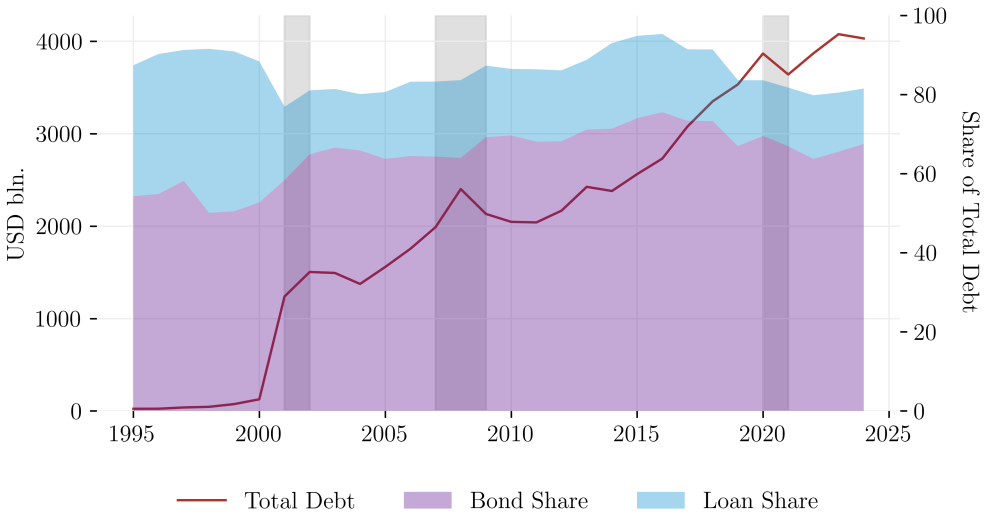
	Dot-com Bubble	Financial Crisis	Covid-19 Pandemic
Acquisition and merger	636	541	299
Other (no SEC filing)	556	212	38
Bankruptcy and liquidation	48	55	31
Going private	32	10	1
Total (matched)	1272	818	369

Notes: The table shows the number of firms exiting the sample around each crisis episode (present at the snap year, absent at the post year defined as the third year of the recovery period - 2004, 2012, 2023) by Compustat exit reason (*DLRSN*). Firms without a matched Compustat deletion record are excluded. *Source(s):* Compustat; author's calculations.



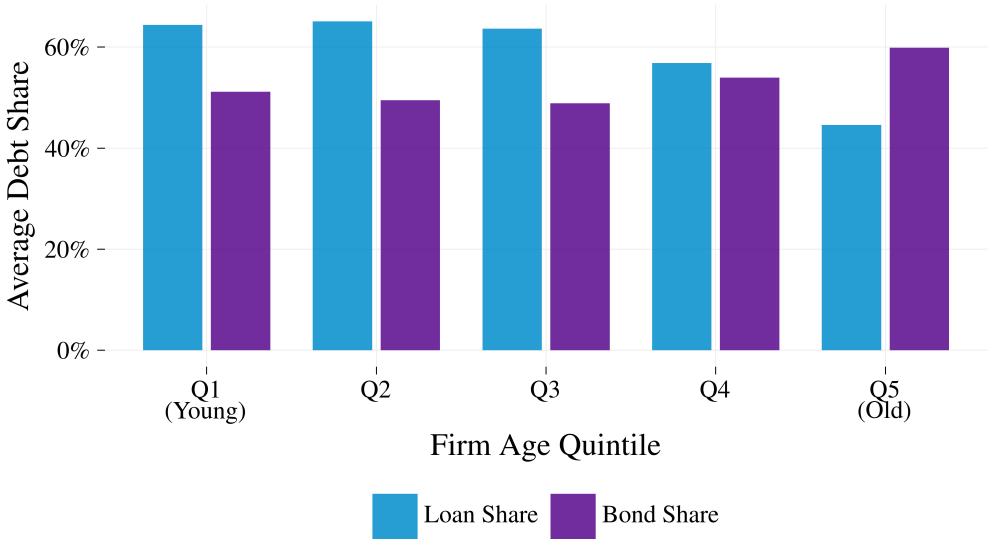
Appendix Figure A4: Employment-to-population ratio: aggregate firm-level data

Notes: The figure compares the employment-to-population ratio implied by the firm-level data with the aggregate U.S. ratio, 1998–2024 (annual). *U.S. total* is civilian employment divided by the civilian non-institutional population aged 16 and over. *CS universe* sums reported employees across all Compustat firms located and incorporated in the U.S. *Regression sample* sums employees across firms in the final estimation sample. Both firm-level sums are divided by the same aggregate population series and, since they cover only a fraction of U.S. employment, are rescaled for comparability (CS universe divided by 0.30, regression sample divided by 0.22) so that the three series are visibly comparable. The figure is therefore informative about co-movement over the cycle, not about levels. Shaded areas mark NBER recessions. *CS* stands for Compustat. *Source(s):* Compustat; Capital IQ; FRED; author's calculations.



Appendix Figure A5: Total debt and its composition over time

Notes: The figure shows total debt per year, summed over each firm, and the respective shares of bond and loan debt. The white area between the top of the stacked shares and 100% represents other debt types not classified as bonds or bank loans (e.g. capital leases, commercial paper, and other borrowings). *Source(s):* Compustat; Capital IQ; author's calculations.

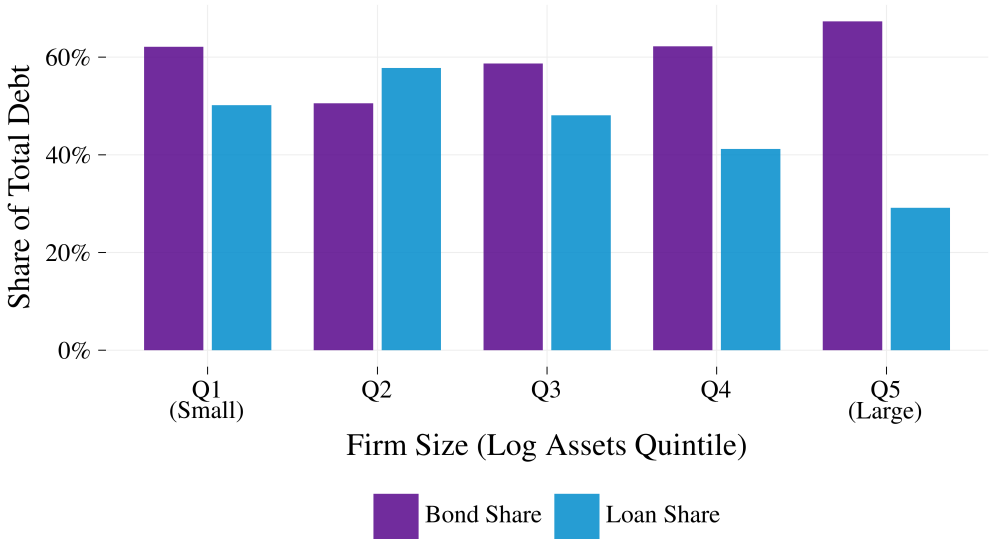


Appendix Figure A6: Debt shares by firm age quintiles

Notes: The figure shows the debt shares of firms in each age quintile. *Source(s):* Compustat; Capital IQ; author's calculations.

Figure A6 shows a slight negative relationship between firm age and the share of loan debt, whereas the share of bond debt remains relatively stable across firm-age quintiles. One possible explanation is that the Compustat universe is tilted toward larger firms, disproportionately representing the upper end of the firm-size distribution. At the same time, this pattern suggests that,

at least within my sample, firm age is not a primary determinant of firms' debt composition.



Appendix Figure A7: Debt composition by firm size quintiles

Notes: The figure shows the debt composition of firms in each size quintile. *Source(s):* Compustat; Capital IQ; author's calculations.



Appendix Figure A8: Debt composition by credit rating

Notes: The figure shows the debt composition of firms in each credit rating category. *A* is the highest credit rating, and *D* is the lowest. *NR* stands for "not rated". *Source(s):* Compustat; Capital IQ; author's calculations.

Appendix Table A5: Bond- and loan-financed firms: summary statistics

	Bond-debt firm	Loan-debt firm	Mixed
Panel A: Share of observations by classification			
Debt share $> 50\%$	0.17	0.11	0.73
Debt share $> 66\%$	0.12	0.07	0.81
Panel B: Share of firms with instrument $> 10\%$ *of total debt*			
Bond debt	1.00	0.68	0.23
Loan debt	0.65	1.00	0.29
Commercial paper	0.05	0.00	0.01
Capital leases	0.11	0.11	0.22
Other (remainder)	0.06	0.04	0.40
Panel C: Firm characteristics (mean, s.d.)			
Log assets	7.47	6.05	5.49
	(2.03)	(1.98)	(2.16)
Log employment	8.38	7.37	6.88
	(2.01)	(1.90)	(2.17)
Log firm age	3.68	3.41	3.23
	(1.00)	(0.95)	(0.97)
Book leverage	0.39	0.37	0.24
	(0.21)	(0.21)	(0.21)
Operating profitability	0.29	0.33	0.35
	(0.22)	(0.24)	(0.34)
Tangibility	0.32	0.28	0.25
	(0.25)	(0.24)	(0.22)
Tobin's Q	1.48	1.33	1.95
	(1.46)	(1.49)	(2.47)
Liquidity	0.10	0.08	0.20
	(0.13)	(0.12)	(0.23)

Notes: The table shows the share of firm-year observations classified by financing type. A *bond-debt firm* (*loan-debt firm*) is defined as an observation where bond (loan) debt exceeds 50% of total debt. *Panel A* reports the distribution of observations across financing types. *Panel B* presents key debt structure characteristics for each type. *Panel C* reports selected firm-level characteristics, with means and standard deviations (in parentheses). *Source(s):* Compustat; author's calculations.

Table A5 compares summary statistics of bond- and loan-financed firms. The definition used is whether the share of total debt is larger than 50% for either bond or loan debt. *Panel A* shows that bond-financed firms make up 17% of the sample, while loan-financed firms account for 11%. The rest of the firms have a mix of both. *Panel B* looks at the importance of other debt types, i.e. what share of firms has an important position — defined as more than 10% of total debt — in other debt types. More than 60% of both loan- and bond-financed firms hold a significant position in the other debt type, suggesting that many firms rely on a mix of both bond and loan financing. Finally, *Panel C* compares the two groups of firms across a range of firm characteristics. The main takeaway is that on average bond-financed firms tend to be larger and employ more workers than loan-financed firms, although the two groups are relatively comparable across most characteristics.

Appendix Table A6: Correlation matrix of assets and liabilities

	Total Assets	Cash	PPE	Receivables	Inventories	Common Equity	Intangible Assets
Total Liabilities	0.96	0.75	0.70	0.82	0.56	0.68	0.67
Total Debt	0.89	0.69	0.58	0.86	0.43	0.57	0.62
Loan Debt	0.34	0.22	0.28	0.13	0.21	0.20	0.39
Bond Debt	0.87	0.69	0.56	0.79	0.39	0.57	0.67
Commercial Paper	0.67	0.39	0.26	0.87	0.28	0.36	0.26
Capital Leases	0.57	0.58	0.54	0.43	0.32	0.50	0.34
Other Debt	0.45	0.33	0.23	0.66	0.24	0.20	0.19
Short-term Debt	0.65	0.46	0.31	0.86	0.28	0.38	0.34
Long-term Debt	0.89	0.71	0.62	0.76	0.42	0.61	0.70

Notes: Pairwise Pearson correlations (complete cases per pair). *PPE* is net property, plant, and equipment, *Total Debt* is the sum of all debt types. *Short-term Debt* is defined as the sum of short-term borrowings and the current portion of long-term debt and capital leases, i.e., debt maturing within the next twelve months, while *Long-term Debt* is defined as the total outstanding balance of long-term-type debt instruments as classified in the capital structure. All correlations are statistically significant at the 1% level. *Source(s):* Compustat; Capital IQ; author's calculations.

Appendix Table A7: Balancedness table for maturing debt type firms

	Loan group	Bond group	Diff.
Maturing debt, own type (% assets)	0.12	0.10	0.02***
	(0.00)	(0.00)	(0.00)
Log assets	6.75	7.77	-1.03***
	(0.06)	(0.06)	(0.00)
Log employment	7.84	8.58	-0.75***
	(0.06)	(0.06)	(0.00)
Log firm age	3.55	3.76	-0.22***
	(0.03)	(0.03)	(0.00)
Book leverage	0.33	0.35	-0.01*
	(0.01)	(0.01)	(0.07)
Operating profitability	0.30	0.29	0.01
	(0.01)	(0.01)	(0.26)
Tangibility	0.31	0.31	0.00
	(0.01)	(0.01)	(0.94)
Tobin's Q	1.51	1.75	-0.23***
	(0.05)	(0.05)	(0.00)
Liquidity	0.10	0.11	-0.01
	(0.00)	(0.00)	(0.27)
N	1103	1079	

Notes: The table compares firm characteristics for firms with loan debt maturing versus bond debt maturing during the recovery period. Firms are classified using the same exposure measures as in the main regressions: cumulative loan/bond debt maturing over the recovery years, based on the pre-crisis snapshot maturity schedule, scaled by pre-crisis (snapshot-year) total assets. Sample: firm-year observations in the snap year of each crisis episode. The two groups are not mutually exclusive: a firm with both bank and bond debt maturing belongs to both. Within each group, firms are sorted into quintiles by their own ratio. At each quintile level the two groups' means are differenced, and these 5 level-differences are then averaged (equal-weighted), so the comparison holds the relative intensity of refinancing pressure fixed. The first row, *Maturing debt, own type (% assets)*, reports each pool's own ratio to confirm the calibrated intensity levels are quantitatively comparable across groups. *Diff.* is the quintile-averaged difference in means (Loan − Bond), p-value in parentheses below. Asterisks indicate significance at the 1%, 5%, and 10% level (***$p < 0.01$; **$p < 0.05$; *$p < 0.1$). *Source(s):* Compustat, Capital IQ; author's calculations.

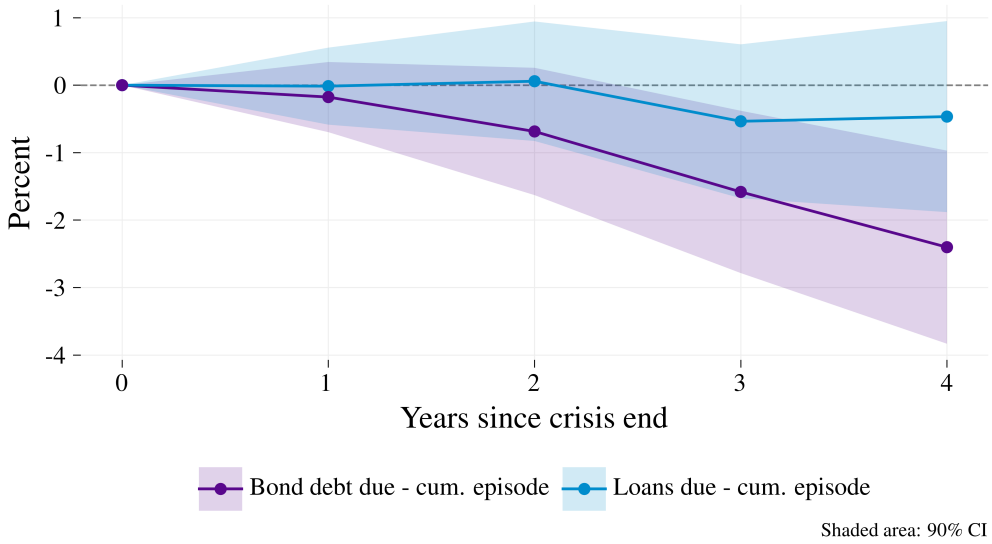
B Additional empirical results and information

B.1 Federal Reserve credit and corporate bond facilities

The corporate bond facilities (PMCCF and SMCCF) fall into the category of attenuating factors. Although the PMCCF never executed a single transaction, its announcement — alongside the active secondary-market purchases of the SMCCF — acted as a central bank backstop. Gilchrist et al. (2024) document that the SMCCF purchases compressed eligible bond spreads. However, the raised bond funds from the primary-market issuance boom were used to hoard cash or repay loan debt rather than being invested in capital or labour (Darmouni and Siani, 2025). Moreover, while active asset purchases were restricted to 2020, the facility's portfolio fully wound down by the end of 2021.

In contrast, the MSLP introduces a potential amplifying bias. Operating from July 6, 2020, through January 8, 2021, the MSLP targeted the "missing middle" of the corporate sector: firms too large for the PPP but too small to cost-effectively access bond markets. By purchasing 95% participations in standardised bank loans from eligible lenders, the Federal Reserve absorbed the vast majority of the credit risk. Over its operational lifespan, the programme supported 1,830 loans totaling $17.5 billion, with an average loan size of $9.5 million (Arseneau et al., 2022).

B.2 Further impulse response functions



Appendix Figure B1: Employment IRF - debt maturing over crisis episode

Notes: The figure reports impulse response functions of cumulative employment growth estimated via local projections. The horizon covers the recovery years following the crisis trough. The response corresponds to a one-standard-deviation increase in the debt variable. Maturing debt is defined as the total debt coming due over the entire crisis episode and is normalised by firm-specific assets measured in the pre-crisis snap year. Shaded areas indicate confidence intervals. The estimated model is defined in Equation (2) and includes the same control sequence as results in Table 5 columns (1) and (2), i.e. *log total assets*, *log firm age*, *rating-dummy*, *log employment*, *sales growth*, *book leverage*, *Tobin's q*, *liquidity*, and *profitability*. *Source(s):* Author's calculations.

B.3 Robustness exercises

Appendix Table B1: Floating interest rate debt

	Cumulative employment growth - recovery				
	Credit facility		Debt interest info		
	(1)	(2)	(3)	(4)	(5)
Bond debt due, recovery	-0.208**	-0.207**	-0.192**	-0.209**	-0.199**
	(0.088)	(0.088)	(0.087)	(0.088)	(0.089)
Loans due, recovery	-0.053	-0.043	-0.042	-0.024	-0.037
	(0.072)	(0.073)	(0.068)	(0.069)	(0.071)
Bank facility open, recovery	0.074				
	(0.062)				
Bank facility open, episode		0.054			
		(0.064)			
Interest coverage			0.000*		
			(0.000)		
Hadlock-Pierce SA Index				0.004	
				(0.008)	
Floating share					0.013
					(0.021)
Industry-Year FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
p(Bond < Loan)	0.063	0.052	0.061	0.029	0.057
N obs	2772	2772	2533	2772	2772
N clusters	2066	2066	1876	2066	2066
R^2 (within)	0.087	0.087	0.101	0.088	0.088

Notes: The dependent variable is cumulative employment growth during the recovery period, measured as the symmetric growth rate. *Bond debt due* and *Loans due* measure the amount of predetermined long-term debt maturing during the crisis episode and recovery period, scaled by pre-crisis (snapshot-year) total assets; *episode* and *recovery* indicate the period over which the cumulative sum is computed. The estimated model is defined in Equation (1). Controls include log total assets, log firm age, rating-dummy, log employment, sales growth, Tobin's Q, liquidity, profitability, and book leverage. *Bank facility open* is defined as the cumulative dollar amount of undrawn bank facility commitments (revolver + term loan facility) set to expire during the recovery window (or full episode), as a share of pre-crisis assets. The *Hadlock-Pierce SA Index* measures external financing constraints. *Floating share* is the share of floating interest rate debt in total debt. All control variables are measured as of the snapshot year τ and winsorised at the 1st/99th percentiles. The row p(Bond < Loan) reports the one-sided p-value from a Wald test of $H_0 : \beta_{\text{Bond debt due}} \geq \beta_{\text{Loans due}}$ against $H_1 : \beta_{\text{Bond debt due}} < \beta_{\text{Loans due}}$. Asterisks indicate significance at the 1%, 5%, and 10% level (***$p < 0.01$; **$p < 0.05$; *$p < 0.1$). Standard errors in parentheses and clustered at the firm-level. The constant term is omitted from the table. *N obs* indicates the number of firm-year observations, while *N clusters* indicates the number of clusters. *Source(s):* Compustat; Capital IQ; author's calculations.

Table B1 additionally controls for the presence of open credit facilities and the share of floating-rate debt. This addresses the concern that firms with greater exposure to floating interest rates may be more sensitive to interest-rate shocks, potentially confounding the relationship between debt structure and employment growth. The estimated effects remain largely unchanged, indicating that the results are not driven by differences in floating-rate exposure. In addition, the table shows

specifications controlling for the interest coverage ratio and the Hadlock-Pierce SA Index.[58]

Appendix Table B2: Debt maturing over recovery period

	Cumulative employment growth - recovery			
	(1)	(2)	(3)	(4)
	No contr.	Basic	No book L	Baseline
Bond debt due, recovery	-0.214**	-0.215**	-0.246***	-0.210**
	(0.088)	(0.089)	(0.081)	(0.088)
Loans due, recovery	-0.035	-0.072	-0.054	-0.025
	(0.067)	(0.067)	(0.063)	(0.069)
Log total assets		-0.015***	0.038***	0.039***
		(0.005)	(0.011)	(0.011)
Log firm age		-0.042***	-0.024***	-0.024***
		(0.009)	(0.008)	(0.009)
Rated (dummy)		0.055***	0.064***	0.067***
		(0.018)	(0.017)	(0.018)
Log employment			-0.063***	-0.064***
			(0.011)	(0.011)
Sales growth (yoy)			0.146***	0.147***
			(0.039)	(0.039)
Tobin's Q			0.026***	0.026***
			(0.007)	(0.007)
Liquidity			-0.051	-0.062
			(0.060)	(0.061)
Operating profitability			0.063	0.061
			(0.045)	(0.045)
Book leverage				-0.052
				(0.049)
Industry-Year FE	Yes	Yes	Yes	Yes
p(Bond < Loan)	0.046	0.091	0.025	0.029
N obs	2832	2832	2772	2772
N clusters	2122	2122	2066	2066
R^2 (within)	0.002	0.020	0.085	0.088

Notes: The dependent variable is cumulative employment growth over the recovery period, measured as the symmetric growth rate. The column titles indicate the respective regression specifications. *Bond debt due* and *Loans due* measure the amount of predetermined long-term debt maturing during the crisis episode and recovery period, scaled by pre-crisis (snapshot-year) total assets; *recovery* indicates the period over which the cumulative sum is computed. The estimated model is defined in Equation (1). *Rated* is a dummy variable indicating whether a firm has a credit rating. *Tobin's Q* is the ratio of market value of assets to book value of assets. *Operating profitability* is defined as revenues minus cost-of-goods-sold divided by total assets. *Tangibility* is the ratio of net property, plant, and equipment to total assets. All control variables are measured as of the snapshot year τ and winsorised at the 1st/99th percentiles. The row p(Bond < Loan) reports the one-sided p-value from a Wald test of $H_0 : \beta_{\text{Bond debt due}} \geq \beta_{\text{Loans due}}$ against $H_1 : \beta_{\text{Bond debt due}} < \beta_{\text{Loans due}}$. Asterisks indicate significance at the 1%, 5%, and 10% level (***$p < 0.01$; **$p < 0.05$; *$p < 0.1$). Standard errors in parentheses and clustered at the firm-level. The constant term is omitted from the table. *N obs* indicates the number of firm-year observations, while *N clusters* indicates the number of clusters. *Source(s):* Compustat; Capital IQ; author's calculations.

[58] The Hadlock-Pierce SA Index (Hadlock and Pierce, 2010) measures financial constraint, and is defined as $\text{SA} = -0.737\,\text{Size} + 0.043\,\text{Size}^2 - 0.040\,\text{Age}$, where *Size* is the natural logarithm of total assets and *Age* is firm age in years. The index serves as a proxy for external financing constraints, with smaller and younger firms generally considered more financially constrained.

Appendix Table B3: Debt maturing over recovery period

	Cumulative employment growth - recovery							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Log growth	MSLP	Empl. g	EBITDA/TA	Bond debt share	Equity	Cal. year	Dec reporting
Bond debt due, recovery	-0.225**	-0.209**	-0.198**	-0.200**	-0.174*	-0.228**	-0.244***	-0.331**
	(0.092)	(0.088)	(0.088)	(0.088)	(0.093)	(0.091)	(0.091)	(0.131)
Loans due, recovery	-0.031	-0.056	-0.024	-0.035	-0.048	-0.006	-0.036	-0.120
	(0.074)	(0.096)	(0.069)	(0.070)	(0.071)	(0.071)	(0.068)	(0.110)
Bond debt due, rec. × Dec. reporting								0.157
								(0.158)
Loans due, rec. × Dec. reporting								0.130
								(0.127)
Loans due, rec. × MSLP eligible		0.060						
		(0.121)						
Log total assets	0.041***	0.039***	0.040***	0.032***	0.041***	0.036***	0.039***	0.039***
	(0.012)	(0.011)	(0.011)	(0.010)	(0.011)	(0.011)	(0.011)	(0.011)
Log firm age	-0.026***	-0.024***	-0.021**	-0.023***	-0.023***	-0.027***	-0.024***	-0.025***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Rated (dummy)	0.072***	0.067***	0.067***	0.069***	0.069***	0.065***	0.068***	0.067***
	(0.019)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Log employment	-0.069***	-0.064***	-0.066***	-0.063***	-0.064***	-0.060***	-0.064***	-0.064***
	(0.012)	(0.011)	(0.011)	(0.011)	(0.011)	(0.012)	(0.011)	(0.011)
Employment growth (yoy)			0.096*	0.089*				
			(0.053)	(0.054)				
Bond debt / total debt					-0.027			
					(0.024)			
Sales growth (yoy)	0.156***	0.147***	0.128***	0.125***	0.147***	0.149***	0.147***	0.146***
	(0.042)	(0.039)	(0.042)	(0.042)	(0.039)	(0.040)	(0.039)	(0.039)
Tobin's Q	0.027***	0.026***	0.024***	0.025***	0.026***	0.026***	0.026***	0.026***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Liquidity	-0.067	-0.063	-0.075	-0.051	-0.058	-0.061	-0.063	-0.063
	(0.064)	(0.061)	(0.060)	(0.066)	(0.061)	(0.062)	(0.061)	(0.060)
Operating profitability	0.067	0.061	0.065		0.061	0.054	0.060	0.061
	(0.048)	(0.045)	(0.045)		(0.045)	(0.046)	(0.045)	(0.045)
Book leverage	-0.050	-0.052	-0.049	-0.040	-0.043	0.004	-0.047	-0.047
	(0.052)	(0.049)	(0.049)	(0.049)	(0.049)	(0.072)	(0.048)	(0.049)
EBITDA / assets				0.115				
				(0.072)				
Equity / total assets						0.064		
						(0.056)		
December reporting (dummy)								-0.024
								(0.017)
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
p(Bond < Loan)	0.029	0.103	0.039	0.046	0.124	0.014	0.020	0.086 0.556
N obs	2772	2772	2755	2755	2772	2611	2772	2772
N clusters	2066	2066	2053	2053	2066	1939	2066	2066
R^2 (within)	0.090	0.088	0.088	0.086	0.085	0.081	0.087	0.087

Notes: The dependent variable is cumulative employment growth over the recovery period, measured as the symmetric growth rate. The column titles indicate the respective regression specifications. *MSLP* stands for Fed's Main Street Lending Program. In the *Cal. year* specification, debt maturity buckets are re-anchored to calendar years (rather than each firm's fiscal-year-end), ensuring maturity timing is comparable across firms and aligned with the calendar-year crisis episode windows. *Bond debt due* and *Loans due* measure the amount of predetermined long-term debt maturing during the crisis episode and recovery period, scaled by pre-crisis (snapshot-year) total assets; *recovery* indicates the period over which the cumulative sum is computed. The estimated model is defined in Equation (1). *Rated* is a dummy variable indicating whether a firm has a credit rating. *Tobin's Q* is the ratio of market value of assets to book value of assets. *Operating profitability* is defined as revenues minus cost-of-goods-sold divided by total assets. *Tangibility* is the ratio of net property, plant, and equipment to total assets. All control variables are measured as of the snapshot year τ and winsorised at the 1st/99th percentiles. The row p(Bond < Loan) reports the one-sided p-value from a Wald test of $H_0 : \beta_{\text{Bond debt due}} \geq \beta_{\text{Loans due}}$ against $H_1 : \beta_{\text{Bond debt due}} < \beta_{\text{Loans due}}$. Asterisks indicate significance at the 1%, 5%, and 10% level (***$p < 0.01$; **$p < 0.05$; *$p < 0.1$). Standard errors in parentheses and clustered at the firm-level. The constant term is omitted from the table. *N obs* indicates the number of firm-year observations, while *N clusters* indicates the number of clusters. *Source(s):* Compustat; Capital IQ; author's calculations.

Appendix Table B4: Debt maturing over recovery period

	Cumulative employment growth			
	(1)	(2)	(3)	(4)
	Baseline	Snap 2y avg.	2y-recovery	4y-recovery
Bond debt due, recovery	-0.210**	-0.219**		
	(0.088)	(0.091)		
Loans due, recovery	-0.025	-0.045		
	(0.069)	(0.069)		
Bond debt due, rec. 2y			-0.291**	
			(0.117)	
Loans due, rec. 2y			-0.073	
			(0.113)	
Bond debt due, rec. 4y				-0.143*
				(0.079)
Loans due, rec. 4y				0.042
				(0.068)
Industry-Year FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
p(Bond < Loan)	0.029	0.043	0.073	0.014
N obs	2772	2777	2747	2772
N clusters	2066	2070	2052	2066
R^2 (within)	0.088	0.081	0.089	0.086

Notes: The dependent variable is cumulative employment growth over the recovery period, measured as the symmetric growth rate. *Bond debt due* and *Loans due* measure the amount of predetermined long-term debt maturing during the crisis episode and recovery period, scaled by pre-crisis (snapshot-year) total assets; *recovery* (rec.) indicates the period over which the cumulative sum is computed. *rec. 2y* and *rec. 4y* refer to the regression specifications where the recovery period is defined as 2 and 4 years, respectively. *Snap 2y avg.* refers to the regression specification where the snapshot year is defined as the average of the two years prior to the crisis. The estimated model is defined in Equation (1). Controls include log total assets, log firm age, rating-dummy, log employment, sales growth, Tobin's Q, liquidity, profitability, and book leverage. All control variables are measured as of the snapshot year τ and winsorised at the 1st/99th percentiles. The row p(Bond < Loan) reports the one-sided p-value from a Wald test of $H_0 : \beta_{\text{Bond debt due}} \geq \beta_{\text{Loans due}}$ against $H_1 : \beta_{\text{Bond debt due}} < \beta_{\text{Loans due}}$. Asterisks indicate significance at the 1%, 5%, and 10% level (***$p < 0.01$; **$p < 0.05$; *$p < 0.1$). Standard errors in parentheses and clustered at the firm-level. The constant term is omitted from the table. *N obs* indicates the number of firm-year observations, while *N clusters* indicates the number of clusters. *Source(s):* Compustat; Capital IQ; author's calculations.

Appendix Table B5: Placebo test - hypothetical crisis in 2014

	Cumulative employment growth			
	(1)	(2)	(3)	(4)
	Episode	Episode	Recovery	Recovery
Bond debt due, episode	-0.253		-0.094	
	(0.198)		(0.162)	
Loans due, episode	0.151		0.251	
	(0.196)		(0.172)	
Bond debt due, recovery		-0.188		-0.074
		(0.196)		(0.164)
Loans due, recovery		0.188		0.298
		(0.214)		(0.189)
Industry-Year FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
N obs	1267	1267	1208	1208
N clusters	1267	1267	1208	1208
R^2 (within)	0.000	0.000	0.000	0.000

Notes: The dependent variable is cumulative employment growth, measured as the symmetric growth rate. The column titles indicate over which period the cumulative employment growth is measured — *Episode* indicates the entire crisis episode, while *Recovery* indicates the recovery period. *Bond debt due* and *Loans due* measure the amount of predetermined long-term debt maturing during the crisis episode and recovery period, scaled by pre-crisis (snapshot-year) total assets; *episode* and *recovery* indicate the period over which the cumulative sum is computed. The estimated model is defined in Equation (1). Controls include log total assets, log firm age, rating-dummy, log employment, sales growth, Tobin's Q, liquidity, profitability, and book leverage. All control variables are measured as of the snapshot year τ and winsorised at the 1st/99th percentiles. Asterisks indicate significance at the 1%, 5%, and 10% level (***$p < 0.01$; **$p < 0.05$; *$p < 0.1$). Standard errors in parentheses and clustered at the firm-level. The constant term is omitted from the table. *N obs* indicates the number of firm-year observations, while *N clusters* indicates the number of clusters. *Source(s):* Compustat; Capital IQ; author's calculations.

Appendix Table B6: Debt maturing over recovery period

	Cumulative employment growth - recovery							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bond debt due, recovery	-0.259***	-0.257***	-0.214***	-0.210**	-0.215**	-0.065	-0.060	-0.023
	(0.079)	(0.076)	(0.080)	(0.088)	(0.094)	(0.153)	(0.292)	(0.511)
Loans due, recovery	0.026	-0.070	-0.030	-0.025	-0.001	0.043	0.009	0.130
	(0.065)	(0.064)	(0.064)	(0.069)	(0.079)	(0.115)	(0.229)	(0.425)
Year FE	-	✓	✓	-	-	-	✓	-
Industry FE	-	-	✓	-	-	-	-	-
Ind.-Year FE (SIC3)	-	-	-	✓	-	-	-	✓
Ind.-Year FE (SIC4)	-	-	-	-	✓	-	-	-
Firm FE	-	-	-	-	-	✓	✓	✓
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
p(Bond < Loan)	0.001	0.015	0.021	0.029	0.026	0.266	0.418	0.402
N obs	2772	2772	2772	2772	2772	2772	2772	2772
N clusters	2066	2066	2066	2066	2066	2066	2066	2066
R^2 (within)	0.048	0.072	0.087	0.088	0.084	0.195	0.194	0.186

Notes: The dependent variable is cumulative employment growth over the recovery period, measured as the symmetric growth rate. *Bond debt due* and *Loans due* measure the amount of predetermined long-term debt maturing during the crisis episode and recovery period, scaled by pre-crisis (snapshot-year) total assets; *recovery* indicates the period over which the cumulative sum is computed. The estimated model is defined in Equation (1). Controls include log total assets, log firm age, rating-dummy, log employment, sales growth, Tobin's Q, liquidity, profitability, and book leverage. All control variables are measured as of the snapshot year τ and winsorised at the 1st/99th percentiles. The row p(Bond < Loan) reports the one-sided p-value from a Wald test of $H_0 : \beta_{\text{Bond debt due}} \geq \beta_{\text{Loans due}}$ against $H_1 : \beta_{\text{Bond debt due}} < \beta_{\text{Loans due}}$. Asterisks indicate significance at the 1%, 5%, and 10% level (***$p < 0.01$; **$p < 0.05$; *$p < 0.1$). Standard errors in parentheses and clustered at the firm-level. The constant term is omitted from the table. *N obs* indicates the number of firm-year observations, while *N clusters* indicates the number of clusters. *Source(s):* Compustat; Capital IQ; author's calculations.

Appendix Table B7: Revenue growth as outcome variable

	Cumulative growth in revenue			
	(1)	(2)	(3)	(4)
	Episode	Episode	Recovery	Recovery
Bond debt due, episode	-0.295**		-0.236**	
	(0.133)		(0.111)	
Loans due, episode	-0.064		-0.018	
	(0.110)		(0.094)	
Bond debt due, recovery		-0.366**		-0.274**
		(0.143)		(0.111)
Loans due, recovery		-0.077		-0.044
		(0.113)		(0.097)
Industry-Year FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
p(Bond < Loan)	0.064	0.036	0.055	0.042
N obs	2977	2977	2772	2772
N clusters	2197	2197	2066	2066
R^2 (within)	0.093	0.095	0.022	0.021

Notes: The dependent variable is cumulative revenue growth. The column titles indicate over which period the cumulative revenue growth is measured — *Episode* indicates the entire crisis episode, while *Recovery* indicates the recovery period. *Bond debt due* and *Loans due* measure the amount of predetermined long-term debt maturing during the crisis episode, only the crisis, and recovery period, scaled by pre-crisis (snapshot-year) total assets; *episode* and *recovery* indicate the period over which the cumulative sum is computed. The estimated model is defined in Equation (1). Controls include log total assets, log firm age, rating-dummy, sales growth, Tobin's Q, liquidity, profitability, and book leverage. All control variables are measured as of the snapshot year τ and winsorised at the 1st/99th percentiles. The row p(Bond < Loan) reports the one-sided p-value from a Wald test of $H_0 : \beta_{\text{Bond debt due}} \geq \beta_{\text{Loans due}}$ against $H_1 : \beta_{\text{Bond debt due}} < \beta_{\text{Loans due}}$. Asterisks indicate significance at the 1%, 5%, and 10% level (***$p < 0.01$; **$p < 0.05$; *$p < 0.1$). Standard errors in parentheses and clustered at the firm-level. The constant term is omitted from the table. *N obs* indicates the number of firm-year observations, while *N clusters* indicates the number of clusters. *Source(s):* Compustat; Capital IQ; author's calculations.

Appendix Table B8: Firms' internal funds

	Cumulative change in	
	Net Operating Working Capital	Retained earnings
	(1)	(2)
	Episode	Recovery
Bond debt due, episode	-0.128***	
	(0.046)	
Loans due, episode	-0.024	
	(0.041)	
Bond debt due, crisis		-1.477*
		(0.861)
Loans due, crisis		0.220
		(0.307)
Industry-Year FE	Yes	Yes
Controls	Yes	Yes
p(Bond < Loan)	0.033	0.031
N obs	2914	2824
N clusters	2158	2092
R^2 (within)	0.063	0.167

Notes: The dependent variable is defined in the column headers, as well as the period over which it is measured. *Bond debt due* and *Loans due* measure the amount of predetermined long-term debt maturing during the crisis episode, only the crisis, and recovery period, scaled by pre-crisis (snapshot-year) total assets; *episode* and *crisis* indicate the period over which the cumulative sum is computed. Both dependent variables are measured as the cumulative change over the specified period. Net Operating Working Capital (NOWC) is defined as (Accounts Receivable + Inventory) − Accounts Payable, divided by total assets. The NOWC variable is used as a proxy for internal funds, as it captures the liquidity available to the firm from its operations, without using an endogenous variable such as cash. The estimated model is defined in Equation (1). Controls include log total assets, log firm age, rating-dummy, sales growth, Tobin's Q, liquidity, profitability, and book leverage. All control variables are measured as of the snapshot year τ and winsorised at the 1st/99th percentiles. The row p(Bond < Loan) reports the one-sided p-value from a Wald test of $H_0 : \beta_{\text{Bond debt due}} \geq \beta_{\text{Loans due}}$ against $H_1 : \beta_{\text{Bond debt due}} < \beta_{\text{Loans due}}$. Asterisks indicate significance at the 1%, 5%, and 10% level (***$p < 0.01$; **$p < 0.05$; *$p < 0.1$). Standard errors in parentheses and clustered at the firm-level. The constant term is omitted from the table. *N obs* indicates the number of firm-year observations, while *N clusters* indicates the number of clusters. *Source(s):* Compustat; Capital IQ; author's calculations.

Appendix Table B9: Additional firm-level outcomes

	Cumulative change in	
	Operating profitability	Revenue per worker
	(1)	(2)
	Episode	Episode
Bond debt due, episode	-0.005	0.006
	(0.046)	(0.109)
Loans due, episode	0.063*	0.153*
	(0.037)	(0.091)
Industry-Year FE	Yes	Yes
Controls	Yes	Yes
p(Bond < Loan)	0.108	0.117
N obs	2977	2995
N clusters	2197	2212
R^2 (within)	0.267	0.172

Notes: The dependent variable is defined in the column headers, as well as the period over which it is measured. *Bond debt due* and *Loans due* measure the amount of predetermined long-term debt maturing during the crisis episode, only the crisis, and recovery period, scaled by pre-crisis (snapshot-year) total assets; *episode* indicates the period over which the cumulative sum is computed. Both *Operating profitability* and *Revenue per worker* represent the cumulative change in the respective variables. The estimated model is defined in Equation (1). Controls include log total assets, log firm age, rating-dummy, sales growth, Tobin's Q, liquidity, profitability, and book leverage. All control variables are measured as of the snapshot year τ and winsorised at the 1st/99th percentiles. The row p(Bond < Loan) reports the one-sided p-value from a Wald test of $H_0 : \beta_{\text{Bond debt due}} \geq \beta_{\text{Loans due}}$ against $H_1 : \beta_{\text{Bond debt due}} < \beta_{\text{Loans due}}$. Asterisks indicate significance at the 1%, 5%, and 10% level (***$p < 0.01$; **$p < 0.05$; *$p < 0.1$). Standard errors in parentheses and clustered at the firm-level. The constant term is omitted from the table. *N obs* indicates the number of firm-year observations, while *N clusters* indicates the number of clusters. *Source(s):* Compustat; Capital IQ; author's calculations.

Table B9 displays the change in operating profitability as well as revenue per worker over the crisis episode. While the coefficients on maturing bank loans are positive and statistically significant, the coefficients on maturing bonds are statistically indistinguishable from zero. This pattern is consistent with a proportional scale contraction under capital-labour complementarity.

C Mathematical derivations for the model

Frictionless labour demand - Equation (4)

Profit at productivity z is $\pi(n) = zn^{\alpha} - wn$. The first-order condition $\alpha z n^{\alpha-1} = w$ gives

$$n^*(z) \;=\; \left(\frac{w}{\alpha z}\right)^{\frac{1}{\alpha-1}} \;=\; \left(\frac{\alpha z}{w}\right)^{\frac{1}{1-\alpha}},$$

where the second equality uses $\frac{1}{\alpha-1} = -\frac{1}{1-\alpha}$. Substituting back, $wn^*(z) = \alpha z(n^*(z))^\alpha$, hence

$$\pi^*(z) \;=\; z(n^*(z))^\alpha - wn^*(z) \;=\; (1-\alpha)\, z\, (n^*(z))^\alpha \;=\; (1-\alpha)\, z^{\frac{1}{1-\alpha}} \left(\frac{\alpha}{w}\right)^{\frac{\alpha}{1-\alpha}}.$$

Microfoundation of default risk ρ

For clarity, the derivation is made for $t = 2$, as this is the period it matters for in the model. Let

$$g(n) \equiv \phi z_0 n^\alpha - wn$$

denote pledgeable $t = 2$ revenue net of the wage bill at scale n. By the budget constraint (6), a firm with internal funds e_1 and debt burden R_2 can operate at scale n if and only if its net burden $D_2 \equiv R_2 - e_1$ satisfies $D_2 \leq g(n)$. Hence $g(n)$ is the largest net burden that a firm operating at scale n can finance. g is strictly concave with $g(0) = 0$ and a unique maximum at n_ϕ solving $\alpha\phi z_0 n_\phi^{\alpha-1} = w$:

$$n_\phi \;=\; \left(\frac{\alpha\phi z_0}{w}\right)^{1/(1-\alpha)} \;=\; \phi^{1/(1-\alpha)}\, n^* \;<\; n^*.$$

Using $wn^* = \alpha z_0 (n^*)^\alpha$, the peak value is

$$g(n_\phi) \;=\; (1-\alpha)\, \phi^{1/(1-\alpha)}\, z_0 (n^*)^\alpha,$$

the largest net burden $R_2 - e_1$ that can be financed at any scale: a firm with $R_2 - e_1 > g(n_\phi)$ cannot operate at $t = 2$. This is the constant appearing in the default-risk function $\rho(e_1; R_2)$ below and in the right-hand inequality of Condition 3(ii).

A firm enters $t = 2$ with liquid internal funds e_1 and faces a debt burden R_2. The firm's maximum deterministic survival buffer is therefore $B \equiv e_1 + g(n_\phi) - R_2 = g(n_\phi) - D_2$.

Suppose the firm is subject to an unobservable, mean-zero logistic liquidity shock ε with scale parameter $\sigma > 0$, realised between $t = 1$ and $t = 2$. The firm defaults if the shock exceeds the survival buffer, $\varepsilon > B$. With F the logistic CDF, this probability is $1 - F(B) = F(-B)$, by symmetry of the distribution:

$$\rho(e_1; R_2) \;=\; \frac{1}{1 + \exp\left(\dfrac{e_1 + g(n_\phi) - R_2}{\sigma}\right)} \tag{17}$$

This yields a smooth default probability that is strictly decreasing in internal funds ($\partial\rho/\partial e_1 < 0$) and strictly increasing in the debt burden ($\partial\rho/\partial R_2 > 0$). The shock is used only to determine default: conditional on survival, the $t = 2$ employment choice is analysed at the pre-shock funds

e_1.

Nash bargaining over continuation value surplus - Equation (9)

The creditor(s) and the firm bargain over a rollover amount Δ^R, which reduces the $t = 1$ payment to $P = R_1^j - \Delta^R$ and defers the balance to $t = 2$ at the risk-free rate $(1 + r)$, reflecting that the bank forgoes its own intermediation margin c on the amount it agrees to defer: the concession is a margin concession, not merely a timing one.

The threat point is full enforcement ($\Delta^R = 0, P = R_1^j$). This leaves the firm with depleted net worth $\hat{e}_1^j \equiv z_1((A_1 - R_1^j)/w)^\alpha$ and raises $t = 2$ default risk to $\rho_H \equiv \rho(\hat{e}_1^j; R_2^j)$ (H for high risk). Let R_2^j be the contractual continuing claim due at $t = 2$, and L_2 the creditor's recovery value (liquidation) if the firm defaults at $t = 2$. Recovery cannot exceed the claim, $L_2 < R_2^j$, so that default entails a positive loss given default $R_2^j - L_2$ for the creditor. Creditors are risk-neutral and value $t = 2$ payoffs at the risk-free rate, i.e. they discount them by $\beta \equiv 1/(1 + r)$. This is the only place in the model where payoffs at different dates are added: the firm has no dividends and values only its $t = 2$ equity. The creditor(s)'s disagreement payoff is $R_1^j + \beta\big[(1 - \rho_H)R_2^j + \rho_H L_2\big]$.

Agreement at a reduced payment P preserves firm health, lowering the default risk to ρ_L. The rolled-over amount increases the $t = 2$ claim to $R_2^j + \Delta^R(1+r)$. The creditor(s)'s agreement payoff is therefore $P + \beta\Big\{(1 - \rho_L)\big[R_2^j + \Delta^R(1 + r)\big] + \rho_L L_2\Big\}$.

Let $\rho^{diff} \equiv \rho_H - \rho_L$ be the net reduction in default risk. The creditor(s)'s surplus from coordination is the difference between the agreement and disagreement payoffs:

$$\begin{aligned} S_C &= (R_1^j - \Delta^R) + \beta\Big\{(1 - \rho_L)\big[R_2^j + \Delta^R(1 + r)\big] + \rho_L L_2\Big\} - \Big(R_1^j + \beta\big[(1 - \rho_H)R_2^j + \rho_H L_2\big]\Big) \\ &= \beta\,\rho^{diff}(R_2^j - L_2) - \rho_L \Delta^R \end{aligned}$$

where the second line uses $\beta(1 + r) = 1$. The risk-free return compensates the creditor for the time value of a deferred dollar, so that the cost of deferral is only the expected default loss ρ_L on that dollar. The rollover is therefore a strict concession whenever $\rho_L > 0$, without a further restriction on parameters.

The firm's expected equity payoff at the end of $t = 2$ is $U_F(P) = (1-\rho) \times e_2$, where $\rho \in \{\rho_H, \rho_L\}$ is the default risk associated with the payment P and e_2 is the final cash post-debt service. Under full repayment (the threat point), $U_F(R_1^j) = (1 - \rho_H)[\hat{e}_1^j + \pi_2(\hat{n}_2) - R_2^j]$. Under renegotiation, $U_F(R_1^j - \Delta^R) = (1 - \rho_L)[e_1^j + \pi_2(n^*) - (R_2^j + \Delta^R(1 + r))]$.

The firm's surplus (S_F) generated by the rollover is the difference in these expected equity values

$$S_F(\Delta^R) \;=\; U_F(R_1^j - \Delta^R) - U_F(R_1^j).$$

Because default risk switches from ρ_H to ρ_L at any positive rollover, this difference does not vanish as $\Delta^R \to 0$. To retain a tractable closed-form Nash solution, the firm's surplus is therefore approximated by the value of the liquidity that the rollover releases, which is linear in Δ^R:

$$S_F(\Delta^R) \;\approx\; \theta\,\Delta^R, \qquad \theta \;\equiv\; -\left.\frac{\partial U_F(P)}{\partial P}\right|_{P=R_1^j},$$

where $U_F(P) = (1-\rho_H)\big[\hat{e}_1(P) + \pi_2(n_2(P)) - R_2^j\big]$ is the threat-point payoff as a function of the payment and $\hat{e}_1(P) \equiv z_1((A_1 - P)/w)^\alpha$. Thus θ is the marginal value of liquidity to the firm at the threat point. A higher payment lowers employment at $t=1$ and thereby internal funds, so U_F is strictly decreasing in P and $\theta > 0$. This is a reduced-form approximation rather than a derived result, and it is applied to the firm's side only: the creditor's surplus retains the two default-risk states. Because θ enters the Nash product below only as a multiplicative constant, the solution depends on the linearity of S_F in Δ^R but not on the value of θ.

With creditor(s) bargaining power $\mu \in (0,1)$, the Nash product is:

$$\max_{\Delta^R} \big(\beta\,\rho^{diff}(R_2^j - L_2) - \rho_L\Delta^R\big)^\mu(\theta\Delta^R)^{1-\mu}.$$

Because the firm's liquidity multiplier θ enters as a linear constant, it factors out of the first-order condition entirely. Taking logs and differentiating with respect to Δ^R:

$$\begin{aligned}\frac{-\mu\rho_L}{\beta\,\rho^{diff}(R_2^j - L_2) - \rho_L\Delta^R} + \frac{1-\mu}{\Delta^R} = 0 \quad &\Longrightarrow \quad \mu\rho_L\Delta^R = (1-\mu)\big(\beta\,\rho^{diff}(R_2^j - L_2) - \rho_L\Delta^R\big)\\ &\Longrightarrow \quad \rho_L\Delta^R = (1-\mu)\,\beta\,\rho^{diff}(R_2^j - L_2).\end{aligned}$$

The optimal negotiated rollover amount is therefore:

$$\Delta^R \;=\; \frac{1-\mu}{(1+r)\,\rho_L}\,\rho^{diff}\,(R_2^j - L_2). \tag{18}$$

The optimal rollover is proportional to the creditor's avoided expected loss, i.e. the improvement in survival probability (ρ^{diff}) multiplied by the loss given default ($R_2^j - L_2$), and it is decreasing in the creditor's bargaining power μ. The finalised $t=1$ payment is $\tilde{R}_1 = R_1^j - \Delta^R$. The rollover is feasible only if $\Delta^R \le R_1^j$, so that $\tilde{R}_1 \ge 0$.

Maturity extension and the default-risk comparison - related to Equation (13)
The loan-financed firm's net debt burden at $t=2$, $D_2^{L,ext} \equiv R_2^{L,ext} - e_1^L$, uses the extended claim $R_2^{L,ext} = R_2^L + \Delta^R(1+r)$ and net worth $e_1^L = A_1 - \tilde{R}_1 + \pi_1^* = (A_1 - R_1^L + \pi_1^*) + \Delta^R$, which embeds the rollover. Feasibility requires $\tilde{R}_1 \ge 0$, i.e. $\Delta^R \le R_1^L$: relief cannot exceed the claim itself.

The expression for e_1^L holds under Condition 2, i.e. when the relief is large enough for the firm

to hire at n_1^*. In this range, π_1^* is profit net of the wage bill at n_1^* and does not depend on Δ^R, so every additional dollar of relief raises net worth by exactly one dollar. (Below this range, additional relief also funds additional hiring, whose revenue raises net worth by more than the relief itself.) Consequently

$$D_2^{L,ext} \;=\; \big[R_2^L + \Delta^R(1+r)\big] - e_1^L \;=\; \underbrace{\big(R_2^L - (A_1 - R_1^L + \pi_1^*)\big)}_{\text{independent of } \Delta^R} + \Delta^R r.$$

Rolling over Δ^R therefore raises the loan-financed firm's $t=2$ net burden by exactly the accrued interest on the deferred amount, $\Delta^R r$, not by Δ^R itself: the principal is offset by the higher net worth just derived, and the deferred amount accrues at the risk-free rate rather than at the bank's rate including the intermediation margin c. Condition 3(i) is stated in terms of $R_2^{L,ext}$ and therefore already accounts for the extension; the derivation shows that each additional dollar of relief tightens it by only r.

The same accounting yields the condition under which $\rho_L < \rho_H$ in the logistic specification. The hypothetical employment under full enforcement for the loan-financed firm is $\hat{n}_1^L \equiv (A_1 - R_1^L)/w$, with net worth $\hat{e}_1^L = z_1(\hat{n}_1^L)^\alpha$, so that net worth under relief exceeds net worth under full enforcement by

$$e_1^L - \hat{e}_1^L \;=\; \Delta^R + \big(\pi_1^* - \pi_1(\hat{n}_1^L)\big).$$

Let leftover cash denote $A_1 - \tilde{R}_1 - w n_1^* \geq 0$ (Condition 2). Then $\Delta^R = w(n_1^* - \hat{n}_1^L) + (\text{leftover cash})$ and $\pi_1^* - \pi_1(\hat{n}_1^L) = \big[z_1(n_1^*)^\alpha - z_1(\hat{n}_1^L)^\alpha\big] - w(n_1^* - \hat{n}_1^L)$, so the wage terms cancel and $e_1^L - \hat{e}_1^L$ equals leftover cash plus the gross revenue gap between the two employment levels. It is strictly more than Δ^R itself, since $\pi_1^* > \pi_1(\hat{n}_1^L)$ by strict concavity ($\hat{n}_1^L \neq n_1^*$).

Applying the default-risk function (17) to both outcomes gives the following chain of equivalences:

$$\begin{aligned}
\rho_L < \rho_H \;&\iff\; \rho(e_1^L; R_2^{L,ext}) < \rho(\hat{e}_1^L; R_2^L) \\
&\iff\; \frac{1}{1 + \exp\left(\dfrac{e_1^L + g(n_\phi) - R_2^{L,ext}}{\sigma}\right)} \;<\; \frac{1}{1 + \exp\left(\dfrac{\hat{e}_1^L + g(n_\phi) - R_2^L}{\sigma}\right)} \\
&\iff\; e_1^L + g(n_\phi) - R_2^{L,ext} \;>\; \hat{e}_1^L + g(n_\phi) - R_2^L \\
&\iff\; e_1^L - \hat{e}_1^L \;>\; R_2^{L,ext} - R_2^L.
\end{aligned}$$

The constant $g(n_\phi)$ cancels because it depends only on (ϕ, α, z_0, w) — the same production and pledgeability primitives in both scenarios and drops out of the comparison between them. Substi-

tuting $e_1^L - \hat{e}_1^L = \Delta^R + \left(\pi_1^* - \pi_1(\hat{n}_1^L)\right)$ (above) and $R_2^{L,ext} - R_2^L = \Delta^R(1+r)$ (eq. (13)) gives

$$\Delta^R + \left(\pi_1^* - \pi_1(\hat{n}_1^L)\right) \;>\; \Delta^R(1+r) \quad \Longleftrightarrow \quad \left(\pi_1^* - \pi_1(\hat{n}_1^L)\right) \;>\; \Delta^R r,$$

i.e. whenever the output loss avoided by hiring at n_1^* instead of $\hat{n}_1^L$ exceeds the interest accrued on the rollover. This is a restriction on parameters and is not implied by Condition 3(i). It is more demanding the smaller the crisis cut $n_1^* - \hat{n}_1^L$ and the larger the rollover Δ^R, because the avoided output loss is second-order in the cut while the interest cost is proportional to Δ^R.

Recovery employment derivation - related to equations (14) & (15)

Let $g(n) \equiv \phi z_0 n^\alpha - wn$ and let $D_2 \equiv R_2^B - \hat{e}_1^B$ denote the bond-financed firm's net debt burden, where $\hat{e}_1^B = z_1(n_1^B)^\alpha$ is the internal funds (net worth) it carries into the recovery (Equation (11)). The recovery budget constraint $wn + R_2^B \le \hat{e}_1^B + \phi z_0 n^\alpha$ is equivalent to $g(n) \ge D_2$.

Because g is strictly concave with a unique peak at n_ϕ (defined above), Condition 3(ii), $g(n^*) < D_2 < g(n_\phi)$, has two implications. First, $g(n) = D_2$ has exactly two roots $n_- < n_\phi < n_+$, since $D_2 > g(n^*) \ge 0$ (using $\phi \ge \alpha$), and the feasible set is $[n_-, n_+]$. Second, $n_+ < n^*$: g is strictly decreasing beyond n_ϕ, $n^* > n_\phi$, and $g(n_+) = D_2 > g(n^*)$. The firm maximises profit $\pi_2(n) = z_0 n^\alpha - wn$ subject to $g(n) \ge D_2$. Since π_2 is strictly increasing on $[0, n^*]$, the firm chooses the largest feasible scale, the upper root, and its budget constraint binds: $n_2^B = n_+ < n^*$ solves $wn_2^B + R_2^B = \hat{e}_1^B + \phi z_0 (n_2^B)^\alpha$, i.e. $g(n_2^B) = D_2$. Since this is a nonlinear equation with no closed-form solution in general, $n_2^B = n_+$ is characterised only implicitly, through its comparative statics, rather than through an explicit formula.

Because g is strictly decreasing beyond its peak and $n_+ > n_\phi$ (strictly, as $D_2 < g(n_\phi)$), $g'(n_+) < 0$. Implicitly differentiating the binding constraint $g(n_2^B) = D_2$ with respect to D_2:

$$g'(n_2^B)\,\frac{dn_2^B}{dD_2} = 1 \quad \Longrightarrow \quad \frac{dn_2^B}{dD_2} = \frac{1}{g'(n_+)} < 0.$$

This single fact — recovery employment is strictly decreasing in the net burden D_2 — is the primitive from which both comparative statics below follow, since $D_2 \equiv R_2^B - \hat{e}_1^B$ depends on $\hat{e}_1^B$ and ψ through two separate channels. Holding R_2^B fixed, $\partial D_2/\partial \hat{e}_1^B = -1$, so by the chain rule

$$\frac{\partial n_2^B}{\partial \hat{e}_1^B} = \frac{dn_2^B}{dD_2} \times \frac{\partial D_2}{\partial \hat{e}_1^B} = \frac{1}{g'(n_+)} \times (-1) = -\frac{1}{g'(n_+)} > 0.$$

Holding $\hat{e}_1^B$ fixed, $\partial D_2/\partial R_2^B = 1$ and $\partial R_2^B/\partial \psi = (1-m)d > 0$ (from eq. (10)), so

$$\frac{\partial n_2^B}{\partial \psi} = \frac{dn_2^B}{dD_2} \times \frac{\partial D_2}{\partial R_2^B} \times \frac{\partial R_2^B}{\partial \psi} = \frac{(1-m)d}{g'(n_+)} < 0.$$

Together,

$$\frac{\partial n_2^B}{\partial \hat{e}_1^B} \;=\; -\frac{1}{g'(n_+)} \;>\; 0, \qquad \frac{\partial n_2^B}{\partial \psi} \;=\; \frac{(1-m)d}{g'(n_+)} \;<\; 0, \tag{19}$$

showing that, within the window of Condition 3(ii), the constrained workforce falls in the post-crisis spread ψ and rises in the internal funds $\hat{e}_1^B$ the firm carries into the recovery.

Growth-rate corollary proof

Trough-to-recovery log growth is $\Delta \ln n^B_{1\to 2} = \ln(n_2^B/n_1^B)$ and $\Delta \ln n^L_{1\to 2} = \ln(n^*/n_1^*)$. Hence:

$$\Delta \ln n^B_{1\to 2} \;<\; \Delta \ln n^L_{1\to 2} \quad\Longleftrightarrow\quad \frac{n_2^B}{n_1^B} \;<\; \frac{n^*}{n_1^*} \quad\Longleftrightarrow\quad \frac{n_2^B}{n^*} \;<\; \frac{n_1^B}{n_1^*},$$

meaning the proportional recovery shortfall must exceed the proportional trough cut. Growth measured from a deeper trough is mechanically inflated, which is why the level comparison in Proposition 1 is unconditional while the growth ranking is not. In the limiting case of a common trough ($n_1^B \to n_1^*$), the right-hand side tends to 1 and the inequality holds strictly whenever $n_2^B < n^*$.

Calibration. Table C1 lists all model parameters, their role, and their source.

Appendix Table C1: Model parameters

Parameter	Description	Source	Value
α	Returns to scale in labour	Assumed	0.700
w	Wage	Normalisation $n^*(z_0) = 1$	0.700
z_0	Pre-crisis TFP	Normalisation $z_0 = 1$	1
δ	Crisis TFP drop	Based on data from Fernald (2014)	0.023
ϕ	Pledgeable revenue share	Close to Kermani and Ma (2020); Crouzet (2018)	0.850
r	Risk-free rate	1-year Treasury, mean since 1990	0.030
c	Intermediation premium	Philippon (2015)	0.007
ψ	Post-crisis bond spread	Target-matched[a]	0.076
m	Maturing debt share	Data[d]	0.297
d	Debt (leverage)	Assumed	1.370
A_1	Liquid funds entering crisis	Assumed	1.083
χ	Liquidation recovery rate	Crouzet (2018)[b]	0.380
$\rho_L; \rho_H$	Default probability in $t = 2$	Assumed	0.300, 0.550
ξ	Creditor coordination friction	Assumed	0.300
N^L, N^B	Number of creditors (bank, bond)	Model assumption	1, 50
μ	Creditor bargaining weight	Abbassi et al. (2021)	0.500
λ	Bond-firm share	Financial Accounts (Z.1): NFC bond debt / (bond + loans)[c]	0.400

[a] ψ is root-found to reproduce the FE-controlled, exposure-scaled empirical growth-wedge moment $\beta_{Bond}\bar{x}_{bond} - \beta_{Loan}\bar{x}_{bank} = -0.0052$ (pooled, recovery spec, Table 5) at the value of m below.
[b] The physical-asset recovery rate reported in Crouzet (2018), is used as a proxy for the firm-level recovery rate in this paper.
[c] Illustrative baseline value used in the simulation figures; the aggregate counterfactual in Section 5.2 uses $\lambda_{\text{pre}} = 0.47$ and $\bar{\lambda} \approx 0.62$, computed in the same way.
[d] Pooled mean of the share of total debt maturing within a year across firms at the three crisis-year snapshots.
Notes: The table lists all model parameters, their role, and their source.

D Jobless gap

To quantify jobless recoveries, I estimate a simple and stylised GDP–employment elasticity on pre-1990 data and use it to construct a counterfactual employment path for each post-1990 crisis. Specifically, I estimate

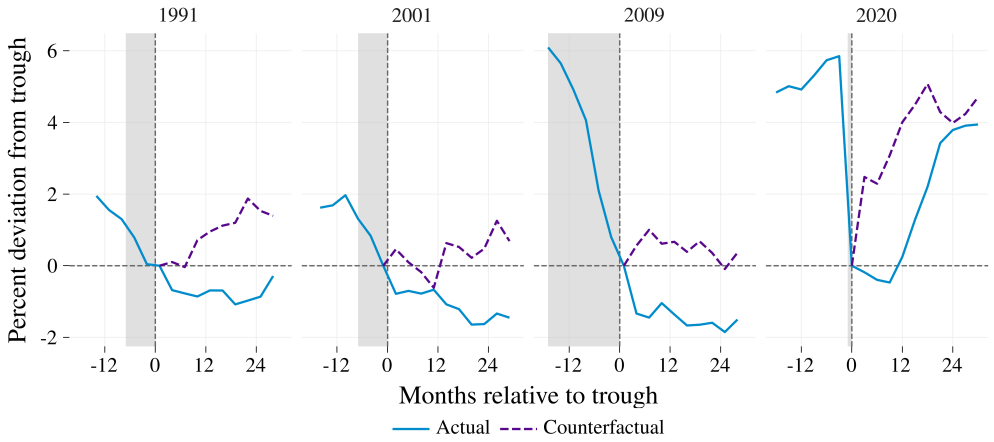
$$\Delta^h \log E_t = \alpha + \beta \, \Delta^h \log Y_t + \varepsilon_t, \tag{20}$$

where E_t is nonfarm payroll employment, Y_t is real GDP, and Δ^h denotes the h-quarter log-difference ($h = 12$, i.e. a three-year horizon). The regression is estimated on all quarters prior to 1990, capturing the average co-movement between output and employment across the full business cycle. The estimated coefficient $\hat{\beta}$ is then used to construct a counterfactual employment level at each date t

$$\hat{E}_t = E_{t-h} \cdot e^{\hat{\beta} \, \Delta^h \log Y_t}. \tag{21}$$

Intuitively, $\hat{E}_t$ is the employment level that the historical GDP-employment relationship would predict at t, given the actual GDP path over the preceding h quarters. The counterfactual employment-to-population ratio is $\hat{e}_t = \hat{E}_t / N_t$, where N_t is the civilian noninstitutional population. The *jobless gap* at date t is defined as $\hat{e}_t - e_t$, where e_t is the actual employment-to-population ratio. A positive gap indicates that employment recovered less than historical GDP-employment co-movement would imply.

Figure D1 plots the actual and counterfactual employment-to-population ratios for each post-1990 crisis. Table D1 reports the jobless gap at a three-year horizon for each of the three crisis episodes.



Appendix Figure D1: Jobless gap: actual vs. counterfactual employment-to-population ratio

Notes: The figure depicts employment dynamics around all NBER-defined recession episodes since the 1990s. The line shows the percentage deviation of the employment-to-population ratio from its respective crisis trough (blue line), with grey shaded areas indicating NBER recession periods. The Covid-19 episode is cut from below for visibility. *Source(s):* U.S. Bureau of Labor Statistics; author's calculations.

Appendix Table D1: Jobless Gap

	Gap (log-pts)	Gap (jobs)
Dot-com	0.03	3600
Global financial crisis	0.02	3290
Covid-19	0.01	950

Notes: The table reports the jobless gap at a three-year horizon for each crisis episode. *Gap (log-pts)* is the difference between predicted and actual log employment growth over the horizon, where the prediction uses the GDP–employment elasticity estimated on pre-1990 data. *Gap (jobs)* converts the growth gap to a level shortfall: the number of jobs missing relative to the GDP-implied counterfactual at $t + 12$ quarters (thousands of persons). A positive value indicates employment fell short of what historical GDP co-movement would have implied. *Source(s)*: U.S. Bureau of Labor Statistics; author's calculations.