The Dynamics of Corporate Debt Structure *

Michael Halling† Jin Yu‡ Josef Zechner§

ABSTRACT

We find that US public firms spread out their debt more across different sources in recession quarters, making measures of debt concentration move pro-cyclically, on average. There is substantial cross-sectional variation in these dynamics. In particular, firms with already low leverage and high debt concentration during expansions further decrease leverage and increase debt concentration in recessions. Compared to sample averages, these firms tend to be smaller and riskier, have more growth options and higher cash levels. Over the entire sample period, firms employ bank debt and market debt in roughly equal amounts, but these debt sources exhibit opposite dynamics over the business cycle. While the fraction of total assets funded by bank debt increases in the recession by approximately 18% of its average non-recession level, the equivalent measure for market debt drops by approximately 7%. Bank debt, in particular term loans, appears to become more attractive during recession quarters, especially for borrowers characterized by high profitability. A cluster analysis shows that a substantial fraction of firms changes its debt policy over the business cycle. For example, 12% of the firms that exclusively use bond-financing pre-recession switch to bank-financing during recessions.

JEL Classifications: G01, G32.

Keywords: corporate debt structure dynamics, debt concentration, business cycle variation, cluster analysis.

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†Stockholm School of Economics and Swedish House of Finance, Drottninggatan 98, 111 60 Stockholm, Sweden. Email: michael.halling@hhs.se

‡Department of Banking and Finance, Monash University, 900 Dandenong Road, Caulfield East, VIC 3145, Australia. Email: jin.yu@monash.edu

§Vienna University of Economics and Business (CEPR and ECGI), Welthandelsplatz 1, 1020 Vienna, Austria. Email: josef.zechner@wu.ac.at

1 Introduction

Corporate debt comes in multiple incarnations, such as term loans, drawn credit lines, senior bonds or notes, subordinated bonds, commercial paper, or capital leases. While there is an extensive theoretical and empirical literature studying firm overall leverage, much less is known about how firms choose their debt structures, i.e. how many different types of debt firms choose to employ and how they decide on the relative weight of each debt type. Even less is known about how corporate debt structures evolve over time. Do firms typically borrow through fewer or more debt sources during recessions, i.e. is debt concentration pro- or counter-cyclical? How do the dynamics of debt concentration differ in the cross-section of firms? Which debt funding sources become more and which become less important during recessions? In this paper we take a step towards answering these questions.

To address these questions, we first propose a simple theoretical framework to model the firm's choice between private and public debt. In contrast to market debt, bank debt is more expensive in the model due to intermediation costs but offers the flexibility to restructure debt in the bad state. In this tractable framework we can show that debt concentration decreases while the private to public debt ratio increases in recessions, as some firms use bond financing exclusively in expansions, but all firms use both debt types during recessions.

To test these predictions empirically, we merge data from Compustat and Capital IQ, using the granular data on various debt sources in firms' balance sheets. The key results that emerge from our analysis can be summarized along two interrelated dimensions. First, we establish several facts regarding the dynamics of debt concentration over the business cycle. Most importantly, we find that firms tend to decrease debt concentration during recessions. This is the case both for the observed debt concentration as well as for the estimated target debt concentration. Thus, we show that debt concentration is pro-cyclical, consistent with our theoretical predictions.

We also find significant cross-sectional differences in debt concentration dynamics. While the majority of firms, especially firms that are larger, that have credit ratings and that have more tangible assets decreases debt concentration during recessions, others actually increase their debt concentration. In particular, we find that growth firms and firms with high cash levels feature counter-cyclical concentration dynamics.

The second set of results focuses on the dynamics of different debt sources over the business cycle. We find that overall, firms' reliance on bank debt increases in recessions, irrespective of firm characteristics, i.e., there is an unconditional negative impact of the recession on the proportion of liabilities funded by market debt. Again, these findings accord well with our theoretical predictions. We also derive several cross-sectional patterns regarding the relative importance of private versus public debt. While rated firms favor market debt in normal times they increase non-market debt in recessions. Furthermore, large firms rely more on market debt while profitable firms as well as cash-rich firms decrease exposure to market debt in recessions.

Finally, we corroborate the above results by performing a cluster analysis which identifies 8 clusters of common debt structures. The most frequent debt structure that applies to more than

30% of the sample relies almost exclusively on senior bonds and notes (on average, more than 93% of total debt). The main advantage of the cluster analysis is its more comprehensive approach. Rather than analyzing the dynamics of each debt type individually it allows us to study combinations of debt types, which presumably more accurately reflect the debt structure optimization that corporate managers implement. It also enables us to study how firms switch between these clusters over the business cycle and how the choice of debt structure cluster is related to firm characteristics.

The results from the cluster analysis provide interesting additional insights. For example, it reveals that the previously discussed counter-cyclical dynamics of bank debt are driven by the following transition patterns in firms' debt policies over the business cycle: (i) firms that concentrate on bank debt before the recession have the highest probability among all clusters to stick to that choice during the recession, and (ii) a relatively large fraction of firms that belong to clusters that either focus on market debt or have diversified debt structures before the recession switch to exclusive bank financing in the recession. A multinomial logit analysis shows that size, cash ratio and existence of a rating favor debt structures that rely predominantly on market debt while profitability seems to have a strongly positive influence on the probability of firms choosing a bank-dominated debt structure.

Our paper is related to several strands of literature. First, there are a number of theoretical papers that attempt to rationalize why firms may wish to use several forms of debt. Most of them focus on the effects of a multi-tiered debt structure on equityholders' and debtholders' future actions. For example, Bergloef and von Thadden (1994), Bolton and Scharfstein (1996), and Hackbarth et al. (2007) derive multi-tiered debt as a solution to the Hart and Moore (1994) problem of strategic default by firm owners. Rajan (1992) and Park (2000) show that a multi-tiered debt structure affects debtholders' future liquidation and rent-extraction strategies, respectively. Heinkel and Zechner (1990), Hackbarth and Mauer (2011) and Donaldson et al. (2019) find that multi-tiered liability structures can be optimal to balance equityholders' subsequent over- and underinvestment incentives.[1]

Our theoretical framework is most closely related to Crouzet (2017) who derives a dynamic model where firms make investment and capital structure decisions. In this model, firms can adjust their debt structure over time. It considers the optimal choice between bank debt which can be renegotiated in distress and public debt which cannot, but does not involve intermediation costs, as we do in our model. In Crouzet (2017) public debt allows firms to move to a bigger scale, and this improves their liquidation values in financial distress, thereby making bank debt cheaper. This complementarity between bank debt and public debt makes it optimal for some firms to use a

[1] There is also a large theoretical literature on the benefits and costs of alternative sources of corporate debt, explaining why different firms may have preferences for different types of debt. Many of these theories are related to renegotiation in financial distress. I.e. public debt such as corporate bonds is considered to be difficult to renegotiate, due to coordination problems. Other lenders, in particular banks, can renegotiate their claims with firms in financial distress more easily. See, for example, Chemmanur and Fulghieri (1994), Bolton and Freixas (2000), Morellec et al. (2015). Diamond (1991) focuses on the monitoring ability of bank debt, which allows younger firms to build reputation, whereas more mature firms switch to public debt. Faulkender and Petersen (2006) argue that bank debt might be more costly than public debt due to a tax disadvantage coming from the organizational form. However, these papers do not analyze why firms wish to simultaneously utilize multiple sources of debt.

multi-tiered debt structure. While this model provides important insights for the dynamic interplay between investment and debt structure, we focus on the choice of debt structure in a much simpler setting, assuming a given investment scale. This allows us to clearly isolate the pure demand effects on debt concentration and on the utilization of market versus bank debt when the project's profitability changes with the business cycle.

His model generates two potentially opposing hypotheses for the dynamics of debt structure over the business cycle. First, if a bank-credit supply shock during a crisis makes bank debt more expensive, more firms switch to pure bond debt. As a consequence, bank debt becomes less prevalent and debt concentration should increase during recessions. Second, if the probability of financial distress increases in a recession, the renegotiability of bank debt becomes more valuable. This should make bank debt more prevalent and debt concentration should decrease. Our paper provides first empirical evidence on the actual dynamics of debt concentration and the prevalence of bank debt versus public debt over the business cycle. Our findings contradict the former hypothesis since firms' debt structures become less concentrated in the recession, and the relative importance of bank debt increases.

There is also an emerging empirical literature on corporate debt structure that has established several key facts. First, firms simultaneously use multiple sources of debt. Barclay and Smith (1995) show that on average firms use 2.4 different debt classes, such as secured debt, ordinary debt, subordinated debt, and preferred stock. Johnson (1997) reports that 73% of firms in the sample simultaneously use at least two out of bank debt, non-bank private debt, and public debt. More recently, Rauh and Sufi (2010) find that 70% of firm-year observations' balance sheet debt comprises significant amounts of at least 2 sources.

Second, empirical studies show that debt structure is strongly linked to firm characteristics.[2] For example, Rauh and Sufi (2010) document that firms with lower credit quality have more multi-tiered debt structure. They also find that correlations between firm characteristics and debt levels depend crucially on what type of debt is considered. In a pioneering study Colla et al. (2013) analyze a broad sample of firms. They find that debt concentration varies widely across firms and that firms with few debt types are more opaque, have high bankruptcy costs and may lack access to some debt markets. In contrast to Rauh and Sufi (2010), they find that credit quality and debt concentration are inversely related (i.e., firms with lower credit quality tend to have more concentrated debt structures), albeit that relation is not monotone across credit quality buckets. However, these papers do not analyze the business cycle dynamics of debt structure and even less so the significant cross-sectional variation in these dynamics. That is exactly what we do in this paper and how we contribute to the literature.

Our results are also related to some papers that document firms' reduced access to bank loans during recessions. Thus, our findings appear to contradict some of these papers. Becker and Ivashina (2014), for example, find substitution from loans to bonds during tight monetary policy,

[2] John et al. (2018) study debt concentration in an international setup and document the importance of country-level characteristics, such as creditor protection laws, on firms' debt structure choices.

tight lending standards, high levels of non-performing loans and low bank equity prices. Ivashina and Scharfstein (2010) find that new syndicated loans fell sharply during the recent financial crisis. For the Euro-area, De Fiore and Uhlig (2015) document a drop in the growth rates of bank loans during the years 2009 to 2010 whereas bond financing increased. Finally, Lin (2016) argues that bank debt dropped during the recent recession due to lack of collateral, which is consistent with our finding that growth firms reduce bank debt during recessions. Benmelech et al. (2019) document a general drop in the role of secured loans.

While these results appear to not accord with our evidence, we believe that this may be explained by important differences in sample selection. The studies above either rely on highly aggregated data, such as flow of funds data, or they rely on subsamples of firms that satisfy specific criteria, such as having public debt outstanding, having a credit rating, or participation in the syndicated loan market.[3] The advantage of our data is that they are based on the balance sheets of a clearly defined sample of firms, namely on all public US firms. One way to reconcile our evidence with existing literature is that many private firms, which are reflected in the flow of funds data but not in our sample, may experience increased difficulties in accessing bank funding during a recession. On the other hand, large firms with ratings and public debt outstanding, which define some of the samples in the above papers, may actually increase bond financing and reduce their reliance on bank debt during the recession. This may imply an overall drop of bank financing in the studies discussed above, while bank financing still increases for the average US public firm, as documented in our paper.

We also find that the dynamics of debt structure exhibit considerable cross-sectional variation. For example, having a credit rating increases (decreases) a firm's reliance on market debt (bank debt) during expansions while it increases (has no effect on) its usage of bank debt (market debt) during recessions. These cross-sectional results for expansions are, broadly speaking, consistent with the literature that focuses on firms' debt structure choices without considering the business cycle dynamics. For example, Denis and Mihov (2003) find that firms with higher (lower) credit quality borrow from the bond markets (banks). We find the same pattern during expansions. Strikingly, this is not true during recessions. In recessions having a rating actually increases reliance on bank borrowing.

The rest of the paper is organized as follows. Section 2 presents a simple theory of optimal debt structure choice. Section 3 describes the empirical models used in the analysis of debt structure and Section 4 describes the data. The results of our analysis of debt concentration dynamics are discussed in Section 5, whereas our findings regarding the dynamics of different debt types over the business cycle are presented in Section 6 and 7. Section 8 concludes.

[3]See Graham et al. (2015) for a related discussion of issues and challenges in reconciling aggregate and firm-level results as well as potential sample selection effects related to corporate leverage decisions.

2 A simple model of optimal debt structure choice

We consider a one-period model with two dates, t_0 and t_1. At t_0, each firm is endowed with a project which requires a fixed investment I and yields H if it succeeds, which occurs with probability 0.5. If the project fails, it generates a cash flow CF_f, which depends on the macroeconomic state. It is M if the macroeconomy is in an expansion and L if it is in a recession, where $0 < L < M < H$. To allow for heterogeneity across firms, we allow L and M to be firm-specific, but we suppress firm subscripts for simplicity.

After the macroeconomic state has been revealed, each firm funds its project with either public debt (face value F_P) or private debt (face value F_B) or both. Without loss of generality, we assume that all debt is pure discount. To keep the focus on debt structure in the most parsimonious setting, we abstract from equity issues. Both the firm owners and public debt holders (i.e., bondholders) are risk neutral and their discount rate is normalized to zero. Private debt (e.g. bank debt) incurs a cost of financial intermediation and is therefore priced at a discount rate $\rho > 0$.

At t_1, the project outcome is realized. If the project fails and the cash flow is insufficient to repay all debt claims, debt can be restructured to avoid costly bankruptcy. However, bondholders cannot coordinate, so they do not engage in debt forgiveness. The private lender will provide debt relief as long as it is incentive compatible. In the absence of debt restructuring all assets are lost and the firm's liquidation value is zero.

Assumption 1 *To rule out the uninteresting case in which all firms can fund the project with riskless debt in an expansion, we assume that at least for some firms $M < I$. Furthermore, we assume that the cost of intermediation satisfies $\rho < \frac{L}{2(I-L)}$ $\forall L$. This implies that debt restructuring in the failure state is efficient for all firms, even if the macro economy is in a recession.*[4]

2.1 Risk-free debt

Here we consider firms, for which $CF_f > I$. In this case the firm can fully fund its project with public debt without incurring any bankruptcy costs. Equity value for these firms is

$$E = \frac{1}{2}(H + M) - I - \rho F_B \tag{1}$$

where $\frac{1}{2}(H+M) - I$ is the net present value (NPV) of the project and ρF_B is the costs of financial intermediation. Private debt is strictly dominated and the firm's optimal debt structure is $F_B = 0$ and $F_P = I$.

[4] This is easy to see since the expected costs of bankruptcy in the absence of restructuring is $0.5L$. To make restructuring in the failure state happen requires $F_P \leq L$, which in turn requires the firm to raise capital via private debt funding of at least $I - L$. This is associated with a cost of intermediation of $\rho(I - L)$. The above inequality states that the gain from avoiding bankruptcy outweighs the additional cost of intermediation, implicit in the private debt's higher discount rate.

2.2 Risky debt

Here we consider firms for which $CF_f < I$, i.e. firms which cannot fund the project with riskless debt. We first derive equity value for the case in which the firm funds its project with public debt only and subsequently the case where it uses a mix of public and private debt. We will also show that issuing only private debt is a dominated strategy.

2.2.1 All public debt financing

Without private debt, default occurs when the project fails. The firm's problem is

$$\max_{F_P} E = \frac{1}{2}(H - F_P) \tag{2}$$

subject to

$$D_P = \frac{1}{2} F_P = I$$

where D_P is the value of public debt at t_0, i.e. the proceeds from the bond issue.

The equity value is equal to the NPV of the project less the expected bankruptcy costs

$$E = \frac{1}{2}(H + CF_f) - I - \frac{1}{2} CF_f. \tag{3}$$

2.2.2 Mix of public and private debt

A mix of public and private debt can only be optimal, if this leads to restructuring in the failure state. Otherwise all public debt would dominate. In this case the firm's capital structure problem becomes

$$\max_{F_B, F_P} E = \frac{1}{2}(H - F_B - F_P) \tag{4}$$

subject to

$$\begin{aligned}
D_P &= F_P, \\
D_B &= \frac{1}{2(1+\rho)}(F_B + CF_f - F_P), \\
D_P + D_B &= I, \\
CF_f - F_P &\geq 0
\end{aligned}$$

where D_B is the value of private debt at t_0. The final inequality is the incentive compatibility constraint ensuring that the private lender is weakly better off with debt relief.

Substituting for D_P and D_B from the equations above this yields

$$I = F_P + \frac{(F_B + CF_f - F_P)}{2(1+\rho)}. \tag{5}$$

Solving for F_P gives

$$F_P = \frac{I - \frac{1}{2(1+\rho)}(F_B + CF_f)}{1 - \frac{1}{2(1+\rho)}}. \tag{6}$$

The value of equity is

$$E = \frac{1}{2}(H - F_B - F_P) - C = \frac{1}{2}\left(H - F_B - \frac{I - \frac{1}{2(1+\rho)}(F_B + CF_f)}{1 - \frac{1}{2(1+\rho)}}\right) - C. \tag{7}$$

The partial derivative of equity value w.r.t. bank debt is given by

$$\frac{\partial E}{\partial F_B} = \frac{-\rho}{1 + 2\rho} < 0. \tag{8}$$

Thus, it is always optimal to issue as little bank debt as possible, given the conjecture of debt relief in the bad state.[5] However, for debt forgiveness to happen, the incentive compatibility constraint must hold. Substituting for F_P in the constraint yields

$$CF_f - \frac{I - \frac{1}{2(1+\rho)}(F_B + CF_f)}{1 - \frac{1}{2(1+\rho)}} \geq 0$$

or

$$F_B \geq 2(1 + \rho)(I - CF_f). \tag{9}$$

Since equity value decreases in F_B, the above condition holds as an equality at the optimum. This also means, that firms always wish to complement their private debt by public debt.[6] The optimal face values are

$$F_B = 2(1 + \rho)(I - CF_f), \quad F_P = CF_f. \tag{10}$$

With the optimal face values, the equity value is

$$E = \frac{1}{2}\left(H - 2(1 + \rho)(I - CF_f) - CF_f\right). \tag{11}$$

Simplifying yields

$$E = \frac{1}{2}(H + CF_f) - I - \rho(I - CF_f). \tag{12}$$

That is, the equity value is equal to the NPV less the financial intermediation cost of private debt. It is easy to show that Assumption 1 implies that for firms which cannot issue riskless debt to fund it project, equity value under pure public debt is always dominated by equity value under a mix of public debt and bank debt, given by equation 11.

In summary, firms which can issue riskless debt will use full bond funding. All other firms will

[5]Note that $\lim_{\rho \to 0} \frac{\partial E}{\partial F_B} = 0$. That is, as the cost of financial intermediation becomes zero, the firm is indifferent between bank debt and public debt, given that restructuring takes place.

[6]As will be shown below, this does not always hold when issuing public debt involves issues a fixed cost. We will discuss the effect of issuance costs of public debt in an extended version of the model.

use a mix of public and private debt which optimally trades off bankruptcy costs against the cost of financial intermediation.

2.3 Model Predictions

To generate testable hypotheses on the variation of the usage of public and private debt by the corporate sector over the business cycle as well as the variation of corporate debt concentration, we now consider the cross-section of firms. In doing so, we consider an economy that is populated by firms indexed by M, the cash flow in the event of project failure. Precisely, we assume that in expansions firms are uniformly distributed according to

$$M \sim U(\underline{M}, \overline{M})$$

where $\underline{M} = I(1 - \Delta)$ and $\overline{M} = I(1 + \Delta)$. Furthermore, we parameterize the project failure cash flow in recessions as $L = M - \Delta I$. That is, a recession reduces firms' cash flows if the project fails by Δ. Thus, in a recession firms' cash flows if their project fails are uniformly distributed according to

$$L \sim U(\underline{L}, \overline{L})$$

where $\underline{L} = I(1 - 2\Delta)$ and $\overline{L} = I$.

For simplicity the payoffs are the same for all firms if the project is successful.

We start by summarizing our results from Sections 2.1 and 2.2 in the following proposition.

Proposition 1 *In expansions,*

1. *firms with $M \geq I$ choose all public debt financing;*
2. *the remaining firms choose a mix of private and public debt financing.*

In recessions all firms choose a mix of private and public debt financing.

Proposition 1 implies that debt concentration, as measured by the number of different debt sources used by the average firm, decreases in recessions, since some firms move from pure bond financing to complement bonds with bank debt. Intuitively, investment opportunities are profitable in expansions. Firms with low credit risk (zero credit risk in this simple model) can borrow directly from the bond market and thus save the cost of financial intermediation. In our model, these firms account for $\dfrac{\overline{M} - I}{\overline{M} - \underline{M}} = 50\%$ of the population.

However, firms with high credit risk face a trade-off between bankruptcy costs and financial intermediation cost. They borrow bank debt as little as possible, just to ensure that banks provide debt relief when their projects fail, and the rest is raised via the public debt market. The fraction of firms that fall into this category is given by $\dfrac{I - \underline{M}}{\overline{M} - \underline{M}} = 50\%$.

In recessions profitability decreases and credit risk increases. As a consequence, the demand for private debt increases. For our parameterization, all firms fund the investment project by a mix of private and public debt in a recession. Among them, those firms with $L \geq I(1-\Delta)$ would be able to borrow risk-free debt, should the macroeconomic state be an expansion because $M = L + \Delta I \geq I$.

Proposition 2 *The average number of firms' different debt sources increases during recessions.*

Proof: It follows from applying Proposition 1 that the average number of debt sources used by firms in expansions is 1.5 whereas it is 2 in recessions.

The next proposition generates a prediction on the relative use of bank versus public debt.

Proposition 3 *In expansions, the private to public debt ratio is*

1. *zero for firms with $M \geq I$; and*
2. $\frac{F_B}{F_P} = 2(1+\rho)\frac{I-M}{M}$ *for all the other firms.*

In recessions, the private to public debt ratio is $\frac{F_B}{F_P} = 2(1+\rho)\frac{I-L}{L}$.

Proof: follows immediately from applying 1.

The following corollary follows.

Corollary 1 *The private to public debt ratio is higher during recessions than during expansions.*

Proof: Follows immediately from Proposition 3.

In summary, our model generates two testable hypotheses.First, bank debt becomes more important in recessions, as measured by the average ratio of bank debt over total debt. Second, we predict that debt concentration, as measured by the average number of debt sources used by firms, decreases in recessions.

2.4 Model Extension: Fixed Issuance Cost of Public Debt

Our analysis has so far focused on the tradeoff between costs of financial intermediation and the flexibility to restructure debt in bad states of nature. We have thereby ignored other features, such as informational frictions, which usually require firms to obtain certification by rating agencies or have their stocks listed on an exchange, before they can access the public debt markets. Placing a public debt issue among investors frequently involves additional expenses with some fixed-cost character, such as hiring an underwriter.

We therefore extend the base model to introduce a fixed cost C, associated with issuing public debt. The optimal debt structure choice looks similar to that of the base model except that all private debt financing can now emerge as an optimal choice. Intuitively, with the fixed cost of issuing public debt, the trade-off firms face when choosing their debt structure now involves issuance and bankruptcy costs of public debt versus the cost of financial intermediation.

We focus on the interesting case where $C < \rho I$.[7] Given this condition, it is clear that in expansions those firms with $M \in [I, I(1+\Delta)]$, i.e. firms that can fund the project via riskless bonds, still choose to borrow entirely via public debt.

The other firms (that is, firms with $M \in [I(1-\Delta), I]$ in expansions and all firms with $L \in [I(1-2\Delta), I]$ in recessions) must borrow using risky debt. Given the efficiency of debt restructuring implied by Assumption 1, all public debt financing is never optimal for these firms because $I > M > L > \underline{L}$.Their optimal choice between all private debt and a mix of both debt is equivalent to minimizing DWC:

$$\min(\rho I, \rho(I - CF_f) + C) = \min(\rho CF_f, C). \tag{13}$$

As a consequence, firms with a lower failure cash flow (relative to C) tend to switch to all private debt financing. More importantly, if a firm uses all private debt financing in expansions, this same firm would also use private debt financing in recessions because $\rho L < \rho M < C$. However, the converse is not true.

In summary, with a fixed issuance cost, we expect that more firms switch to all private debt financing in recessions. Therefore, our result that bank debt is more important in recessions becomes stronger. However, at the same time, the cyclical pattern of debt concentration derived in Proposition 2 may no longer hold, since some firms switch from a mixed debt structure to all private debt, thereby increasing debt concentration.

3 Empirical models of debt concentration and debt types

The empirical framework that we apply in this paper builds on the existing empirical capital structure literature (see, for example, Halling et al. (2016), Hovakimian et al. (2001), Korajczyk and Levy (2003), Hovakimian et al. (2004), Leary and Roberts (2005)) and is based on panel regressions with firm fixed effects. In order to account for costly leverage adjustments that imply that firms are usually not at their optimal leverage unless one observes a lumpy adjustment, the estimation is based on a sample of refinancing firm quarters, in which we observe substantial leverage adjustments using a 5% cutoff, instead of the entire sample. For the purpose of this paper, we extend the above reasoning to debt concentration as well as the exposure to individual debt sources. The different dependent variables are reflected in the choice of the relevant refinancing events and the resulting refinancing sub-samples used in the estimation. Thus, throughout the paper we interpret the output of these empirical models as proxying for optimal debt concentration and optimal exposures to different debt sources. Specifically, we estimate the following panel models with firm fixed effects:

$$\mathbf{Y}_{i,t+1} = \beta_0 + \beta_0^{rec} \mathbf{1}_{t+1}^{rec} + \sum_s \mathbf{X}_{i,t} \mathbf{1}_{t+1}^{s} \beta^s + f_i, \quad s \in S \equiv \{rec, exp\} \tag{14}$$

[7] If $C \geq \rho I$, then public debt is dominated by private debt. In this case firms never choose public debt financing, regardless of the state of the business cycle.

where $\mathbf{Y}$ is debt concentration or a debt type (scaled by total assets). The recession dummy ($\mathbf{1}^{rec}$) captures the unconditional effect of the business cycle. We also interact each firm characteristic with a recession and an expansion dummy to explicitly model variation in the coefficients across the business cycle. $\mathbf{X}$ contains firm characteristics, that is,

$$\mathbf{X} = [size, mtb, \ profit, tang, capx, divpayer, cash, rated] \,.$$

Following Halling et al. (2016), we measure the dynamics of debt concentration and different debt types over the business cycle as follows. Let $\mathbf{TY}(\mathbf{X}, \mathbf{1}^{rec}, \mathbf{1}^{exp})$ be the fitted dependent variable estimated from equation (14). Consider now an individual firm with time-varying firm characteristics $\mathbf{X}^{exp}$ and $\mathbf{X}^{rec}$ during expansions and recessions, respectively. After purging time-invariant firm fixed effects, this firm's debt structure across different macroeconomic states is given by

$$\mathbf{TY}^{exp} = \mathbf{TY}(\mathbf{X}^{exp}, \mathbf{1}^{exp} = 1, \mathbf{1}^{rec} = 0) = \beta_0 + \mathbf{X}^{exp}\beta^{exp}; \tag{15}$$

and

$$\mathbf{TY}^{rec} = \mathbf{TY}(\mathbf{X}^{rec}, \mathbf{1}^{exp} = 0, \mathbf{1}^{rec} = 1) = \beta_0 + \beta_0^{rec} + \mathbf{X}^{rec}\beta^{rec}. \tag{16}$$

Taking the difference between the two allows us to assess the cyclicality of the analyzed dependent variable for a given firm. In detail, taking the difference yields the following expression:

$$\Delta\mathbf{TY} = \mathbf{TY}^{rec} - \mathbf{TY}^{exp} = \beta_0^{rec} + (\mathbf{X}^{rec}\beta^{rec} - \mathbf{X}^{exp}\beta^{exp}) \,. \tag{17}$$

Importantly, the functional form of that firm-level measure allows us to model the effects of (i) time-varying firm characteristics, (ii) time-varying coefficients, and (iii) the business cycle itself, through the recession dummy, on the cyclicality of the dependent variable for the average firm. The combined effects of (i) and (ii) are captured by $(\mathbf{X}^{rec}\beta^{rec} - \mathbf{X}^{exp}\beta^{exp})$. This definition of cyclicality goes beyond merely looking at effect (iii); specifically, at the sign of β_0^{rec}.

In the last step of the empirical framework, we separate the effect of time-varying firm characteristics from time-varying coefficients. For that purpose, let $\Delta\mathbf{X} = \mathbf{X}^{rec} - \mathbf{X}^{exp}$ and $\Delta\beta = \beta^{rec} - \beta^{exp}$. We separately estimate the average coefficient vector, $\bar{\beta}$, from the following regression model

$$\mathbf{Y}_{i,t+1} = \beta_0 + \beta_0^{rec}\mathbf{1}_{t+1}^{rec} + \mathbf{X}_{i,t}\bar{\beta} + f_i.$$

In contrast to the model in equation (14), this regression does not look at expansionary and recessionary observations separately. Further more, we denote the average firm characteristics aggregating expansions and recessions by $\bar{\mathbf{X}}$. We can write $\bar{\beta} = w_b\beta^{exp} + (1 - w_b)\beta^{rec}$ and $\bar{\mathbf{X}} = w_x\mathbf{X}^{exp} + (1 - w_x)\mathbf{X}^{rec}$. The weights w_b and w_x are greater than zero and less than one, depending on the distribution of expansionary and recessionary observations.

Note further that

$$
\begin{aligned}
&\left(\mathbf{X}^{rec}\beta^{rec}-\mathbf{X}^{exp}\beta^{exp}\right)-\left(\Delta\mathbf{X}\bar{\beta}+\bar{\mathbf{X}}\Delta\beta\right)\\
=&\Delta\mathbf{X}\beta^{rec}+\mathbf{X}^{exp}\Delta\beta-\Delta\mathbf{X}\left(w_b\beta^{exp}+(1-w_b)\beta^{rec}\right)-\left(w_x\mathbf{X}^{exp}+(1-w_x)\mathbf{X}^{rec}\right)\Delta\beta\\
=&\Delta\mathbf{X}\Delta\beta(w_b+w_x-1)
\end{aligned}
$$

where $(w_b + w_x - 1)$ is bounded between negative one and one. Ignoring the higher order term $\Delta\mathbf{X}\Delta\beta$ yields

$$\mathbf{X}^{rec}\beta^{rec}-\mathbf{X}^{exp}\beta^{exp}\approx\Delta\mathbf{X}\bar{\beta}+\bar{\mathbf{X}}\Delta\beta.$$

We are finally able to disentangle the effect coming from time-varying firm characteristics, captured by $\Delta\mathbf{X}\bar{\beta}$ holding the coefficient estimates constant, from the effect coming from time-varying coefficients, captured by $\bar{\mathbf{X}}\Delta\beta$ holding firm characteristics constant. This allows us to comprehensively evaluate different drivers of debt structure dynamics.

4 Data Description

This section describes how the base case sample of firms is constructed as well as the subsample of firms with active leverage, debt concentration and debt structure changes. We also present and discuss summary statistics.

4.1 Sample Construction

The sample is based on quarterly data from Compustat and Capital IQ from 2002 through 2017. We start with all firm-quarters in Compustat. Following the literature (e.g., Colla et al. (2013) and Halling et al. (2016)), we remove financial and utility firms. Applying the following filters, we drop firm-quarters with: (1) missing or zero value of total assets; (2) missing or zero value of total debt (short-term debt plus long-term debt); and (3) book (market) leverage greater than one or less than zero. We also remove very small firms that have an average book value of total assets less than 5 million US dollars.[8]

Firm variables include the natural logarithm of net sales (*sales*), market-to-book ratio (*mtb*), operating income before depreciation to total assets ratio (*profit*), net property, plant, and equipment to total assets ratio (*tang*), capital expenditures to total assets ratio (*capx*), cash to total assets ratio (*cash*), and a dividend payer dummy (*divpayer*).[9] We winsorize the continuous firm characteristics at the 1st and 99th levels except market to book which is winsorized at the 95th level. We extract S&P long term issuer credit rating for US firms from Compustat (Rauh and Sufi (2010)). We also create a rating dummy (*rated*) which equals one if a firm is rated (in any month of a quarter); and zero otherwise. For each firm-quarter, we take the maximum of the three monthly

[8]Constant 2002Q4 dollars are used to adjust total assets (and sales) when necessary.

[9]The selection of firm-level variables is, to a large extent, following Frank and Goyal (2009).

ratings and use it as the credit rating for the firm in that quarter ($rating\_max$).[10]

As in Colla et al. (2013), we use Capital IQ debt variables to identify seven distinctively different debt types: term loans (*tl*), drawn credit lines (*dc*), senior bonds and notes (*sbn*), subordinated bonds and notes (*sub*), commercial paper (*cp*), capital leases (*cl*), and other debt ($others$).[11] Using the seven debt types, we construct several debt specialization measures. First, a normalized Herfindahl-Hirschman Index (HHI) of debt type usage:

$$\frac{\sum_{n=1}^{7}\left(\frac{\text{debt source}_n}{\text{total debt}}\right)^2 - \frac{1}{7}}{1-\frac{1}{7}}. \tag{18}$$

Second, an exclusive debt usage dummy, *Excl90*, which equals one if a firm has more than 90% of its total debt in one debt type; and zero otherwise.

For each firm-quarter, we deem a debt source as used if the firm uses a non-zero amount of that debt source. We then count the total number of used debt sources ($NumDebt0$), which represents the third measure of debt specialization. Finally, we classify a debt source as used if a firm's usage of the debt source exceeds 1% of total assets and count the total number of used debt sources ($NumDebt1$). We consider these two variables as alternative debt concentration measures.

As a next step, we merge the filtered Compustat firm-quarters with those from Capital IQ. Capital IQ provides detailed information on debt types, which also allows us to compute total debt (sum of seven mutually exclusive debt types). We further remove firm-quarters with the absolute difference between total debt from the two data sources exceeding 10% of total debt. Finally, we aggregate term loans and drawn credit line to define bank debt and aggregate senior bonds and notes, subordinated bonds and notes, and commercial paper to define market debt.

To define recessions, we use the National Bureau of Economic Research (NBER) US business cycle expansions and contractions. We have only one recession in our sample period because the coverage of debt type data by Capital IQ is not comprehensive until 2002 (see footnote 4, Colla et al. (2013)). The recessionary period covers seven quarters, starting at 2007Q4 and ending at 2009Q2. Apart from the above merged sample, we also construct an event window (a subsample) that includes 16 quarters prior to 2007Q4, 2007Q4-2009Q2, and 16 quarters after 2009Q2. We set event time to zero for 2007Q4 through 2009Q2 and consider the 16 pre-recession and 16 post-recession quarters as expansions (counterfactuals). For these 32 quarters, we group, chronologically, four consecutive quarters as one event time period, for example, event time = -4 for 2003Q4 through 2004Q3 and event time = +4 for 2012Q3 through 2013Q2.

We define a firm-quarter as experiencing a substantial leverage increase if the change in its total debt less net equity issuance (that is, equity issuance less equity repurchase) to its lagged

[10]We convert credit ratings into integer values, with 1 being the lowest rating (D/SD) and 10 being the highest rating (AAA). We also create the minimum of the three monthly ratings ($rating\_min$) that is highly correlated with $rating\_max$ ($\rho = 0.98$). For the sake of space, we use $rating\_max$ in our empirical tests.

[11]Other debt in Capital IQ refers to unclassified debt types. We note evidence that some firms in pre-2010 years tend to label certain types of debt (*sbn* being the most prominent example) as other debt in their 10Qs and then recognize the actual debt type in their 10Ks of the same year. We therefore remove firm-quarters with other debt exceeding 3% of total debt.

total assets ratio is greater than 5%. Similarly, a firm-quarter experiences a substantial leverage decrease if the ratio is less than -5%. A refinancing dummy is turned on in a firm-quarter if it either increases or decreases its leverage (see, for example, Leary and Roberts (2005)). We will refer to this sample as ref_lr in the remainder of the paper. We then basically apply the same methodology to different types of debt and define debt-type-specific refinancing events. Finally, we also define a refinancing sample that represents the combination of all the earlier ones — i.e., this sample, labeled ref_all, includes all firm-quarter observation where total leverage or any individual debt type experiences a substantial change. This sample is used to identify debt-concentration-related refinancing events.

These refinancing events represent situations in which firms, most likely, made active choices to change and adjust their leverage, debt concentration or exposure to individual debt sources and, accordingly, move those variables to optimal levels in the process.[12] Thus, focusing on those observations allows us to interpret the resulting multivariate models as describing firms' target level policies. In the following section, we will briefly compare the different refinancing samples.

4.2 Descriptive Statistics

Before moving into the detailed empirical analysis, Table 1 summarizes our base-case sample of US public firms. There are about 31,000 expansionary firm-quarters and 5,472 recessionary firm-quarters. That is, about 15% of firm-quarters are in economic downturns. Firm characteristics vary substantially over the business cycle. We document pro-cyclical dynamics of profitability (profit), market-to-book ratio (mtb), tangibility (tang), the fraction of dividend payers (divpayer), and the fraction of firms with ratings (rated). These patterns provide intuitive evidence that firms experience negative shocks during recessions. Hence, firms become less profitable, their market values deteriorate relative to book values, and they reduce dividend payments during recessions. Note that we defer the discussion of variables associated with debt structure to later sections, where we will provide a detailed analysis.

The above summary statistics describe the base-case sample of US public firms analyzed in the paper. As described above, in the multivariate analysis we use different samples that reflect firm-quarter observations in which the respective dependent variable experiences a substantial change. This allows us to estimate the multivariate models from data that reflect active changes to the dependent variable. Table 2 shows the overlap between the different refinancing samples used in the remainder of the paper. Sample ref_all is the largest sample that represents the combination of all other refinancing samples — i.e., any substantial change in leverage or any individual debt type is included in that sample. Referring to ref_lr, 56% (36%) of firm quarters are associated with substantial changes in bank debt (market debt). In terms of individual debt types, significant leverage changes frequently happen together with significant changes in drawn credit (46%), in

[12] Korteweg et al. (2020) analyze this accounting-based approach to identify significant leverage adjustments using hand-collected data from corporate filings. They report that around 10% of leverage adjustments might be due to "passive" events; i.e., events that are not driven by corporate actions. Such "passive" leverage adjustments could, for example, be driven by investor actions (e.g., option exercise).

senior bonds and notes (34%) and term loans (33%).

Zooming into the sample with significant changes in bank debt (ref_bankd), which includes 8,980 observations, we find that those changes come mostly from changes in drawn credits (77%) and to a somewhat lesser extent from changes in term loans (58%). The overlap with significant changes in market debt is below 50%. On the other hand, significant market debt changes (ref_marketd), which are found for 6,502 observations, overlap more extensively with changes in bank debt (64%). In terms of individual debt sources, those changes go nearly almost hand in hand with changes in senior bonds and notes (92%) and only in about 50% of the cases with changes in subordinated bonds and notes.

4.3 Total Leverage Dynamics

In this section, we summarize the most important results regarding overall leverage based on the sample used in the paper. We include this analysis to facilitate the comparison with our earlier paper, Halling et al. (2016), that used a similar cross-section of firms but a much longer time-series. Specifically, an important motivation for this discussion is to assess whether the recent recession, the Global Financial Crisis (GFC), which is the only recession covered by the sample period in this paper, appears to be different from the average recession during the last 30 years in terms of leverage dynamics.

Table 1 shows that the average firm during the sample period has 25% book and 18% market leverage during expansionary observations. Book leverage as well as market leverage increase by 2% and 3%, respectively, during recessions. Figure 1 displays the dynamics of observed leverage over the business cycle. Comparing these results to the ones reported in Halling et al. (2016) (i.e., Table 1 and Figure 1) we observe consistent but slightly amplified levels as well as dynamics of leverage during the GFC. In the case of market leverage, for example, we find counter-cyclical dynamics in both cases; we also see elevated levels of market leverage after recessions (compared to before recessions) in both cases. Thus, we conclude that the GFC, in terms of leverage dynamics, does not appear to be fundamentally different from earlier recessions.[13]

5 Dynamics of Debt Specialization

In this section, we summarize our empirical results for debt specialization, which is an aggregate characteristic of corporate debt structure. We first focus on the dynamics of observed debt specialization, then analyze the determinants of target debt specialization, study their dynamics over the business cycle, and finally evaluate the underlying sources of debt specialization dynamics.

[13]Note that we also perform target level estimation for book and market leverage, and that we also analyze the dynamics of target book and market leverage over the business cycle. In the interest of brevity we do not include the detailed results in the paper. These results, however, are again consistent with the results documented in Halling et al. (2016) and, thus, this analysis further supports the assessment that the GFC is not very particular in terms of leverage dynamics.

5.1 Cyclicality of Observed Debt Specialization

Table 1 shows summary statistics over the business cycle for the four measures of debt concentration that we consider. In the case of HHI, we find that the average firm has a concentration of 76% in its debt structure during expansions. This number drops slightly but statistically significantly to 74% during recessions. Similarly, the number of debt types (NumDebt0 and NumDebt1) used by the average firm exhibits a significant increase, albeit small in economic magnitude, during recessions. Thus, debt concentration seems to be pro-cyclical. Figures 2 and 3 visualize the dynamics for an equal-weighted as well as a value-weighted average. While the pro-cyclical dynamics are less pronounced for equal-weighted averages, they are substantially stronger in the value-weighted averages. It is also interesting to observe that debt concentration post-recession seems to be somewhat higher than pre-recession.

The results discussed so far apply to the average firm and, thus, might hide a lot of heterogeneity in the cross-section. To investigate this, we first split the sample of firms by overall leverage cyclicality into firms with counter-cyclical and pro-cyclical market leverage. Figure 4 shows the corresponding results. In this case, we find very pronounced patterns. Firms that increase leverage during recessions (counter-cyclical leverage dynamics, left column in Figure 4) do so by diversifying across multiple debt sources. In stark contrast, firms that decrease leverage during recessions (pro-cyclical leverage dynamics, right column in the figure) do so by concentrating their debt structure. Thus, debt concentration dynamics mirror leverage dynamics.

Next, we split the sample by debt specialization dynamics and analyze the firm characteristics for each group. Table 3 summarizes the corresponding results. A first observation is that the sample is approximately split into two halves when using this procedure. Firms that move to a more concentrated debt structure during recessions are less levered, smaller, hold more cash, have more growth options, fewer tangible assets, are less profitable, pay dividends less often, are less frequently rated, have worse ratings, and a more concentrated debt structure on average. In the next section, we will investigate those relations in more detail using a multivariate regression framework.

Table 3 also highlights interesting differences in the debt types that firms with different debt specialization dynamics tend to use. Firms with counter-cyclical debt specialization dynamics rely more on bank debt (this is due to both usage of term loans and drawn credits) and less on market debt (here the effect seems to be dominated by a smaller exposure to senior bonds). We will analyze the dynamics of individual debt types in more detail in the next chapter.

5.2 Determinants and Cyclicality of Target Debt Specialization

The results in the previous subsection document substantial cross-sectional variation in debt concentration dynamics. In this section, we investigate this in more detail, using a multivariate regression framework and a sample of firm-quarter observations that reflect substantial leverage as well as individual debt type changes. As outlined in Chapter 3, the multivariate regressions are designed to allow for an unconditional effect of the business cycle through a recession dummy and variation in coefficient estimates across the business cycle through interaction terms. Table 5 summarizes the results (column 2, labeled HHI).

The point estimate of the recession dummy is insignificant, so that there is no unconditional effect of the recession on debt concentration. However, there are several interesting findings that document how the recession affects various drivers of debt concentration. First, while the existence of a rating is associated with lower debt concentrations even during expansions this negative effect becomes significantly more pronounced. Thus, firms with ratings can access both bank and bond markets, but they tend to diversify their debt structure more during recessions, as the benefits of diversification across different debt types apparently become more important during bad times.

Second, cash and the market-to-book ratio (i.e., growth options) show a positive while size and tangibility a negative impact on debt concentration during expansions as well as during recessions. In all these situations, point estimates of coefficients are larger (although not statistically significantly) during recessions than during expansions. One interpretation of these results is that flexible, unconstrained firms (i.e., large firms with tangible assets) tend to diversify their debt structure, in general but even more so during recessions, while potentially constrained firms (growth firms with cash buffers) have to work with concentrated debt structures that become even more concentrated during recessions. Thus, the results show that the differences in firms' debt structures get even more pronounced during recessions. Finally, we also observe an interesting pattern for profitability: during expansions profitable firms feature more concentrated debt structures (consistent with Crouzet (2017)) but this positive association vanishes during recessions.

In a next step, we use the multivariate model to calculate estimates of target debt concentration for each firm during expansions as well as during recessions by multiplying firm characteristics in a given period by the coefficients of the model. Figure 6 illustrates the dynamics of target debt concentration and shows a pronounced pro-cyclical pattern; i.e., target debt concentration drops during recessions by around 3 percentage points (see also Table 6 that shows that this difference is statistically significant). Thus, the average firm in the sample finds it "optimal"to lower the debt concentration during recessions. It is interesting to note that the dynamics of target concentration are much clearer and more substantial in economic terms than the dynamics of observed debt concentration.

Given this stark difference between observed and target concentration, it becomes a particularly interesting and important question to assess the drivers of the pronounced dynamics of target concentration. As explained in Section 3, we distinguish three sources of business cycle dynamics: (i) the unconditional effect of the recession captured by the recession dummy, (ii) the variation in model coefficients across the business cycle, and (iii) the variation in firm characteristics. Table 7 shows the corresponding results. Panel A reviews the coefficients of the recession dummy and shows that, in the case of tHHI (i.e., target debt concentration), the unconditional effect of the recession is slightly positive but statistically insignificant. This minor positive effect, however, gets reversed by significantly negative effects associated with the variation in coefficient estimates as well as firm characteristics. It is interesting to note that the variation in coefficients has an impact that is twice as large as the effect associated with variation in firm characteristics.

How do these results on the dynamics of debt specialization fit into the literature? Rauh and Sufi (2010) argue that riskier firms exhibit a more multi-tiered debt structure. This is a purely cross-sectional result but if we assume that, in a recession, most firms are likely to become riskier we expect debt concentration to drop during a recession. The pronounced pro-cyclical dynamics of target debt concentration, shown in Figure 6, are consistent with that expectation.

However, the analysis so far has also clearly shown that not all firms follow similar dynamics. In particular, cash-rich firms as well as firms with growth options tend towards more concentrated debt structures. Precautionary motives are frequently used to explain corporate cash holdings and it also seems reasonable to assume that those cash holdings become particularly valuable during recessions. Thus, having access to cash during recessions might mitigate the increase in riskiness (for the interaction between cash and debt structure, see also Colla et al. (2018)). Alternatively, cash might also proxy for financial constraints (i.e., firms optimally built up cash buffers in the past expecting to be financially constrained in the future) and financially constrained firms might not have access to certain debt markets and thus exhibit more concentrated debt structures — in particular so during recessions.

A similar argument could also apply for growth firms, as they are frequently considered to be risky and potentially constrained, in particular during recessions. This would also be consistent with the positive association between market-to-book and debt concentration. However, a recent literature on the value premium argues that growth firms are actually less risky than value firms because they are more flexible to respond, through their inherent real options, to business cycle variation. Using the same argument, large firms as well as firms with large amounts of tangible assets could be considered to be risky, in particular during recessions, as these firms cannot adjust easily to the macroeconomic environment. Given that interpretation, our results regarding the debt concentration dynamics — debt becomes more concentrated for growth firms and somewhat more diversified for large firms with tangible assets during recessions — would be perfectly consistent with the argument and earlier result of Rauh and Sufi (2010).

Colla et al. (2013) show that firms' debt concentration is positively associated with bankruptcy costs, opaqueness, and lack of access to some debt market. Again, their results are purely cross-sectional but if we assume that, for most firms, bankruptcy costs, opaqueness and barriers to access debt markets increase during recessions, we would expect to find counter-cyclical dynamics of debt concentration — as we do, in terms of observed debt concentration, for about 50% of the sample. Pro-cyclical dynamics, however, dominate overall and, in particular, we find that debt concentration decreases for firms with ratings, large firms and firms with tangible assets — i.e., least opaque firms with access to all debt markets and lowest bankruptcy costs (as argued above, those firms might still be risky during recessions but, in case of bankruptcy, tangible assets, for example, mitigate and reduce the associated costs) consistent with Colla et al. (2013).

Overall, our results seem to lend some support to Rauh and Sufi (2010) as well as Colla et al. (2013). We also argue that both supply effects (e.g., some types of firms become more "attractive" to banks/public markets during recessions; see Faulkender and Petersen (2006) and Leary (2009) for a motivation of the importance of supply effects in capital structure decisions) as well as demand effects (e.g. firms that used to be largely bond financed during expansions decide to take out some bank debt as flexibility has become more important during recessions, consistent with our theoretical model as well as Crouzet (2017)) play an important role.

6 Dynamics of Debt Structure

In this section, we study the dynamics of different debt types over the business cycle. The results of the previous section show that debt concentration of the average firm follows pro-cyclical dynamics but that the cross-sectional variation is large. An obvious next step is to investigate how firms use different debt types over the business cycle. It is also directly related to the previous section, as it sheds light on how firms increase or decrease their debt concentration dynamically.

6.1 Cyclicality of Observed Debt Structure

This section reports stylized facts for observed debt type ratios. To simplify the discussion we will, throughout this section, focus on market debt and bank debt. In the next section we will then zoom into the various individual debt types in more detail. Table 1 shows corresponding summary statistics over the business cycle. We find that, in general, firms have similar levels of bank debt (12% of total assets) and market debt (13% of total assets) during the sample period. Their dynamics across the business cycle are, however, different. While bank debt increases during recessions for the average firm (from 11% during expansions to 13% during recessions), market debt decreases slightly during recessions (from 14% during expansions to 13% during recessions). Even though these differences over the business cycle may appear relatively small in absolute terms, they are sizable as a proportion (i.e. a more than 18% increase in bank debt relative to the level in expansions and a more than 7% decrease in market debt relative to the level in expansions) and they are all statistically significant.

Figure 5 visualizes the dynamics of market and bank debt over the business cycle for the average firm. Similar to the summary statistics discussed before, it shows that bank debt becomes more important in recessions while market debt becomes less important — reaching its lowest value actually in the period right after the recession. It is also interesting to observe that the level of bank debt stays elevated post-recession wile market debt seems to move back towards pre-recession levels after the recession.

From an ex-ante perspective and given the sizable literature on bond markets and the banking industry during the recent financial crisis (which as of now ends up being the only recession that we have in the sample, as discussed before), we find those dynamics surprising, as they are in stark contrast to the prevailing perception that firms substituted bank debt with bond financing during the crisis. Table 4 zooms into the individual firms with counter- and pro-cyclical dynamics of bank and market debt and reports average firm characteristics for the different groups.

In the case of bank debt, we find that about 55% of all firms feature counter-cyclical dynamics in observed bank debt ratios. Those firms tend to have higher book and market leverage ratios consisting of more bank as well as more market debt compared to firms with pro-cyclical bank debt. They also feature more diverse debt structures. In terms of firm characteristics, we find that firms with counter-cyclical bank debt dynamics are larger, more profitable, have more tangible assets, pay dividends and have rating more frequently but are less growth-oriented and have lower cash balances. Thus, those firms appear to be high-quality, low-risk and financially rather unconstrained firms.

In the case of market debt, we find that about 60% of all firms in the sample feature pro-cyclical market debt dynamics. Interestingly, in this case we do not see any significant differences in total leverage or the overall level of market debt (in the case of bank debt, firms with pro-cyclical market debt feature slightly higher levels of bank debt). In a next step, we explore whether firm characteristics help to understand the variation in firms' market debt dynamics. We observe that firms with pro-cyclical market debt have more tangible assets and are rated more frequently. They also have lower cash levels and seem to invest more. Interestingly, all the other firm characteristics do not seem to vary significantly across firm with pro- and counter-cyclical market debt dynamics. These results are in stark contrast to the ones for bank debt dynamics. One interpretation is that in the case of market debt dynamics either changing firm characteristics or supply-side effects (i.e., characteristics of bond markets themselves) matter a lot.

6.2 Determinants and Cyclicality of Target Debt Structure

To understand the dynamics of different debt sources in more detail, we move from observed debt structures to potentially optimal, target debt structures that firms actively choose. As before, we run multivariate regressions on a sample of firm-quarter observations, in which firms changed different debt types substantially, to extract estimates of target debt structures. In a first step we pool different debt types into market and bank debt. Table 5 summarizes the corresponding results (columns 3 and 4 labeled bankd_at and marketd_at).

The unconditional effect of the recession (i.e., the coefficients of the recession dummy in the regressions) implies an increase in bank debt and a decrease in market debt. Further more, whether a firm is rated or not plays an important role. Firms that have a rating tend to have a larger fraction of market debt and a smaller fraction of bank debt during expansions. During recessions, however, the rating dummy has no impact on market debt but a positive impact on bank debt. One supply-side interpretation of this result is that banks use the existence of a rating as a quality criterion when deciding whether to lend or not to a given borrower. Overall, it seems that firms with ratings that, as we discussed above, move to a more diversified debt structure during recessions do so mostly by borrowing more from banks during recessions.

Another interesting firm characteristic is firm size. During recessions, size has a positive impact on market debt and a negative (albeit insignificant) impact on bank debt while, during expansions, size seems to play a minor role in determining those debt ratios. Thus, during recessions large firms seem to favor market debt over bank debt. Thus, the earlier result that large firms diversify more across various debt types during recessions seems to be driven by an increase in market-based debt.

This result potentially also reconciles some of the tension between our results and the existing literature on the global financial crisis, as mentioned earlier. This literature usually finds that firms substituted bonds for bank debt during the GFC. Many of those papers, given the data sources they use, suffer, however, from substantial selection biases and usually focus on large firms that have ratings and participate in secured lending markets. In that sense, our results that large firms favor market debt is consistent with that literature.

In terms of firm profitability, we find the well-documented situation that more profitable firms dislike any type of leverage — i.e., have lower bank debt as well as lower market debt — during expansions (Ai et al. (2020) provide an excellent discussion of the link between profitability and leverage). During recessions, the coefficient increases significantly and becomes even positive (albeit not statistically different from zero) for bank debt. For market debt, in contrast, the coefficient decreases dramatically (by a factor of 4). I.e., profitable firms dramatically reduce their exposure to market-based debt.

We also find that cash-rich and firms with growth options, which both tend to move towards more concentrated debt structure during recessions, achieve this increase in concentration through different strategies. While cash-rich firms show a tendency to reduce market-based debt (for interaction between cash and debt structure, see also Colla et al. (2018)), firms with growth options instead seem to decrease bank-based debt. In this case, a supply-side argument comes to mind suggesting that cash-rich firms are more attractive borrowers for banks during recessions, where capital constraints are often binding, than growth firms that are costly in terms of bankruptcy risk.

In a next step, we use these multivariate models to calculate the implied target levels of bank and market debt over the business cycle. Figure 9 shows very pronounced patterns: target market debt is pro-cyclical while target bank debt is counter-cyclical. In both cases, economic magnitudes seem to be sizable with changes in the range of 2 (bank debt) to 4% (market debt) of total assets associated with these dynamics. Table 6 shows that these differences are statistically significant.[14]

The final step of this analysis decomposes the target level dynamics into the same three sources of business-cycle dynamics considered in the earlier chapter on debt concentration — the unconditional effect of the recession dummy, variation coming from firm characteristics and variation coming from coefficient estimates. Table 7 shows the corresponding results. Panel A reviews the effects

[14] Table 6 also highlights an interesting pattern with respect to the number of observations across recessions and expansions. In general, one would expect the ratio of observations across the business cycle to be relatively constant across debt variables. If we, however, calculate the ratio between the number of observations during recessions and the total number of observations in a given sample, we find that it varies. For target market leverage (tml), target book leverage (tbl) and target debt concentration (hhi) that ratio is around 12% (i.e., 12% of the respective samples with substantial changes are observations during recessions). In contrast, for target bank debt (tbankd) and target market debt (tmarketd) as well as target individual debt types included in the table, we find that this ratio is in the range of 6 to 7%. Thus, it seems that adjustments of individual debt sources happen less frequently during recessions than adjustments of total leverage or debt concentration. As a consequence, this implies that during recessions firms tend to split up significant adjustments to overall leverage across different types of debt while during expansions they tend to do larger changes in individual debt types.

associated with the recession dummy for tbankd (target bank debt) and tmarketd (target market debt). As discussed before, being in a recession has an unconditional effect which is positive for bank debt and negative for market debt. Importantly, these effects appear to be large in economic terms with a 7% increase in bank debt and a close to 8% decrease in market debt relative to total assets.

This result could capture, for example, general liquidity effects implying that liquidity in public bonds markets decreases (for all firms) during recessions relative to that of bank debt. This interpretation, however, seems to be at odds with the literature focusing on specific lending channels during the GFC and showing that bank lending instead of public market lending became rather scarce. It also seems to be somewhat implausible given the usual assessment that banks' capital constraints become more binding during recessions. Alternatively, one could think about demand-side effects arguing that firms, irrespective of their specific characteristics, have a preference for bank debt versus market debt, most likely due to important differences in the characteristics of bank and market debt that become more important during recessions (e.g., negotiability, importance of information asymmetries, etc.).

Panel B shows the impact of coefficient variation over the business cycle on the cyclicality of target market and bank debt. Interestingly, in this case results go in the opposite direction; i.e., coefficient variation suggests a decrease in bank debt of 5.4% and an increase in market debt of 2.6% during recessions. Again, these effects are large in economic terms and offset to some extent the unconditional effects discussed just before. If we apply a supply-side interpretation to the variation in coefficients, these results suggest that the supply of public debt is becoming more attractive for firms relative to the supply of bank debt. Such an interpretation would be consistent with the notion that bank debt became scarcer, most likely due to tightening capital constraints, during recessions. It would also be consistent with the existing literature on the GFC.

Panel C, finally, looks at the contribution of the variation in firm characteristics towards the dynamics of market and bank debt. Again, we find that this channel suggests a decrease in bank debt of 40 bps and an increase in market debt of 80 bps during recessions, similar to the variation in coefficients. In this case, however, economic magnitudes are quite small and this source of cyclicality seems to be, by far, the least important one. If we interpret the variation in firm characteristics over the business cycle as capturing demand-side effects, then these results suggest that the demand for bank (market) debt decreases (increases) during recessions.

To conclude, we find that the overall cyclicality of target bank and market debt is driven by an unconditional effect associated with business cycle recessions. The variation in the regression coefficients as well as variation in firm characteristics imply opposite dynamics.

6.3 Cyclicality of Individual Debt Types

The final step of the analysis zooms into individual debt types — term loans, drawn credit, senior bonds and notes, subordinated bonds, commercial paper and capital leases. In this context, it is important to emphasize that the data quality deteriorates somewhat, especially for those individual debt types that are less frequently used by firms in the sample. Table 1 shows that term loans and drawn credits increase during recessions[15] In contrast, senior bonds and notes decrease by around 1% during recessions. These results are consistent with the earlier results for bank and market debt and show that the bank debt dynamics come from both, term loans and drawn credit, while the market debt dynamics are driven by senior bonds and notes.

Figure 7 summarizes the dynamics of each individual debt type relative to total assets over the business cycle. The figure illustrates that term loans and drawn credit lines increase during recessions. In contrast, senior bonds and notes drop. Subordinated bonds show an overall decreasing trend that seems to be independent from the business cycle. Commercial paper and capital leases do not feature strong business cycle dynamics. However, these sources also represent very small fractions of the debt structure of the average firm. Importantly, these results are not sensitive to the denominator and look similar when we calculate the ratios as a percentage of total debt (see Figure 8).

Table 5 shows the results when we apply the multivariate framework to individual debt types (columns 5 to 7 labeled tl_at, dc_at and sbn_at). For this analysis, we focus on the three most common debt types, term loans, drawn credit as well as senior bonds and notes. Important observations are that the coefficients associated with the recession dummy are positive in the case of term loans and drawn credit but negative in the case of senior bonds, albeit none of them is statistically significant. These results are consistent with earlier results on bank and market debt.

The existence of a rating is again a very important firm-level variable. We observe that during expansions ratings are associated with a positive effect on senior bonds and a negative effect on drawn credit (and no effect on term loans), as one would expect. During recessions, however, the positive effect on senior bonds vanishes nearly entirely while the negative effect on drawn credit persists. In addition, however, term loans exhibit an economically very large and statistically significant positive effect. Thus, the earlier result that firms with ratings increase their bank debt during recessions is entirely due to an increase in term loans.

Another interesting pattern is shown for cash holdings. During expansions, cash only plays an important, negative role for drawn credit. During recessions, that negative association between cash and drawn credit triples while at the same time we now also find a large negative coefficient on senior bonds but a large positive coefficient on term loans. These results imply that, in recessions, cash-rich firms decrease their borrowing through drawn credit and senior bonds substantially and instead increase their funding through term loans.

Finally, profitability shows negative coefficients for all three types of debt during expansions. During recessions, the coefficients for term loans and drawn credit remain negative but become much smaller in absolute and insignificant in statistical terms. Interestingly, however, in the case of senior bonds, the negative coefficient of profitability becomes 5-times as large as during expansions indicating that profitable firms reduce their borrowing through senior bonds substantially in

[15] Commercial paper, capital leases, subordinated bonds and other debt sources also seem to increase during recessions but to such a small extent that differences over the business cycle are less than 1%. Thus, the differences reported in the table are shown as 0.00.

recessions.

Figure 10 shows the dynamics of target levels of term loans, drawn credits and senior bonds implied by the multivariate models just discussed. We find very pronounced counter-cyclical dynamics for term loans. In contrast, drawn credit shows less clear-cut dynamics, as the lowest levels are reached 1 to 2 years before the recessionary observation, then there is an upward jump during the recession, and finally drawn credits remain at elevated levels after the recession. Senior bonds, instead, show pro-cyclical dynamics with a pronounced drop during recessions. Interestingly, however, the pre-recession and post-recession levels of senior bonds are quite different with the latter being around 2% lower. Table 6 further supports this assessment showing that the dynamics for term loans as well as senior bonds are statistically significant while drawn credit does not show a cyclical pattern.

Last, we decompose these dynamics into different sources. Table 7 shows the corresponding results. The unconditional effects associated with recessions are statistically insignificant. The variation in coefficient estimates, instead, shows a significantly negative impact on term loans and drawn credit, and a significantly positive impact on senior bonds, albeit the latter is very small in economic terms. These patterns are consistent with our earlier discussion of bank versus market debt.

Finally, we observe interesting results for the importance of the variation in firm characteristics — their impact on the cyclicality of term loans is positive while it is is negative for drawn credit. This suggests that the business-cycle variation in firm characteristics creates different demand for term loans and drawn credit. This result is interesting, as it suggests that, in particular during recessions, the changing firm characteristics have different effects on the desired use of term loans versus drawn credit, even though both are provided by banks. In the case of senior bonds, the variation in firm characteristics implies counter-cyclical dynamics similar to our finding for market debt before.

7 Cluster Analysis of Corporate Debt Structure Choices over the Business Cycle

Our results so far show pro-cyclical dynamics for debt concentration and market debt but counter-cyclical dynamics for bank debt, both for observed as well as estimated target values. However, the current results do not establish an explicit link between debt concentration and leverage dynamics. Specifically, these results do not explain how much of the decrease in debt concentration during recessions comes from an increase/decrease in the use of bank debt, an increase/decrease in the use of market debt or contemporaneous changes in both sources of debt at the same point in time? Put differently, the results so far focus on each of the variables of interest — debt concentration, use of market debt, bank debt and individual debt types — separately instead of modeling them jointly, as corporate managers will most likely do when they think about “optimal”corporate debt policies.

To overcome these shortcomings, we perform a cluster analysis in this section (see Colla et al. (2013)) for an example of cluster analysis in a related context). The key advantage of the cluster analysis is that it analyzes multiple variables jointly and that it discretizes the policy space into a limited number of commonly-chosen debt structures. More specifically, cluster analysis relies on the minimization of the variance within clusters (in terms of the Euclidian distance of a firm-year or firm-quarter observation from the center of its own cluster) and the maximization of the variance between clusters (in terms of the Euclidian distance of a firm-year or firm-quarter observation from the center of other clusters).[16] The cluster analysis is based on our six primary debt sources (sbn, tl, dc, sub, cl and cp) as well as $others$, all scaled by total debt. As we also use these seven debt sources to construct our debt concentration variable, HHI (see equation (18)), examining how a firm switches from one cluster to another over the business cycle represents a tractable way to link the business cycle variation in debt concentration to the business cycle variation in individual debt sources.

7.1 Identification of Most Common Debt Structure Policies

Table 8 Panel A provides summary statistics for the eight clusters identified in the cluster analysis using the full sample of data during the event period. The most popular debt structure is found in about 32% of all firm-quarters and relies predominantly on senior bonds and notes (we label this cluster accordingly SBN). On average, 93% of total debt of firms in this cluster comes from senior bonds and notes. Firms in the SBN-cluster are larger, have higher market-to-book ratio, more tangible assets, are more likely to pay dividends and to be rated compared to firms using different debt structure clusters. The next two clusters in terms of frequency of observations identify firms that specialize in borrowing almost exclusively through term loans (we label that cluster TL) or drawn credit lines (we call that cluster DC). Those clusters represent around 17% of the observations each. Observations falling into each of these clusters are therefore substantially less frequent than those falling into cluster SBN. Firms in cluster TL have, for example, 91% of total debt, on average, coming from TL. Compared to firms in cluster SBN, firms in this cluster are smaller, less likely to pay dividends and to be rated. Firms in cluster DC are somewhat similar to the ones in cluster TL but have lower market-to-book ratios, less cash, and are almost never rated. It is important to point out that those three most popular clusters are all highly concentrated with HHI around 0.85 for all three clusters.[17]

The next group of four clusters share the feature that they contain firms that use more than one debt source. The labels that we assign to those clusters (i.e., SBN+DC, SBN+TL, SUB+3, and DC+TL) describe the debt types that are prominent in each cluster. In total, firm-quarter

[16] We use the STATA command *cluster kmeans* to run the cluster analysis. We estimate up to 15 clusters and identify eight clusters as the "optimal" number of clusters using the Calinski-Harabasz index as a stopping rule.

[17] There is one more cluster that is even more concentrated, namely the one labeled CL in Table 8, as firms in this cluster almost exclusively concentrate on capital leases. Those firms, however, also stick out in terms of other characteristics. In particular, they have very low leverage ratios - average market leverage, for example, is only 3%. In general, we are skeptical that these firms fit well into our discussion and, as a consequence, excluded them from the remaining empirical analyses.

observations assigned to these clusters account for around one fourth of all firm-quarters. Firms in clusters that include SBN, again, tend to be larger, more likely to pay dividends and to be rated, though they have lower market-to-book ratios than firms exclusively focusing on SBN. Almost by definition all these clusters are more diversified across debt sources with HHI being around 0.4 for all except cluster SUB+3. It is also interesting to observe that firms in these clusters tend to have higher leverage ratios than those using SBN, TL, or DC exclusively.

In the following subsections, we will investigate in more detail the business cycle dynamics of the debt structure policies represented by the clusters. To simplify this exercise and to keep the results tractable, we will further aggregate the 7 clusters discussed so far according to their exposure to bank and market debt. In addition to cluster SBN that captures all firms with an almost exclusive focus on market debt, we pool clusters TL, DC and TL+DC into one cluster labeled TLDC. Thus, this cluster includes all firms that almost exclusively use bank debt in their corporate debt structure. The third cluster represents firms that use a mix of market and bank debt (it is labeled MIX) and consists of firms in clusters SBN+DC, SBN+TL and SUB+3. Table 8 Panel B shows the characteristics of these three clusters. The summary statistics in terms of exposure to different debt types as well as firm characteristics are as one would expect given the construction of these clusters.

7.2 Business Cycle Dynamics of Common Debt Structure Policies

In this section, we study the previously defined debt structure clusters over the business cycle. For this purpose, we break the event window into three sub-periods: pre-recession (2003Q4 to 2007Q3), recession (2007Q4 to 2009Q2), and post-recession (2009Q3 to 2012Q3). Table 9 provides some simple summary statistics. Panel A illustrates the distribution of firm-quarters within the three clusters over the business cycle. It specifically shows that during the recession the fraction of TLDC-firms increases, especially relative to the period before the recession. This result is consistent with our earlier finding that the fraction of borrowing from banks increases in recessions. This increase is mirrored by a similar decrease in firms that specialize in market debt, i.e., firms in the SBN-cluster. The frequency of firms that use both sources of debt, i.e., firms in the MIX-cluster, drops only slightly during recessions. Interestingly, those dynamics do not seem to immediately revert after the recession. The fraction of firms using bank debt stays basically unchanged while some firms seem to switch from the MIX-cluster to the SBN-cluster.

These simple summary statistics, however, are affected by sample composition effects and, thus, do not clearly show how individual firms move between clusters over the business cycle. To address this question, Panels B and C show transition matrices. Panel B focuses on the transition from the pre-recession to the recession period.[18] We find a total of 1,525 firm-quarter observations during recessions that belong to firms that prefer the SBN-cluster in the pre-recession period. 1,087 or

[18]Firm-quarters in the recession period are our objects. We start from the pre-recession period and for each firm compute its time-series mode (over the 16 pre-recession quarters) in terms of cluster preference. Note that we have in total 5,061 firm-quarter observations during recessions and among them we are able to identify 4,114 firm-quarters belonging to firms with non-missing time-series mode in the pre-recession.

71% of those continue to be in the SBN-cluster during the recession while 12% switch to the TLDC-cluster and 17% to the MIX-cluster. Similarly, of those firm-quarter observations associated with firms that prefer the TLDC-cluster pre-recession, 83% remain in the same cluster while 7% switch to the SBN-cluster and 10% switch to the MIX-cluster. Finally, in the case of the MIX-cluster, the smallest fraction, namely only 61% of firm-quarter observations, remains in the same cluster. 26% switch to the TLDC-cluster in the recession while another 13% switch to the SBN-cluster.

These results show that several transition patterns contribute to the earlier results. The increase in bank debt during recessions is driven by a combination of the following dynamics: (a) firms that concentrate on bank debt before the recession have the highest probability among all clusters to stick to that choice during the recession, and (b) a relatively large fraction of firms that belong to the MIX and the SBN-cluster before the recession switch to the TLDC-cluster in the recession. Similarly, the extent of market debt decreases during recessions as (a) firms that use market debt pre-recession have a relatively low probability (compared to firms preferring bank debt pre-recession) to continue with that choice in the recession, and (b) the probabilities of firms preferring the TLDC and MIX-cluster pre-recession switching to the SBN-cluster are relatively small.

Panel C repeats the above analysis but for the transition from recession to post-recession. It shows that firms that are in the SBN and the TLDC-cluster during recessions have an approximately equal probability of around 80% of remaining in those clusters during the post-recession period. Also transition probabilities between those clusters and into the MIX-cluster are basically identical. Firms that favor the MIX-cluster during recessions, however, behave very differently. There is only a 49% chance that these firms continue in the MIX-cluster post-recession. Instead, a large fraction of 36% of those firms switch over to the SBN-cluster, while only around 16% switch to the TLDC-cluster after the recession. Those patterns are consistent with our earlier finding of pro-cyclical debt concentration dynamics.

Overall, these results describe interesting and rich transition patterns. The current tests, however, do not reveal the underlying characteristics of the firms in each of the individual cells in the transition matrices. To address this issue, we perform multinomial logistic regressions in a next step.

7.3 Multivariate Analysis of Debt Policy Transitions over the Business Cycle

The earlier discussion has shown that some firms tend to choose substantially different debt structures during expansions and recessions while other firms tend to continue with one debt structure policy throughout the business cycle. Our analysis so far has not controlled for firm characteristics. In this section, we summarize results from multinomial logistic regressions for the recession (Model (1)) and the post-recession (Model (2)) period separately. We control for a given firm's pre-recession preferred debt structure policy using pre-recession-cluster fixed effects in Model (1) and, similarly, we include recession-cluster fixed effects in Model (2). Firm controls are lagged by one period and are the same variables that we used in our earlier target debt level and target debt concentration regressions.

Specifically, we estimate the following multinomial logistic model

$$\Pr(cluster = n) = \frac{e^{\beta_{0,n}+\mathbf{X}\beta_n}}{\sum_{m=1}^{3} e^{\beta_{0,m}+\mathbf{X}\beta_m}}, \tag{19}$$

where $n = 1$ if the firm's debt structure cluster is SBN (the base cluster), 2 for TLDC, and 3 for MIX. $\beta_{0,n}$ is the coefficient of the constant and β_n is a vector of coefficients for cluster n, where $\beta_{0,1}$ and β_1 is set to be zero, and $\mathbf{X}$ is a vector of firm controls as well as the preferred cluster fixed effects in the business cycle period preceding the one analyzed in a given model (measured by the firm's time-series mode of debt structure clusters).

The point estimate of a coefficient in the multinomial logistic regression analysis tells us the impact of a given explanatory variable on the probability of a firm ending up in a particular cluster relative to a base cluster. We choose the SBN-cluster as the base cluster. Note that all coefficients of a given model (i.e., Model (1) and Model (2) in our case) across the two dependent variables (i.e., the two remaining clusters) are estimated jointly. Table 10 shows the corresponding results. The p-value of a coefficient estimate is placed in parentheses underneath, and the statistical significance of differences between coefficient estimates in Model (1) and those in Model (2) is indicated by ***, **, * next to coefficients in Model (1).

The being-rated variable shows a very strong pattern. In this case, we find significantly negative coefficients across all columns in the Table. This means that being rated decreases the probability of being in any of the other two clusters in every period of the business-cycle as compared to the SBN-cluster. Interestingly for the TLDC-cluster, the negative coefficient in the case of Model (1) (i.e., regarding the probability of a firm choosing the TLDC-cluster in a recession) is significantly smaller (i.e., less negative) than the coefficient in Model (2) (i.e., regarding the probability during the post-recession period). Thus, the negative influence of the rating variable on the probability of being in the TLDC-cluster is much reduced during recessions.

We then perform a ceteris paribus analysis to better quantify the economic magnitudes of these coefficients in terms of their impact on explicit conditional probabilities of a firm with given characteristics ending up in a given cluster. For this, we choose a variable of interest, fix all other continuous variables at their sample means, and consider different scenarios for the dummy variables (i.e., for the dividend payer dummy, the rating dummy and the preferred cluster dummies). In the case of the rating dummy — when setting the dividend-payer dummy equal to zero — we find that during recessions the probability of a firm that belonged to the SBN-cluster in the pre-recession period to switch to the TLDC-cluster in the recession is 18% if the firm is not rated but only 7% if it is rated. The comparable probabilities are 18% and 16% for the MIX-cluster. Thus, while the effect of being rated is negative in both cases, the magnitude of the effect is much smaller for the MIX-cluster. The negative effect is also much more pronounced during the post-recession period; while the probability to switch to the TLDC-cluster from the SBN-cluster is 19% for unrated firms it is only 3% for rated firms in the post-recession period.

Cash-holdings and firm size show similarly consistent, statistically significant negative coefficients across all specifications summarized in Table 10. Thus, larger firms and firms with higher cash ratios have lower probabilities of being in any of the two clusters other than SBN in all states of the business-cycle. The coefficient of cash in the case of the TLDC-cluster is significantly smaller, i.e., more negative for recession observations than during post-recession observations. For example, for a firm belonging to the SBN-cluster pre-recession with a one standard deviation larger than average cash ratio (otherwise the firm is unrated, not paying dividends and all other continuous variables are at their averages) the probability of switching to the TLDC-cluster (MIX-cluster) is 6.4% (5.8%) lower during recessions than for a firm with average cash ratio.

Capital expenditures also show negative coefficients throughout but the ones estimated for Model (1), i.e., with recessionary observations, are not significantly different from zero. Thus, capital expenditures predominantly have a negative impact on the probability of being in the TLDC and the MIX-cluster during the post-recession period. Even though the coefficient of -10.6 appears large it translates into a moderate 2% drop in the probability of switching to the TLDC-cluster for a firm belonging to the SBN-cluster pre-recession with a one standard deviation larger than average measure of capital expenditures (otherwise the firm is unrated, not paying dividends and all other continuous variables are at their averages).

Profitability, in contrast, shows positive coefficients that are significant if the TLDC-cluster represents the dependent variable. Thus, profitable firms have a higher probability of borrowing from banks, in particular during the recession period (the increase in probability is around 2.4% for a firm belonging to the SBN-cluster pre-recession with a one standard deviation larger than average measure of profitability). In the post-recession period, profitability is, in fact, the only firm characteristic with a positive coefficient estimate. MTB and the dividend-payer dummy also receive positive, albeit insignificant, coefficient estimates during recessions while they obtain negative ones during the post-recession period (the differences between the coefficients across periods are statistically significant in both cases).

8 Conclusion

This paper documents that debt concentration of US public firms moves pro-cyclically, i.e. firms spread out their debt more across a larger number of sources in recession quarters. However, there is substantial cross-sectional variation in these dynamics leading to more pronounced differences across firms' debt funding strategies during recessions. Less highly levered firms decrease leverage further in the recession and they do so by reducing the number of debt sources they utilize and by concentrating their borrowing in a single or very few debt types. By contrast, firms with higher debt levels increase their leverage even further in the recession and they do so by relying on debt sources that were utilized less before the recession, i.e. by decreasing debt concentration. The former firms tend to be smaller, riskier, less profitable, tend to have more growth options and higher cash levels.

When we estimate firms' target debt concentration in a multivariate model, we confirm that the average firm wishes to reduce its debt concentration during recessions. In fact, the dynamics of target concentration levels are more pronounced than the observed dynamics. We split the business cycle effect on target debt concentration into an unconditional recession effect, the effects due to changing regression coefficients (i.e. firm characteristics contribute differently to target concentration levels in recessions) and the effect due to changing firm characteristics (i.e. firms become less profitable etc. during recessions). The results show that the concentration dynamics are driven by changing model coefficients and by changing characteristics.

The multivariate analysis shows that in particular firms with large cash levels and firms with sizable growth options tend to move to higher debt concentration levels in recessions. This is consistent with a view that it may become very difficult or expensive for these firms to access certain debt markets in recessions, and that it is therefore optimal to implement more concentrated debt structures. In line with this interpretation, the higher cash levels may have been chosen by these firms out of a precautionary motive.

We then provide evidence on the drivers of the debt concentration dynamics by exploring the cyclicality of the main debt sources. We first document that our publicly listed US firms employ bank debt and market debt in roughly equal amounts. However, these debt sources exhibit opposite dynamics over the business cycle. We find that the fraction of total assets funded by bank debt increases in the recession by approximately two percentage points, which represents an increase of about 18% relative the value during expansions. By contrast, the equivalent measure for market debt decreases by approximately one percentage point, representing a drop of approximately 7% relative to the value during expansions.

When we estimate the target bank debt and market debt ratios in expansions and in recessions in a multivariate model, we find that the recession dummy indicates a desired increase in bank debt and a decrease in market debt. With regard to firm characteristics, we find that, as expected, firms with a credit rating use market debt more intensively during expansions. However, having a rating does not lead to higher usage of market debt during recessions. Strikingly, having a rating rather has a positive impact on using more bank debt in recessions. This is consistent with banks' tightening their loan standards during recessions, so that firms without ratings experience difficulties to obtain loans, while firms with ratings obtain new bank loans more easily. This also accords well with the finding that firm profitability is positively associated with bank debt in recessions, but strongly negatively with market debt. The only variable with a positive effect on market debt in recessions is firm size. Thus, bank loans appear to become more attractive during recession quarters, especially for higher-quality firms characterized by high profitability and having a rating, whereas only large firms obtain more debt funding via the bond markets.

Interestingly, we find that both cash rich firms as well as firms with growth options move to more highly concentrated debt structures in recessions, but they achieve this through very different channels. Cash rich firms seem to largely reduce market debt in recessions, while firms with growth options reduce bank debt.

Overall, the analysis of the dynamics of corporate debt composition appears to be a fruitful avenue to enhance our understanding of corporate capital structure decisions. This paper represents a first step, but many extensions are possible. For example, it would interesting to compare the debt structure dynamics in countries with different institutional environments. International evidence would also increase the number of recessions in the analysis. Identifying more sharply the effects of the recession on corporate debt structures via their impact on firm characteristics and via their impact on financial intermediaries would also be interesting.

Appendix A

Our main data sources are Compustat, Capital IQ and the National Bureau of Economic Research's (NBER) business cycle dates. This appendix presents definitions of the variables used in the empirical analysis (see Table A1).

Table A1 Variable Definitions

Variables (Acronym)	Definition
Firm characteristics	
Sales (size)	The natural logarithm of net sales (in 2002 USD)
Market to book ratio (mtb)	The market value of total assets to the book value of total assets ratio
Profitability (profit)	The operating income before depreciation to total assets (book value) ratio
Tangibility (tang)	The net PPE to total assets (book value) ratio
Capital expenditures (capx)	The capital expenditures to total assets (book value) ratio
Cash (cash)	The cash and short-term investments to total assets (book value) ratio
Dividend payer (divpayer)	A dummy variable equals one if payout is greater than zero; and zero otherwise
Rated (rated)	A dummy variable equals one if a firm is rated (in any month of a quarter); and zero otherwise
Rating (rating_max)	The maximum of the three monthly ratings of a firm-quarter if rated
Rating (rating_min)	The minimum of the three monthly ratings of a firm-quarter if rated
Debt structure variables	
Term loans (tl)	Term loans
Drawn credit line (dc)	Drawn credit line
Senior bonds and notes (sbn)	Senior bonds and notes
Subordinated bonds and notes (sub)	Subordinated bonds and notes
Commercial paper (cp)	Commercial paper
Capital leases (cl)	Capital leases
Other debt and total trust-preferred stock (others)	Other debt
Bank debt (bankd)	Sum of term loans and drawn credit line
Market debt (marketd)	Sum of senior and subordinated bonds and notes and commercial paper
Debt concentration (HHI)	A normalized Herfindahl-Hirschman Index of debt concentration (Colla, Ippolito, and Li, 2013)
Excl90 (Exl90)	A dummy variable equals one if a firm obtains at least 90% of its debt from one debt type; and zero otherwise
Number of debt sources (NumDebt0)	Number of used debt sources; a debt source is counted if a firm uses a non-zero amount of the debt source
Number of debt sources (NumDebt1)	Number of used debt sources; a debt source is counted if the used debt source accounts for at least 1% of total assets
Debt variables	
Total debt (ttd)	Short term debt plus long term debt
Book leverage (bl)	The total debt to total assets ratio
Market leverage (ml)	The total debt to total assets (market value) ratio
Net book leverage (nbl)	The total debt less cash and short-term investments to total assets ratio
Net market leverage (nml)	The total debt less cash and short-term investments to total assets (market value) ratio
Business cycle dummies	
Recession (rec)	A dummy variable equals one if 2007Q4 through 2009Q2; and zero otherwise
Expansion (exp)	A dummy variable equals one minus rec

References

Ai, H., Frank, M. Z., Sanati, A., 2020. The trade-off theory of corporate capital structure, working paper.

Barclay, M. J., Smith, Clifford W., J., 1995. The maturity structure of corporate debt. The Journal of Finance 50, 609–631.

Becker, B., Ivashina, V., 2014. Cyclicality of credit supply: Firm level evidence. Journal of Monetary Economics 62, 76 – 93.

Benmelech, E., Kumar, N., Rajan, R., 2019. The decline of secured debt, working paper.

Bergloef, E., von Thadden, E.-L., 1994. Short-term versus long-term interests: Capital structure with multiple investors. The Quarterly Journal of Economics 109, 1055–1084.

Bolton, P., Freixas, X., 2000. Equity, bonds, and bank debt: Capital structure and financial market equilibrium under asymmetric information. Journal of Political Economy 108, 324–351.

Bolton, P., Scharfstein, D. S., 1996. Optimal debt structure and the number of creditors. Journal of Political Economy 104, 1–25.

Chemmanur, T., Fulghieri, P., 1994. Reputation, renegotiation, and the choice between bank loans and publicly traded debt. The Review of Financial Studies 7, 475–506.

Colla, P., Ippolito, F., Li, K., 2013. Debt specialization. Journal of Finance 68, 2117–2141.

Colla, P., Lin, Y., Nagler, F., 2018. Cash holdings and debt structure, working paper.

Crouzet, N., 2017. Aggregate Implications of Corporate Debt Choices. The Review of Economic Studies 85, 1635–1682.

De Fiore, F., Uhlig, H., 2015. Corporate debt structure and the financial crisis. Journal of Money, Credit and Banking 47, 1571–1598.

Denis, D. J., Mihov, V. T., 2003. The choice among bank debt, non-bank private debt, and public debt: evidence from new corporate borrowings. Journal of Financial Economics 70, 3 – 28.

Diamond, D. W., 1991. Monitoring and reputation: The choice between bank loans and directly placed debt. Journal of Political Economy 99, 689–721.

Donaldson, J. R., Gromb, D., Piacentino, G., 2019. Conflicting priorities: A theory of covenants and collateral, working Paper.

Faulkender, M., Petersen, M. A., 2006. Does the source of capital affect capital structure? Review of Financial Studies 19, 45–79.

Frank, M. Z., Goyal, V. K., 2009. Capital structure decisions: Which factors are reliably important? Financial Management 38, 1–37.

Graham, J. R., Leary, M. T., Roberts, M. R., 2015. A century of capital structure: The leveraging of corporate america. Journal of Financial Economics 118, 658–683.

Hackbarth, D., Hennessy, C. A., Leland, H. E., 2007. Can the trade-off theory explain debt structure? Review of Financial Studies 20, 1389–1428.

Hackbarth, D., Mauer, D. C., 2011. Optimal Priority Structure, Capital Structure, and Investment. The Review of Financial Studies 25, 747–796.

Halling, M., Yu, J., Zechner, J., 2016. Leverage dynamics over the business cycle. Journal of Financial Economics 122, 21–41.

Hart, O., Moore, J., 1994. A Theory of Debt Based on the Inalienability of Human Capital*. The Quarterly Journal of Economics 109, 841–879.

Heinkel, R., Zechner, J., 1990. The role of debt and perferred stock as a solution to adverse investment incentives. Journal of Financial and Quantitative Analysis 25, 1–24.

Hovakimian, A., Hovakimian, G., Tehranian, H., 2004. Determinants of target capital structure: The case of dual debt and equity issues. Journal of Financial Economics 71, 517–540.

Hovakimian, A., Opler, T., Titman, S., 2001. The debt-equity choice. The Journal of Financial and Quantitative Analysis 36, 1–24.

Ivashina, V., Scharfstein, D., 2010. Bank lending during the financial crisis of 2008. Journal of Financial Economics 97, 319 – 338.

John, K., Kaviani, M. S., Kryzanowski, L., Maleki, H., 2018. Do country-level creditor protections affect firm-level debt structure?, working paper.

Johnson, S. A., 1997. An empirical analysis of the determinants of corporate debt ownership structure. Journal of Financial and Quantitative Analysis 32, 47–69.

Korajczyk, R. A., Levy, A., 2003. Capital structure choice: Macroeconomic conditions and financial constraints. Journal of Financial Economics 68, 75–109.

Korteweg, A., Schwert, M., Strebulaev, I. A., 2020. Proactive capital structure adjustments: Evidence from corporate filings, working Paper, forthcoming in the Journal of Financial and Quantitative Analysis.

Leary, M. T., 2009. Bank loan supply, lender choice, and corporate capital structure. The Journal of Finance 64, 1143–1185.

Leary, M. T., Roberts, M. R., 2005. Do firms rebalance their capital structures? The Journal of Finance 60, 2575–2619.

Lin, L., 2016. Collateral and the choice between bank debt and public debt. Management Science 62, 111–127.

Morellec, E., Valta, P., Zhdanov, A., 2015. Financing investment: The choice between bonds and bank loans. Management Science 61, 2580–2602.

Park, C., 2000. Monitoring and structure of debt contracts. The Journal of Finance 55, 2157–2195.

Rajan, R. G., 1992. Insiders and outsiders: The choice between informed and arm's-length debt. The Journal of Finance 47, 1367–1400.

Rauh, J. D., Sufi, A., 2010. Capital structure and debt structure. Review of Financial Studies 23, 4242–4280.

Table 1 Summary statistics

This table reports summary statistics of debt variables (Panel A) and firm characteristics (Panel B). Statistics are calculated for the merged Compustat-Capital IQ firm-quarters over an event window. We set event time to zero for 2007Q4 through 2009Q2 (*rec*) and consider the 16 pre-recession and 16 post-recession quarters as expansions (*exp*). For these 32 quarters, we group, chronologically, four consecutive quarters as one event time period, for example, event time = -4 for 2003Q4 through 2004Q3 and event time = +4 for 2012Q3 through 2013Q2. Variable definitions are summarized in Appendix A.

		all			*exp*			*rec*		*rec-exp*	
VARIABLES	mean	sd	N	mean	sd	N	mean	sd	N	mean	p-value
Debt variables											
bl	0.26	0.20	36,568	0.25	0.20	31,096	0.27	0.21	5,472	0.01	0.00
ml	0.19	0.17	36,568	0.18	0.16	31,096	0.21	0.19	5,472	0.03	0.00
HHI	0.76	0.25	36,568	0.76	0.25	31,096	0.74	0.26	5,472	-0.02	0.00
Excl90	0.54	0.50	36,568	0.55	0.50	31,096	0.52	0.50	5,472	-0.03	0.00
NumDebt0	2.31	1.15	36,568	2.29	1.13	31,096	2.38	1.22	5,472	0.09	0.00
NumDebt1	1.61	0.92	36,568	1.60	0.91	31,096	1.65	0.95	5,472	0.05	0.00
bankd_at	0.12	0.15	36,567	0.11	0.15	31,095	0.13	0.16	5,472	0.02	0.00
marketd_at	0.13	0.17	36,565	0.14	0.17	31,093	0.13	0.16	5,472	-0.01	0.01
tl_at	0.06	0.13	36,568	0.06	0.12	31,096	0.07	0.14	5,472	0.01	0.00
dc_at	0.05	0.10	36,568	0.05	0.09	31,096	0.06	0.10	5,472	0.01	0.00
sbn_at	0.11	0.16	36,565	0.11	0.16	31,093	0.10	0.15	5,472	-0.01	0.00
sub_at	0.02	0.08	36,568	0.02	0.08	31,096	0.02	0.08	5,472	0.00	0.07
cp_at	0.00	0.01	36,568	0.00	0.01	31,096	0.00	0.02	5,472	0.00	0.00
cl_at	0.01	0.03	36,568	0.01	0.03	31,096	0.01	0.03	5,472	0.00	0.08
others_at	0.00	0.00	36,568	0.00	0.00	31,096	0.00	0.00	5,472	0.00	0.00
Firm variables											
size	4.57	2.25	36,123	4.57	2.24	30,734	4.60	2.31	5,389	0.03	0.35
mtb	1.86	1.43	36,568	1.89	1.44	31,096	1.73	1.34	5,472	-0.16	0.00
profit	0.02	0.08	35,725	0.02	0.07	30,400	0.01	0.10	5,325	-0.01	0.00
tang	0.28	0.25	36,560	0.28	0.25	31,088	0.27	0.24	5,472	-0.01	0.00
capx	0.01	0.02	36,345	0.01	0.02	30,931	0.02	0.02	5,414	0.00	0.00
divpayer	0.33	0.47	36,568	0.34	0.47	31,096	0.31	0.46	5,472	-0.03	0.00
cash	0.16	0.19	36,563	0.16	0.19	31,091	0.16	0.20	5,472	0.00	0.08
rated	0.36	0.48	36,568	0.36	0.48	31,096	0.35	0.48	5,472	-0.02	0.02
rating_max	6.26	1.07	13,147	6.25	1.06	11,258	6.33	1.10	1,889	0.08	0.00
rating_min	6.24	1.09	13,147	6.23	1.08	11,258	6.30	1.12	1,889	0.07	0.01

Table 2 Refinancing dummies
This table shows the mean of refinancing dummies, which can be interpreted as the occurrence of refinancing events. Following Leary and Roberts (2005), we define a refinancing dummy, *ref_lr*, equals one if the net change in capital structure (that is, the change in total debt minus the difference between equity issuance and repurchase) exceeds 5% of the lagged total assets and zero otherwise. Replacing total debt with an individual debt source, we similarly define refinancing dummies *ref_tl*, *ref_dc*, ..., *ref_cl*. Also, *ref_all* is an all refinancing dummy summarizing refinancing events induced by either a significant change in total leverage (*ref_lr*) or that in any of the individual debt sources (*ref_tl*, *ref_dc*, ..., *ref_cl*). *ref_bankd* (*ref_marketd*) is the refinancing dummy for bank debt (market debt). Bank debt (market debt) is the sum of *tl* and *dc* (*sbn*, *sub*, and *cp*). Variable definitions are summarized in Appendix A.

	ref_all		*ref_lr*		*ref_bankd*		*ref_marketd*	
VARIABLES	mean	N	mean	N	mean	N	mean	N
ref_all	1.00	16,625	1.00	13,985	1.00	8,980	1.00	6,502
ref_lr	0.84	16,625	1.00	13,985	0.87	8,980	0.77	6,502
ref_bankd	0.54	16,625	0.56	13,985	1.00	8,980	0.64	6,502
ref_marketd	0.39	16,625	0.36	13,985	0.46	8,980	1.00	6,502
ref_tl	0.34	16,625	0.33	13,985	0.58	8,980	0.57	6,502
ref_dc	0.45	16,625	0.46	13,985	0.77	8,980	0.55	6,502
ref_sbn	0.37	16,625	0.34	13,985	0.45	8,980	0.92	6,502
ref_sub	0.21	16,625	0.23	13,985	0.35	8,980	0.52	6,502
ref_cp	0.21	16,625	0.22	13,985	0.33	8,980	0.50	6,502
ref_cl	0.20	16,625	0.22	13,985	0.34	8,980	0.47	6,502

Table 3 Debt concentration dynamics and firm characteristics
This table reports differences in average debt and firm characteristics for firms with counter-cyclical debt concentration dynamics (*ccyc_HHI*) or pro-cyclical debt concentration dynamics (*pcyc_HHI*). We (1) determine for each individual firm whether its debt concentration (*HHI*) is counter- or pro-cyclical, (2) compute for each firm and each variable its time-series mean and (3) average time-series means across the cross-section of firms in each of the two cyclicality groups. Variable definitions are summarized in Appendix A.

VARIABLES	*ccyc_HHI*		*pcyc_HHI*		*ccyc-pcyc*	
Debt variables	mean	N	mean	N	Diff. in mean	p-value
diff_HHI	0.13	1,230	-0.17	1,201	0.29	0.00
ml	0.18	1,230	0.20	1,201	-0.02	0.00
bl	0.25	1,230	0.28	1,201	-0.03	0.00
diff_ml	0.02	1,230	0.06	1,201	-0.04	0.00
diff_bl	-0.01	1,230	0.04	1,201	-0.05	0.00
tl_at	0.07	1,230	0.06	1,201	0.01	0.24
dc_at	0.05	1,230	0.05	1,201	0.00	0.36
sbn_at	0.09	1,230	0.13	1,201	-0.04	0.00
sub_at	0.02	1,230	0.03	1,201	0.00	0.32
cp_at	0.00	1,230	0.00	1,201	0.00	0.00
cl_at	0.01	1,230	0.01	1,201	0.00	0.37
bankd_at	0.12	1,230	0.12	1,201	0.01	0.13
marketd_at	0.12	1,230	0.15	1,201	-0.04	0.00
HHI	0.77	1,230	0.73	1,201	0.05	0.00
	ccyc_HHI		*pcyc_HHI*		*ccyc-pcyc*	
Firm variables	mean	N	mean	N	Diff. in mean	p-value
size	3.81	1,224	4.45	1,192	-0.64	0.00
mtb	2.00	1,230	1.84	1,201	0.16	0.00
profit	0.00	1,226	0.01	1,197	-0.01	0.00
tang	0.26	1,230	0.28	1,201	-0.02	0.05
capx	0.01	1,229	0.02	1,200	0.00	0.17
divpayer	0.25	1,230	0.32	1,201	-0.07	0.00
cash	0.19	1,230	0.15	1,201	0.04	0.00
rated	0.25	1,230	0.36	1,201	-0.11	0.00
rating_max	5.94	385	6.12	502	-0.18	0.01
rating_min	5.92	385	6.09	502	-0.17	0.02

Table 4 Bank and market debt dynamics and firm characteristics
This table reports differences in average debt and firm characteristics for firms with counter-cyclical and pro-cyclical bank debt dynamics (Panel A) and with counter-cyclical and pro-cyclical market debt dynamics (Panel B). We (1) determine for each individual firm whether its bank debt, or market debt, is counter- or pro-cyclical, (2) compute for each firm and each variable its time-series mean and (3) average time-series means across the cross-section of firms in each of the two cyclicality groups. Variable definitions are summarized in Appendix A.

	Panel A: Bank debt					
VARIABLES	*ccyc_bankd_at*		*pcyc_bankd_at*		*ccyc-pcyc*	
Debt variables	mean	N	mean	N	Diff. in mean	p-value
diff_bankd_at	0.09	1,295	-0.05	1,057	0.14	0.00
ml	0.20	1,295	0.18	1,057	0.03	0.00
bl	0.28	1,295	0.24	1,057	0.04	0.00
diff_ml	0.08	1,295	-0.01	1,057	0.09	0.00
diff_bl	0.06	1,295	-0.04	1,057	0.10	0.00
tl_at	0.08	1,295	0.06	1,057	0.01	0.01
dc_at	0.06	1,295	0.05	1,057	0.01	0.04
sbn_at	0.11	1,295	0.09	1,057	0.02	0.00
sub_at	0.02	1,295	0.02	1,057	0.00	0.72
cp_at	0.00	1,295	0.00	1,057	0.00	0.35
cl_at	0.01	1,295	0.01	1,057	0.00	0.00
bankd_at	0.14	1,295	0.12	1,057	0.02	0.00
marketd_at	0.14	1,295	0.11	1,057	0.02	0.00
HHI	0.73	1,295	0.77	1,057	-0.04	0.00
	ccyc_bankd_at		*pcyc_bankd_at*		*ccyc-pcyc*	
Firm variables	mean	N	mean	N	Diff. in mean	p-value
size	4.41	1,288	3.81	1,051	0.60	0.00
mtb	1.78	1,295	1.92	1,057	-0.14	0.00
profit	0.02	1,289	0.00	1,054	0.01	0.00
tang	0.28	1,295	0.26	1,057	0.03	0.00
capx	0.02	1,294	0.01	1,056	0.00	0.05
divpayer	0.31	1,295	0.26	1,057	0.05	0.00
cash	0.14	1,295	0.18	1,057	-0.04	0.00
rated	0.35	1,295	0.24	1,057	0.11	0.00
rating_max	6.02	535	5.99	314	0.02	0.75
rating_min	5.98	535	5.97	314	0.01	0.91

	Panel B: Market Debt					
VARIABLES	*ccyc_marketd_at*		*pcyc_marketd_at*		*ccyc-pcyc*	
Debt variables	mean	N	mean	N	Diff. in mean	p-value
diff_marketd_at	0.08	878	-0.07	1,238	0.15	0.00
ml	0.20	878	0.20	1,238	0.00	0.71
bl	0.28	878	0.28	1,238	0.00	0.68
diff_ml	0.08	878	0.01	1,238	0.07	0.00
diff_bl	0.08	878	-0.03	1,238	0.11	0.00
tl_at	0.06	878	0.07	1,238	-0.01	0.03
dc_at	0.05	878	0.05	1,238	0.00	0.40
sbn_at	0.13	878	0.13	1,238	0.01	0.39
sub_at	0.03	878	0.03	1,238	0.00	0.67
cp_at	0.00	878	0.00	1,238	0.00	0.48
cl_at	0.01	878	0.01	1,238	0.00	0.01
bankd_at	0.11	878	0.12	1,238	-0.01	0.02
marketd_at	0.16	878	0.16	1,238	0.01	0.29
HHI	0.73	878	0.74	1,238	0.00	0.75
	ccyc_marketd_at		*pcyc_marketd_at*		*ccyc-pcyc*	
Firm variables	mean	N	mean	N	Diff. in mean	p-value
size	4.29	874	4.26	1,228	0.04	0.73
mtb	1.90	878	1.89	1,238	0.00	0.95
profit	0.01	875	0.01	1,236	0.00	0.64
tang	0.25	878	0.29	1,238	-0.03	0.00
capx	0.01	878	0.02	1,237	0.00	0.00
divpayer	0.31	878	0.30	1,238	0.01	0.42
cash	0.17	878	0.15	1,238	0.02	0.01
rated	0.32	878	0.37	1,238	-0.05	0.01
rating_max	6.05	332	6.05	541	0.00	1.00
rating_min	6.02	332	6.02	541	0.00	0.99

Table 5 Multivariate regression with firm fixed-effects

This table presents regression results for firm fixed-effects models using refinancing observations. Our refinancing samples are based on Compustat North America quarterly data over a period from 2002 to 2017. Table 2 reports the summary statistics of the refinancing dummies. Regression models include a contemporaneous business cycle dummy (*rec*) and allow coefficients of lagged firm characteristics to vary over the business cycle. *p*-Values (in parentheses) are based on standard errors clustered at the firm level. Variable definitions are summarized in Appendix A. ****, **, * next to coefficients during recessions (rec) indicate that the coefficient is significantly different at the 1%, 5%, and 10% level from the one during expansions.*

VARIABLES	*HHI* *ref_all*	*bankd_at* *ref_bankd*	*marketd_at* *ref_marketd*	*tl_at* *ref_tl*	*dc_at* *ref_dc*	*sbn_at* *ref_sbn*
exp_l_size	-0.017	0.003	-0.003	0.005	-0.004	0.002
	(0.000)	(0.517)	(0.542)	(0.239)	(0.297)	(0.711)
rec_l_size	-0.020	-0.010*	0.012***	-0.006	-0.003	0.011*
	(0.001)	(0.238)	(0.091)	(0.505)	(0.716)	(0.084)
exp_l_mtb	0.006	0.002	0.006	-0.000	0.003	0.006
	(0.003)	(0.324)	(0.043)	(0.923)	(0.051)	(0.042)
rec_l_mtb	0.010	-0.014**	0.002	-0.011	-0.004	0.003
	(0.070)	(0.087)	(0.766)	(0.307)	(0.386)	(0.683)
exp_l_profit	0.047	-0.156	-0.107	-0.123	-0.050	-0.112
	(0.024)	(0.000)	(0.011)	(0.010)	(0.062)	(0.011)
rec_l_profit	-0.003	0.057**	-0.496***	-0.029	-0.039	-0.501**
	(0.967)	(0.564)	(0.000)	(0.847)	(0.619)	(0.001)
exp_l_tang	-0.121	0.090	-0.016	0.086	0.047	-0.009
	(0.001)	(0.025)	(0.757)	(0.064)	(0.132)	(0.857)
rec_l_tang	-0.136	0.063	0.008	0.088	-0.028	0.021
	(0.011)	(0.336)	(0.902)	(0.294)	(0.607)	(0.748)
exp_l_capx	0.201	-0.004	-0.306	0.180	-0.062	-0.324
	(0.191)	(0.973)	(0.092)	(0.244)	(0.526)	(0.079)
rec_l_capx	-0.104	0.096	0.302	-0.880	0.581	-0.101
	(0.805)	(0.897)	(0.665)	(0.393)	(0.320)	(0.878)
exp_l_divpayer	0.018	0.005	0.010	0.004	0.001	0.005
	(0.078)	(0.512)	(0.422)	(0.689)	(0.870)	(0.654)
rec_l_divpayer	0.025	0.008	0.044*	-0.023	0.015	0.029
	(0.239)	(0.700)	(0.036)	(0.309)	(0.537)	(0.165)
exp_l_cash	0.119	-0.044	-0.022	0.013	-0.044	-0.022
	(0.000)	(0.121)	(0.579)	(0.706)	(0.015)	(0.574)
rec_l_cash	0.127	0.040	-0.126	0.155**	-0.150*	-0.151*
	(0.022)	(0.607)	(0.109)	(0.030)	(0.012)	(0.042)
exp_l_rated	-0.075	-0.031	0.073	0.009	-0.051	0.078
	(0.000)	(0.007)	(0.000)	(0.505)	(0.000)	(0.000)
rec_l_rated	-0.130**	0.054***	-0.011***	0.111***	-0.052	0.020**
	(0.000)	(0.059)	(0.720)	(0.004)	(0.010)	(0.514)
rec	0.016	0.070	-0.077	0.041	0.042	-0.043
	(0.592)	(0.071)	(0.087)	(0.409)	(0.185)	(0.349)
Constant	0.808	0.166	0.184	0.091	0.124	0.150
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Firm FEs	Y	Y	Y	Y	Y	Y
Observations	16,625	8,980	6,502	5,691	7,496	6,205
R-squared	0.068	0.010	0.077	0.001	0.033	0.127
Number of Firms	3,957	2,526	2,151	2,116	2,200	2,096

Table 6 The dynamics of target debt variables
This table reports summary statistics of target debt dynamics. Target debt variables are estimated using the multivariate regression models with firm fixed-effects in Table 5 and their means are averaged over an event window. We set event time to zero for 2007Q4 through 2009Q2 (*rec*) and consider the 16 pre-recession and 16 post-recession quarters as expansions (*exp*). For these 32 quarters, we group, chronologically, four consecutive quarters as one event time period, for example, event time = -4 for 2003Q4 through 2004Q3 and event time = +4 for 2012Q3 through 2013Q2. Variable definitions are summarized in Appendix A.

	full			*exp*			*rec*			*rec-exp*	
VARIABLES	mean	sd	N	mean	sd	N	mean	sd	N	mean	p-value
tml	0.20	0.07	7,774	0.19	0.07	6,802	0.22	0.07	972	0.02	0.00
tbl	0.31	0.06	7,774	0.31	0.05	6,802	0.30	0.06	972	-0.01	0.00
tHHI	0.72	0.09	9,306	0.72	0.09	8,189	0.69	0.12	1,117	-0.03	0.00
tbankd_at	0.20	0.03	4,343	0.20	0.03	4,075	0.21	0.04	268	0.01	0.00
tmarketd_at	0.21	0.04	3,344	0.21	0.04	3,104	0.18	0.05	240	-0.03	0.00
ttl_at	0.14	0.03	2,701	0.14	0.03	2,558	0.16	0.05	143	0.02	0.00
tdc_at	0.11	0.03	3,648	0.11	0.03	3,423	0.11	0.04	225	0.00	0.86
tsbn_at	0.20	0.04	3,145	0.20	0.04	2,918	0.19	0.05	227	-0.01	0.00

Table 7 Sources of target debt dynamics

This table analyzes where the variation in target debt dynamics is coming from. We look at (i) the coefficient of the recession dummy; (ii) variation in model parameters (in this case the target debt variable is calculated as the product of average firm characteristics and business-cycle-dependent regression coefficients); and (iii) variation in firm characteristics (in this case the target debt variable is calculated as the product of firm characteristics and constant regression coefficients). The table reports levels of target debt variables during recessions and expansions as well as corresponding differences for an average firm. Note that we ignore any fixed effects in this analysis. Variable definitions are summarized in Appendix A.

	Panel A: Coefficient of the recession dummy			
Variables	rec	exp	Diff.	p-value
tml	0.045		0.045	0.008
tbl	0.019		0.019	0.374
tHHI	0.016		0.016	0.592
tbankd	0.070		0.070	0.071
tmarketd	-0.077		-0.077	0.087
ttl_at	0.041		0.041	0.409
tdc_at	0.042		0.042	0.185
tsbn_at	-0.043		-0.043	0.349
	Panel B: Variation in model parameters			
Variables	rec	exp	Diff.	p-value
tml	0.167	0.196	-0.028	0.000
tbl	0.280	0.307	-0.028	0.000
tHHI	0.693	0.721	-0.028	0.000
tbankd	0.139	0.193	-0.054	0.000
tmarketd	0.235	0.209	0.026	0.000
ttl_at	0.113	0.142	-0.029	0.000
tdc_at	0.072	0.106	-0.035	0.000
tsbn_at	0.200	0.197	0.003	0.000
	Panel C: Variation in firm characteristics			
Variables	rec	exp	Diff.	p-value
tml	0.204	0.195	0.009	0.000
tbl	0.307	0.307	0.000	0.983
tHHI	0.707	0.722	-0.015	0.000
tbankd	0.190	0.194	-0.004	0.014
tmarketd	0.217	0.209	0.008	0.000
ttl_at	0.152	0.142	0.010	0.000
tdc_at	0.091	0.107	-0.015	0.000
tsbn_at	0.216	0.197	0.020	0.000

Table 8 Cluster analysis

This table analyzes debt structure clusters using firm-quarter observations over the sample period from 2003Q4 through 2013Q2. We follow Colla et al. (2013)'s method and obtain eight common debt structure clusters, which are SBN, TL, DC, SBN+DC, CL, SBN+TL, SUB+3, and TL+DC. Panel A presents mean debt ratios and firm characteristics for the eight identified clusters. For tractability, we further aggregate the primary clusters into three groups: SBN, TLDC (that is, the aggregate of TL, DC, and TL+DC), and MIX(that is, the aggregate of SBN+DC, SBN+TL, and SUB+3). Panel B presents mean debt ratios and firm characteristics for the three aggregated clusters. Variable definitions are summarized in Appendix A.

Panel A: All clusters

cluster	*Freq.*	*Percent*	*HHI*	*NumDebt1*	*sbn_ttd*	*tl_ttd*	*dc_ttd*	*sub_ttd*	*cl_ttd*	*cp_ttd*	*bankd_ttd*	*marketd_ttd*	*ml*	*bl*
SBN	11,766	32.18	0.87	1.44	0.93	0.02	0.02	0.01	0.01	0.01	0.04	0.95	0.18	0.27
TL	6,449	17.64	0.84	1.44	0.02	0.91	0.03	0.02	0.02	0.00	0.94	0.05	0.18	0.25
DC	6,008	16.43	0.84	1.41	0.03	0.02	0.91	0.01	0.02	0.00	0.94	0.04	0.15	0.20
SBN+DC	2,725	7.45	0.41	2.40	0.54	0.03	0.35	0.03	0.03	0.02	0.38	0.60	0.23	0.31
CL	2,696	7.37	0.93	0.52	0.01	0.01	0.02	0.00	0.95	0.00	0.03	0.02	0.03	0.05
SBN+TL	2,464	6.74	0.39	2.60	0.50	0.42	0.04	0.03	0.02	0.00	0.46	0.53	0.30	0.39
SUB+3	2,302	6.30	0.66	1.94	0.05	0.10	0.07	0.77	0.01	0.00	0.17	0.82	0.24	0.34
TL+DC	2,158	5.90	0.39	2.47	0.04	0.44	0.44	0.03	0.03	0.02	0.88	0.09	0.23	0.29
Total	36,568	100.00	0.76	1.61	0.39	0.23	0.22	0.06	0.09	0.01	0.45	0.46	0.18	0.26

cluster	*l_size*	*l_profit*	*l_mtb*	*l_tang*	*l_capx*	*l_divpayer*	*l_cash*	*l_rated*
SBN	5.48	0.02	1.93	0.30	0.01	0.47	0.16	0.60
TL	3.64	0.01	1.97	0.25	0.01	0.20	0.19	0.21
DC	3.96	0.02	1.71	0.26	0.01	0.28	0.10	0.06
SBN+DC	5.15	0.03	1.63	0.35	0.02	0.48	0.07	0.48
CL	3.15	0.00	2.60	0.17	0.01	0.14	0.36	0.02
SBN+TL	5.38	0.03	1.59	0.34	0.01	0.34	0.10	0.63
SUB+3	4.58	0.02	1.71	0.22	0.01	0.16	0.17	0.47
DC+TL	3.88	0.02	1.59	0.26	0.01	0.23	0.08	0.13
Total	4.55	0.02	1.87	0.28	0.01	0.33	0.16	0.36

Panel B: Aggregated clusters

cluster	*Freq.*	*Percent*	*HHI*	*NumDebt1*	*sbn_ttd*	*tl_ttd*	*dc_ttd*	*sub_ttd*	*cl_ttd*	*cp_ttd*	*bankd_ttd*	*marketd_ttd*	*ml*	*bl*
SBN	11,766	34.74	0.87	1.44	0.93	0.02	0.02	0.01	0.01	0.01	0.04	0.95	0.18	0.27
TLDC	14,615	43.15	0.77	1.58	0.03	0.48	0.45	0.02	0.02	0.00	0.93	0.05	0.18	0.24
MIX	7,491	22.12	0.48	2.33	0.38	0.18	0.16	0.26	0.02	0.01	0.34	0.64	0.26	0.35
Total	33,872	100.00	0.74	1.69	0.42	0.25	0.24	0.07	0.02	0.01	0.49	0.49	0.20	0.27

cluster	*l_size*	*l_profit*	*l_mtb*	*l_tang*	*l_capx*	*l_divpayer*	*l_cash*	*l_rated*
SBN	5.48	0.02	1.93	0.30	0.01	0.47	0.16	0.60
TLDC	3.81	0.02	1.80	0.26	0.01	0.24	0.14	0.13
MIX	5.05	0.02	1.64	0.31	0.01	0.34	0.11	0.53
Total	4.66	0.02	1.81	0.28	0.01	0.34	0.14	0.38

Table 9 The dynamics of debt structure clusters

This table presents the business cycle dynamics of three aggregate debt structure clusters. We break our sample period into three sub-periods: pre-recession (2003Q4 to 2007Q3), recession (2007Q4 to 2009Q2), and post-recession (2009Q3 to 2012Q3). Panel A reports the overall dynamics. Panel B focuses on the transition from the pre-recession (columns) to the recession (rows) period. Specifically, we start from the pre-recession period and for each firm we compute its time-series mode (over the 16 pre-recession quarters) and then track the debt structure clusters the firm ends up in during the recession period. Panel C focuses on the transition from the recession (columns) to the post-recession (rows) period and otherwise follows the same procedure as described for Panel B. Variable definitions are summarized in Appendix A.

Panel A: Business cycle dynamics of debt clusters

	pre-recession		recession		post-recession	
cluster	*Freq.*	*Percent*	*Freq.*	*Percent*	*Freq.*	*Percent*
SBN	3,115	37.48	1,538	30.39	7,113	34.70
TLDC	3,057	36.78	2,305	45.54	9,253	45.14
MIX	2,140	25.75	1,218	24.07	4,133	20.16
Total	8,312	100.00	5,061	100.00	20,499	100.00

Panel B: Transition from the pre-recession to the recession period

	All		SBN		TLDC		MIX	
cluster_rec	Freq.	Percent	*Freq.*	*Percent*	*Freq.*	*Percent*	*Freq.*	*Percent*
SBN	1,323	32.16	1,087	71.28	113	6.97	123	12.71
TLDC	1,772	43.07	179	11.74	1,339	82.60	254	26.24
MIX	1,019	24.77	259	16.98	169	10.43	591	61.05
Total	4,114	100.00	1,525	100.00	1,621	100.00	968	100.00

Panel C: Transition from the recession to the post-recession period

	All		SBN		TLDC		MIX	
cluster_post	Freq.	Percent	*Freq.*	*Percent*	*Freq.*	*Percent*	*Freq.*	*Percent*
SBN	6,215	34.34	4,002	79.93	794	8.69	1,419	35.86
TLDC	8,348	46.12	485	9.69	7,248	79.34	615	15.54
MIX	3,536	19.54	520	10.39	1,093	11.96	1,923	48.60
Total	18,099	100.00	5,007	100.00	9,135	100.00	3,957	100.00

Table 10 Multivariate analysis of debt structure clusters

This table presents multinomial logistic regression results, controlling for a given firm's pre-recession preferred debt structure cluster (measured by its time-series mode of debt structure cluster during the pre-recession period) in Model (1) and recession preferred debt structure cluster (measured by its time-series mode of debt structure cluster during the recession period) in Model (2). Therefore, Model (1) focuses on the transition from the pre-recession period to the recession period and Model (2) focuses on the transition from the recession period to the post-recession period. For both models, we use the same set of firm controls which also equal the ones used in our target debt level and debt concentration regressions. We set the SBN-cluster as the base cluster. All coefficients across the two other clusters (TLDC and MIX) are estimated jointly for Models (1) and (2). Variable definitions are summarized in Appendix A. ****, **, * next to coefficients in Model (1) indicate that the coefficient is significantly different at the 1%, 5%, and 10% level from the one in Model (2).*

	TLDC		MIX	
	(1)	(2)	(1)	(2)
VARIABLES	*cluster_rec*	*cluster_post*	*cluster_rec*	*cluster_post*
l_size	-0.229	-0.172	-0.056	-0.062
	(0.000)	(0.000)	(0.119)	(0.000)
l_mtb	0.061**	-0.032	-0.068	-0.001
	(0.129)	(0.184)	(0.178)	(0.958)
l_profit	3.565*	1.364	1.905	0.244
	(0.001)	(0.007)	(0.130)	(0.636)
l_tang	0.138	-0.403	0.266	0.125
	(0.658)	(0.002)	(0.371)	(0.301)
l_capx	-2.502**	-10.639	-2.442	-7.675
	(0.478)	(0.000)	(0.491)	(0.000)
l_cash	-3.213**	-2.258	-2.970	-2.496
	(0.000)	(0.000)	(0.000)	(0.000)
l_divpayer	0.076*	-0.177	0.075***	-0.323
	(0.551)	(0.003)	(0.530)	(0.000)
l_rated	-1.092***	-2.099	-0.295	-0.415
	(0.000)	(0.000)	(0.031)	(0.000)
2.mode_cluster_pre	4.074		1.888	
	(0.000)		(0.000)	
3.mode_cluster_pre	2.583		3.052	
	(0.000)		(0.000)	
2.mode_cluster_rec		4.200		2.207
		(0.000)		(0.000)
3.mode_cluster_rec		1.465		2.265
		(0.000)		(0.000)
Constant	0.072	0.099	-0.562	-0.860
	(0.730)	(0.340)	(0.011)	(0.000)
Observations	3,936	17,592		
pseudo R-squared	0.357	0.378		

Figure 1: **Observed leverage dynamics.** The graphs show the dynamics of observed leverage ratios over the business cycle. We set event time to zero for 2007Q4 through 2009Q2 and consider the 16 pre-recession and 16 post-recession quarters as expansions (counterfactuals). For these 32 quarters, we group, chronologically, four consecutive quarters as one event time period, for example, event time = -4 for 2003Q4 through 2004Q3 and event time = +4 for 2012Q3 through 2013Q2. Variable definitions are summarized in Appendix A.

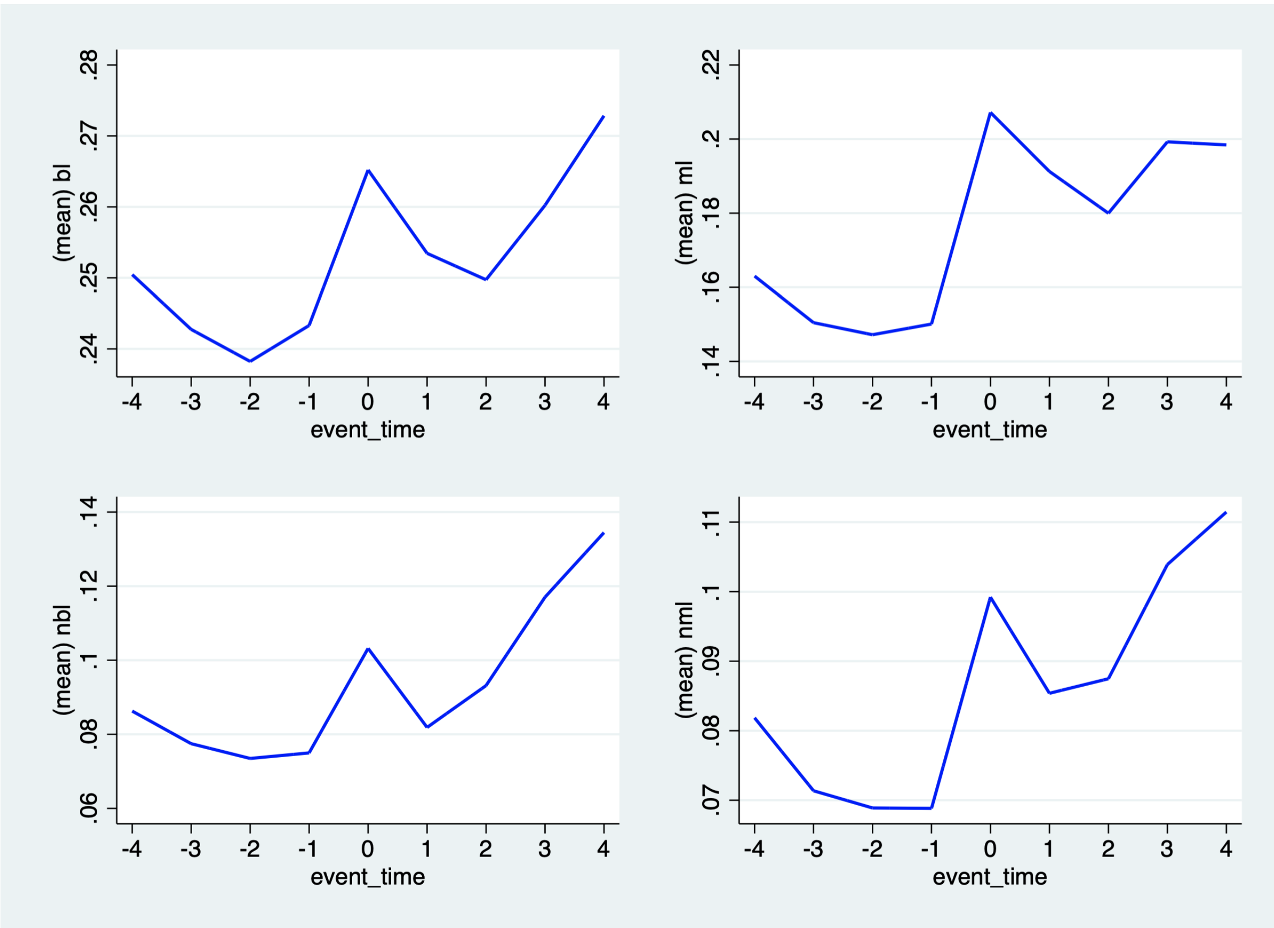

Figure 2: **The dynamics of observed debt concentration measures I.** The graphs show the dynamics of (value-weighted) observed debt concentration over the business cycle. We set event time to zero for 2007Q4 through 2009Q2 and consider the 16 pre-recession and 16 post-recession quarters as expansions (counterfactuals). For these 32 quarters, we group, chronologically, four consecutive quarters as one event time period, for example, event time = -4 for 2003Q4 through 2004Q3 and event time = +4 for 2012Q3 through 2013Q2. Variable definitions are summarized in Appendix A.

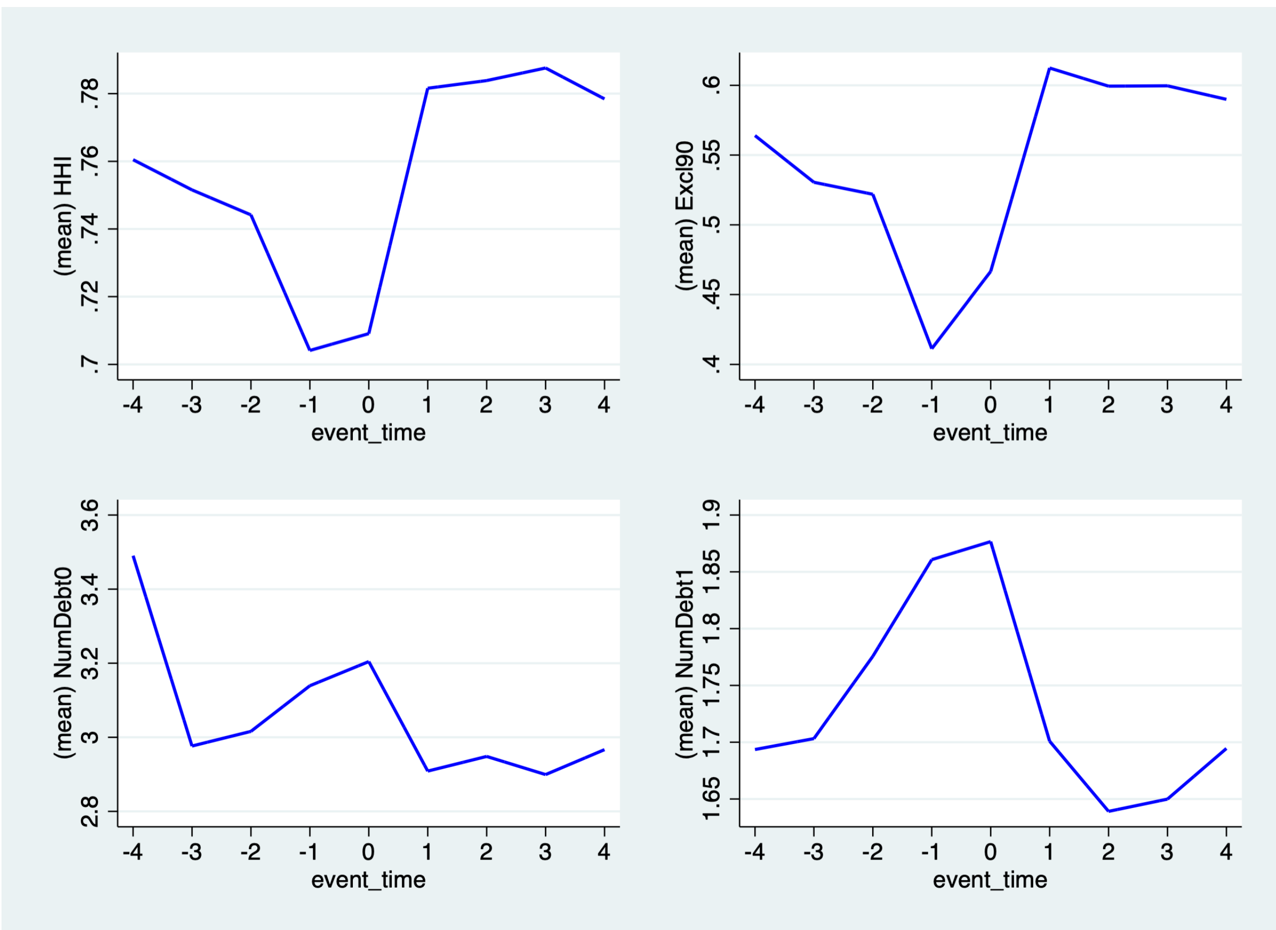

Figure 3: **The dynamics of observed debt concentration measures II.** The graphs show the dynamics of (equally-weighted) observed debt concentration over the business cycle. We set event time to zero for 2007Q4 through 2009Q2 and consider the 16 pre-recession and 16 post-recession quarters as expansions (counterfactuals). For these 32 quarters, we group, chronologically, four consecutive quarters as one event time period, for example, event time = -4 for 2003Q4 through 2004Q3 and event time = +4 for 2012Q3 through 2013Q2. Variable definitions are summarized in Appendix A.

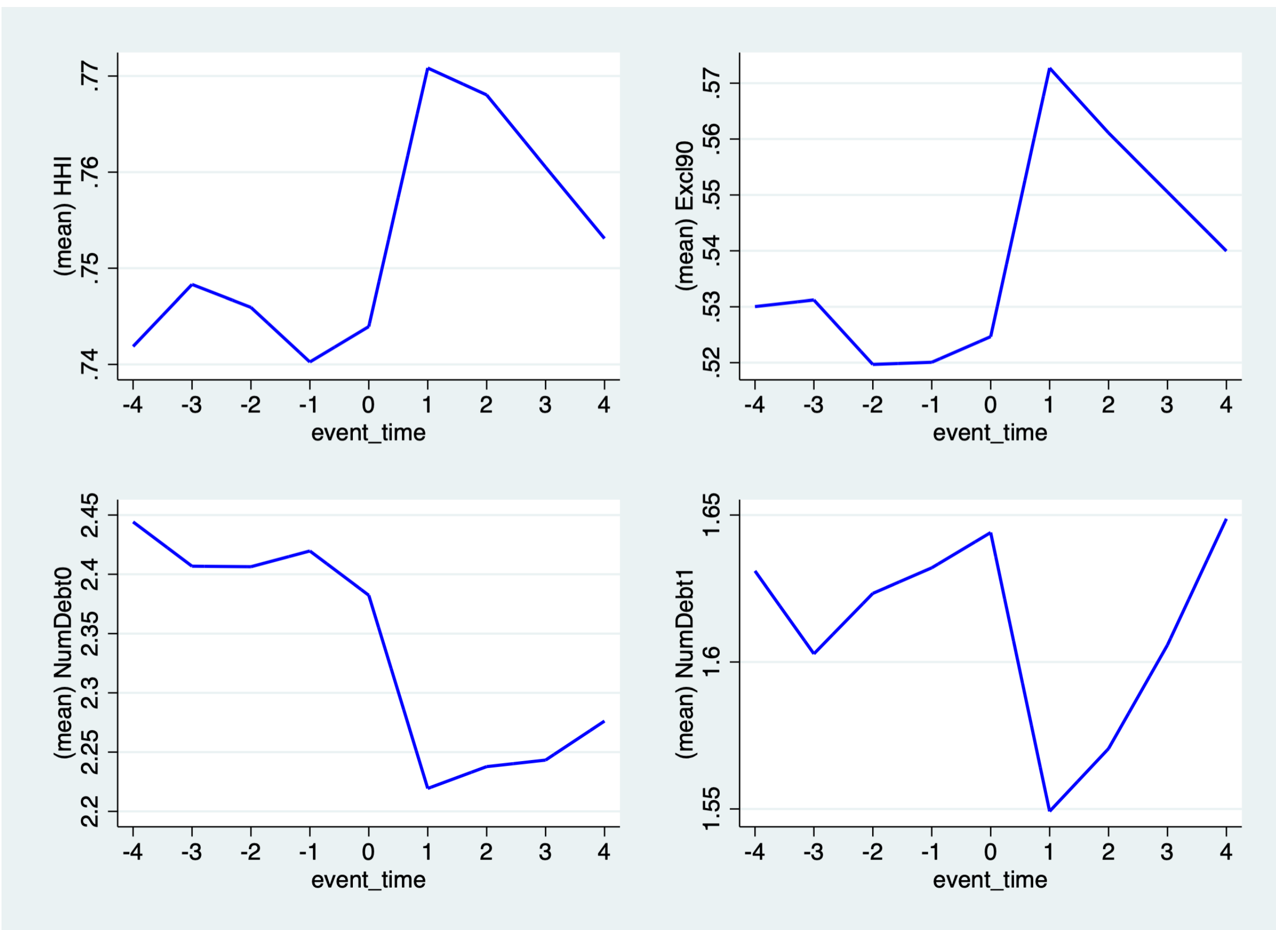

Figure 4: **Debt concentration and leverage cyclicality.** The graphs show the dynamics of observed debt concentration over the business cycle for counter- (left panel) and pro-cyclically (right panel) levered firms. We set event time to zero for 2007Q4 through 2009Q2 and consider the 16 pre-recession and 16 post-recession quarters as expansions (counterfactuals). For these 32 quarters, we group, chronologically, four consecutive quarters as one event time period, for example, event time = -4 for 2003Q4 through 2004Q3 and event time = +4 for 2012Q3 through 2013Q2. Variable definitions are summarized in Appendix A.

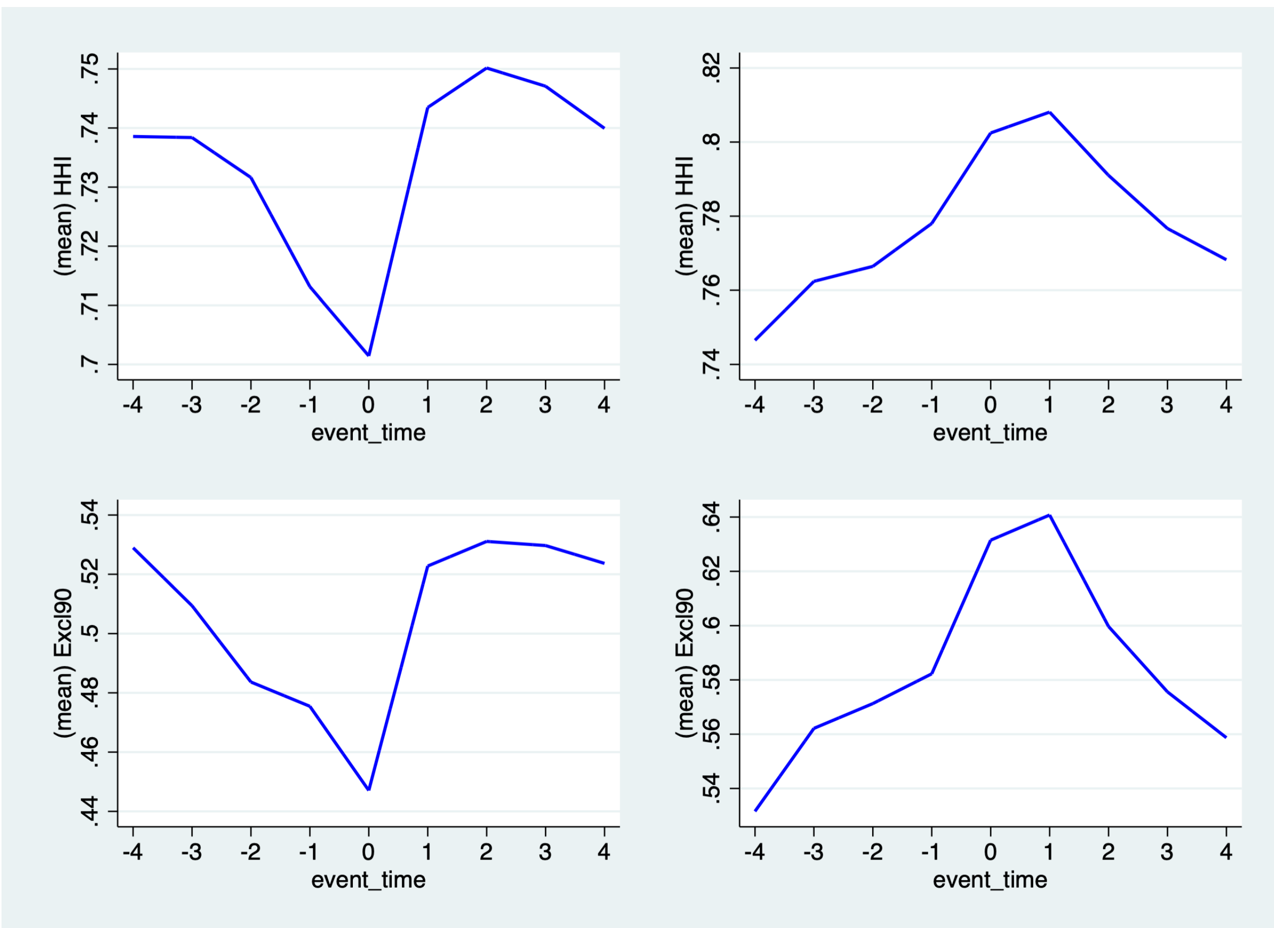

Figure 5: **The dynamics of observed bank and market debt.** The graphs show the dynamics of bank debt and market debt (scaled by total assets) over the business cycle. We set event time to zero for 2007Q4 through 2009Q2 and consider the 16 pre-recession and 16 post-recession quarters as expansions (counterfactuals). For these 32 quarters, we group, chronologically, four consecutive quarters as one event time period, for example, event time = -4 for 2003Q4 through 2004Q3 and event time = +4 for 2012Q3 through 2013Q2. Variable definitions are summarized in Appendix A.

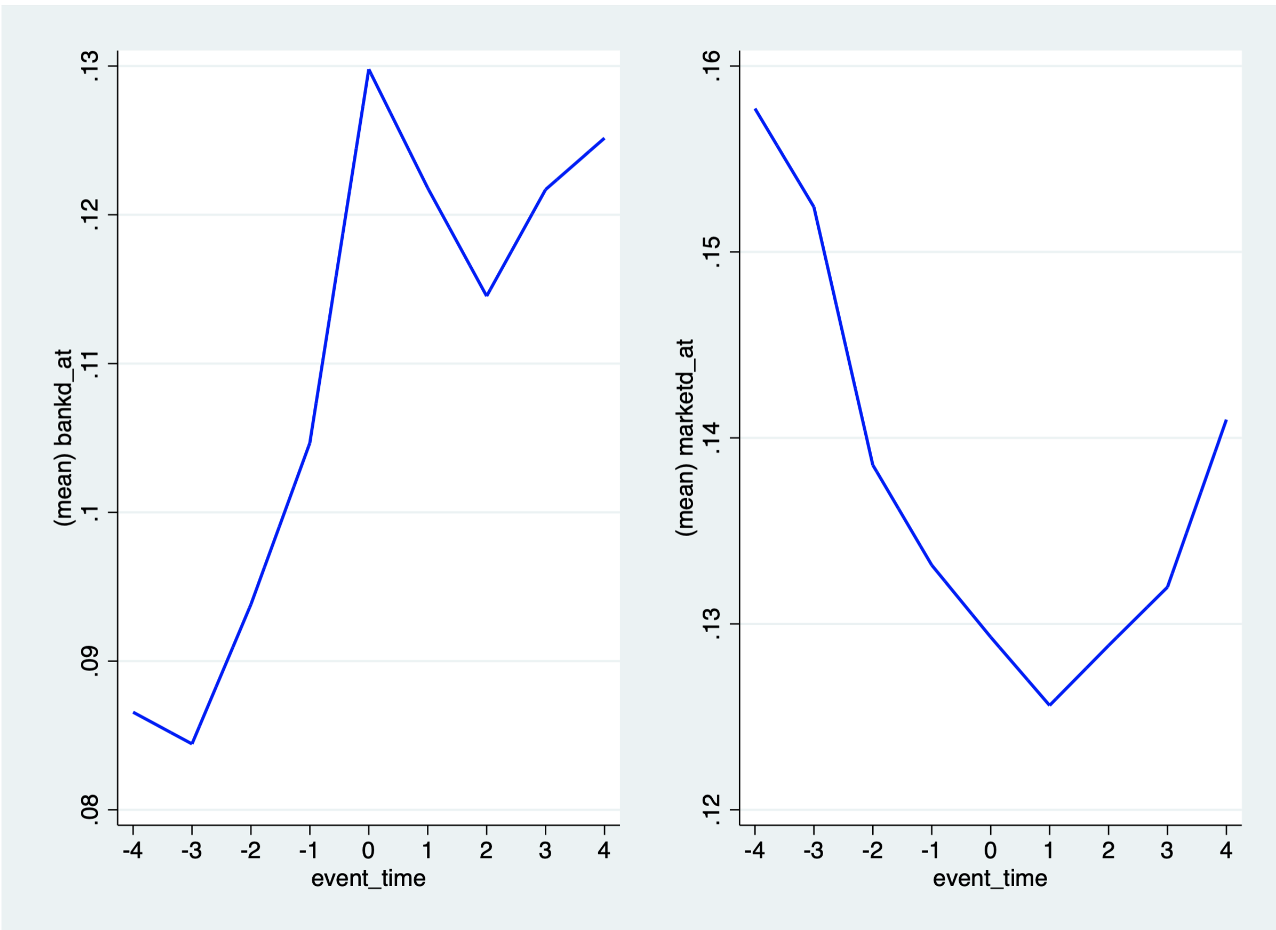

Figure 6: **The dynamics of target debt concentration.** The graphs show the dynamics of target debt concentration (*tHHI*)over the business cycle. We set event time to zero for 2007Q4 through 2009Q2 and consider the 16 pre-recession and 16 post-recession quarters as expansions (counterfactuals). For these 32 quarters, we group, chronologically, four consecutive quarters as one event time period, for example, event time = -4 for 2003Q4 through 2004Q3 and event time = +4 for 2012Q3 through 2013Q2. Variable definitions are summarized in Appendix A.

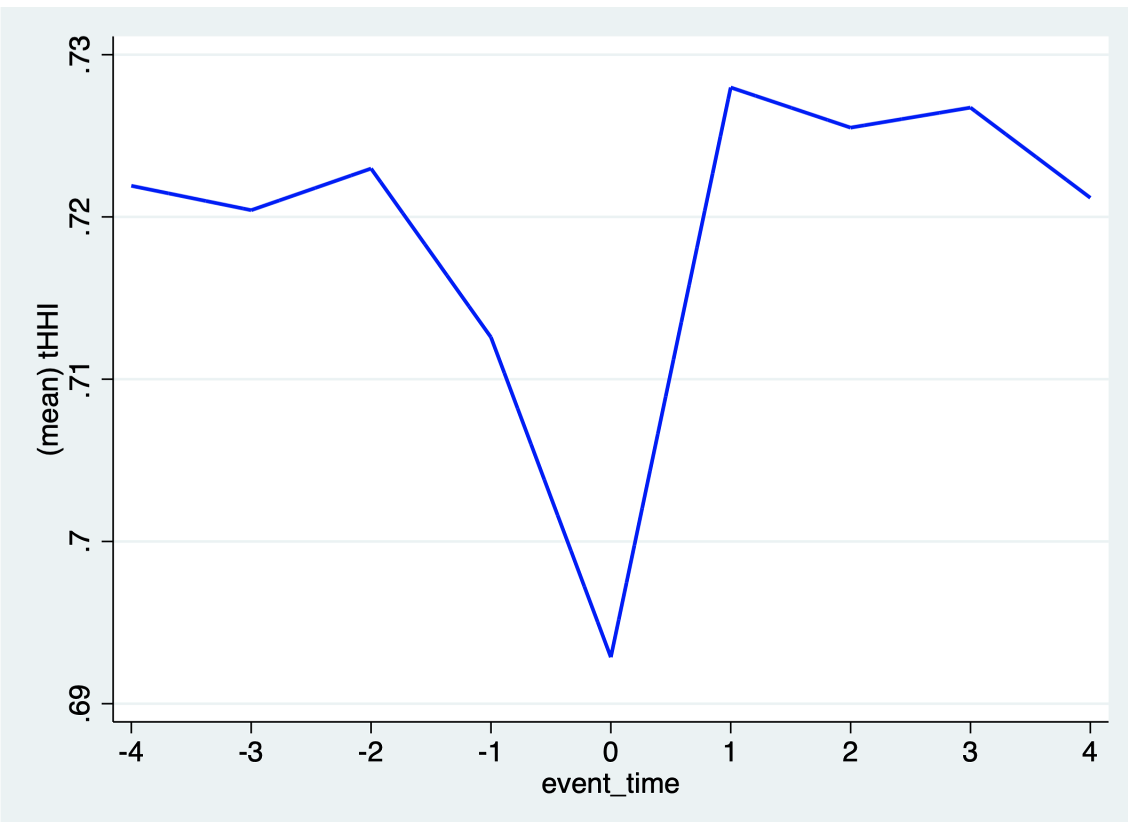

Figure 7: **Observed debt sources dynamics I.** The graphs show the dynamics of observed debt sources (scaled by total assets) over the business cycle. We set event time to zero for 2007Q4 through 2009Q2 and consider the 16 pre-recession and 16 post-recession quarters as expansions (counterfactuals). For these 32 quarters, we group, chronologically, four consecutive quarters as one event time period, for example, event time = -4 for 2003Q4 through 2004Q3 and event time = +4 for 2012Q3 through 2013Q2. Variable definitions are summarized in Appendix A.

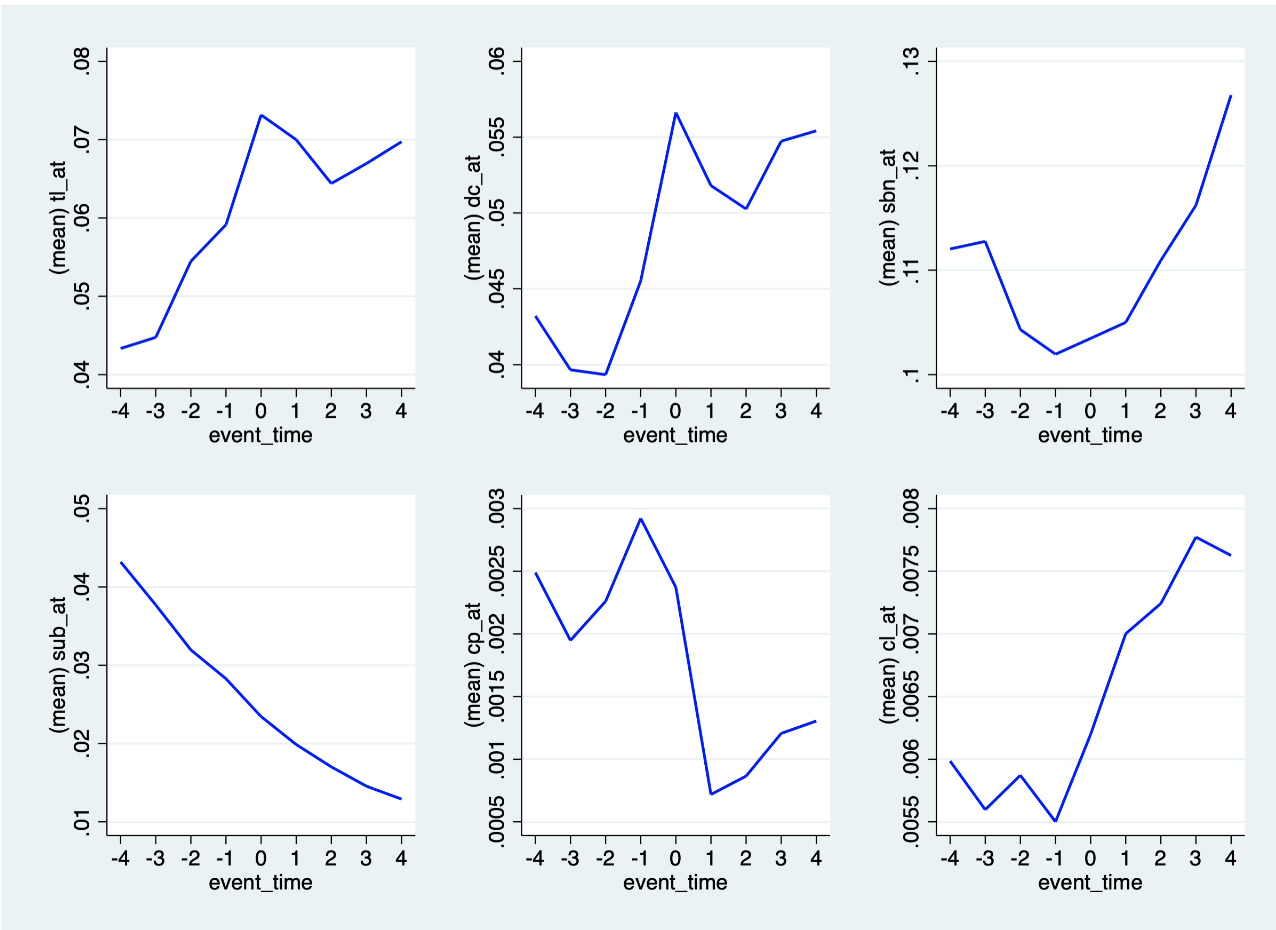

Figure 8: **Observed debt sources dynamics II.** The graphs show the dynamics of observed debt sources (scaled by total debt) over the business cycle. We set event time to zero for 2007Q4 through 2009Q2 and consider the 16 pre-recession and 16 post-recession quarters as expansions (counterfactuals). For these 32 quarters, we group, chronologically, four consecutive quarters as one event time period, for example, event time = -4 for 2003Q4 through 2004Q3 and event time = +4 for 2012Q3 through 2013Q2. Variable definitions are summarized in Appendix A.

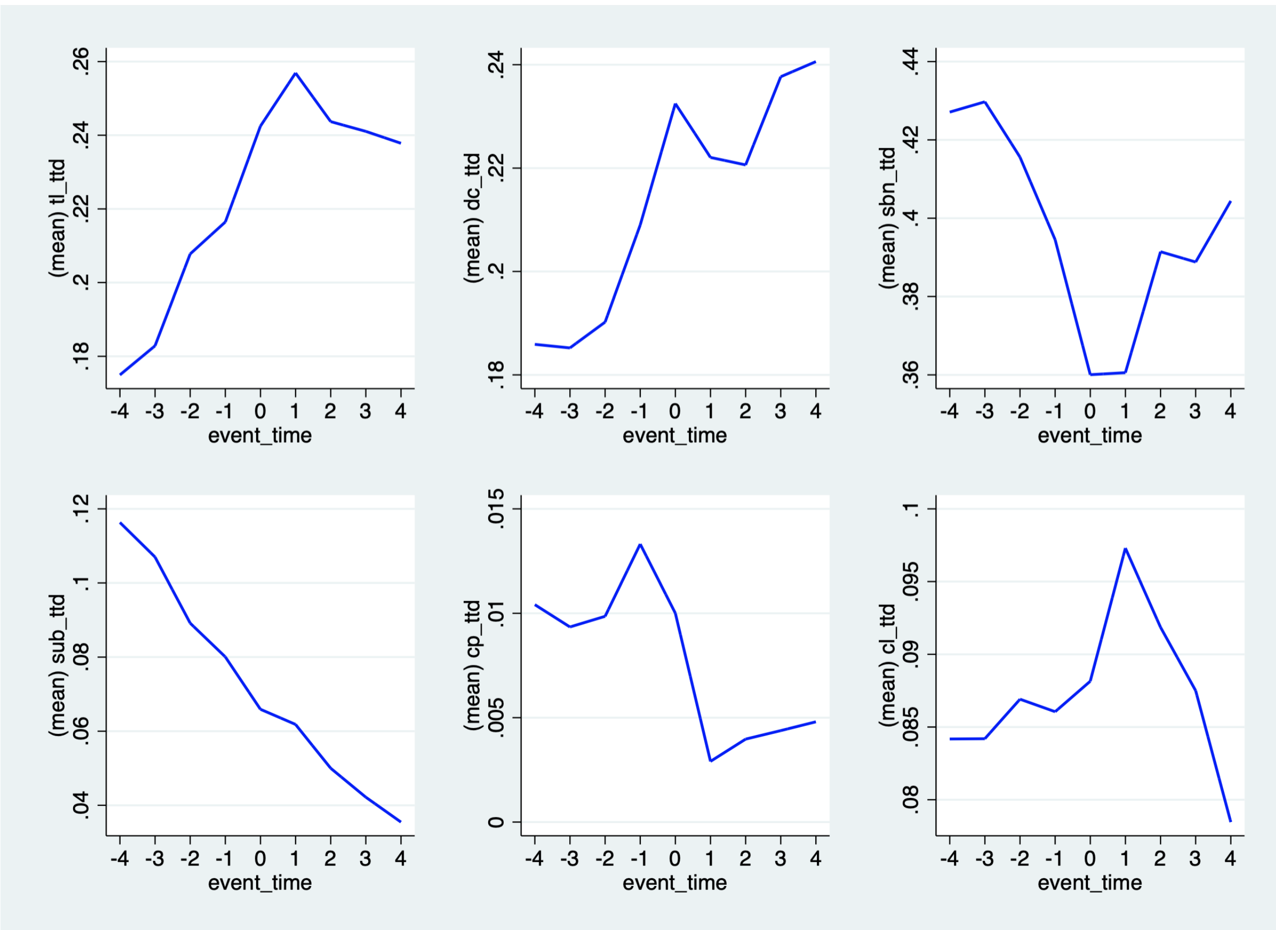

Figure 9: **The dynamics of target bank and market debt.** The graphs show the dynamics of target bank (*tbankd_at*) and market debt (*tmarketd_at*) over the business cycle. We set event time to zero for 2007Q4 through 2009Q2 and consider the 16 pre-recession and 16 post-recession quarters as expansions (counterfactuals). For these 32 quarters, we group, chronologically, four consecutive quarters as one event time period, for example, event time = -4 for 2003Q4 through 2004Q3 and event time = +4 for 2012Q3 through 2013Q2. Variable definitions are summarized in Appendix A.

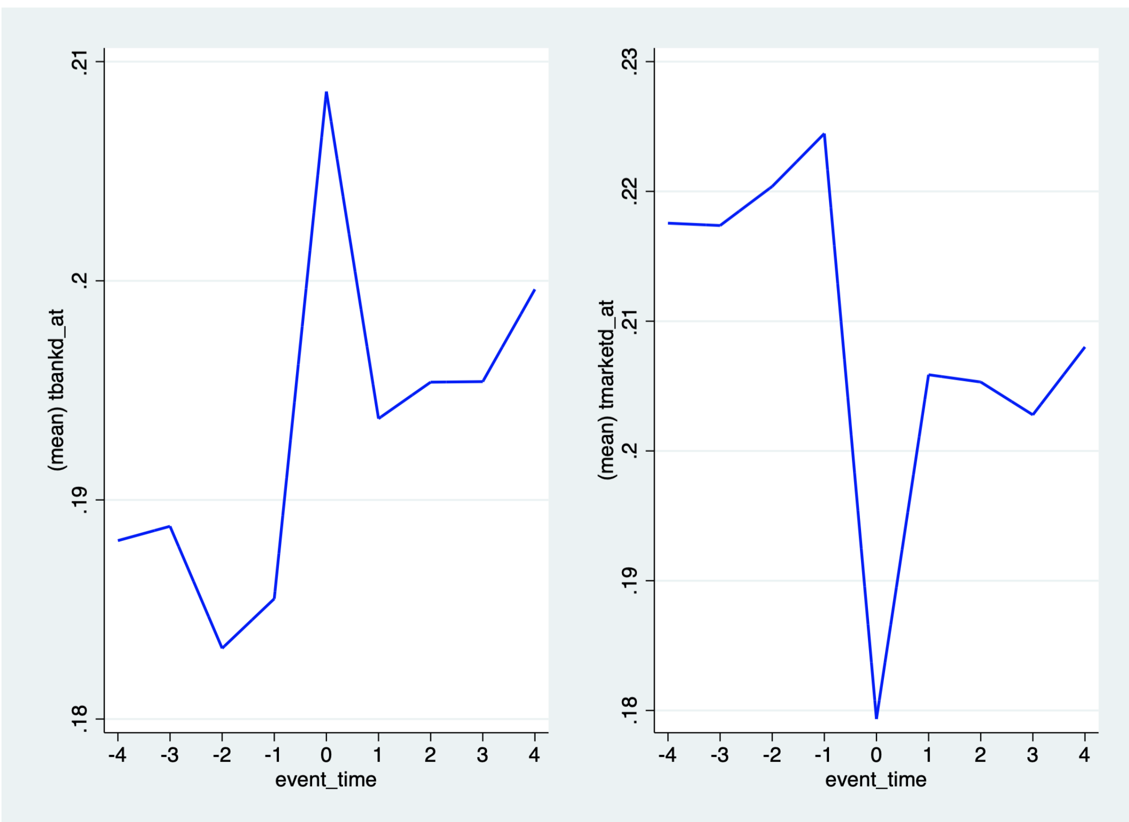

Figure 10: **The dynamics of target primary debt sources.** The graphs show the dynamics of target term loans (*ttl_at*), drawn credit line (*tdc_at*), and senior bonds and notes (*tsbn_at*)over the business cycle. We set event time to zero for 2007Q4 through 2009Q2 and consider the 16 pre-recession and 16 post-recession quarters as expansions (counterfactuals). For these 32 quarters, we group, chronologically, four consecutive quarters as one event time period, for example, event time = -4 for 2003Q4 through 2004Q3 and event time = +4 for 2012Q3 through 2013Q2. Variable definitions are summarized in Appendix A.