Corporate Debt Structure and Costs under Product Market Competition

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Abstract

The literature documented that facing intensive industry competition, firms substitute bank debt with public debt to reduce the external pressure of bank monitoring. It is not clear how product market competition affects specific corporate debt structure. This study fills the literature gap by examining corporate leverages, debt structures, and the costs of six types of debt from the underlying mechanism that firms choose different debt components in response to product market competition under the effects of a range of firm characteristics and economic conditions. Our analyses of various types of debt in fine details reveal that product market competition generally reduces the majority of debt except for bonds and other borrowings. Nevertheless, competition usually mitigates the leverage puzzle of the negative relationship between profitability and total debt or some types of debt by increasing about 5% to 9% of these types of debt in profitable firms. Besides, competition raises the credit spreads of all types of debt due to the bank monitoring of bank debt and the need for public debt for reducing external monitoring pressure.

Keywords: Industry Competition; Debt Structure; Costs of Debt; Leverage Puzzle; Industry Concentration

JEL: C24, D24, G32, O16

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1 Introduction

A central theme in corporate finance is that the financing policy of a firm is determined not only by financing frictions like bankruptcy costs, taxes, and refinancing costs, but also by internal and external pressures. Although both empirical and theoretical literature has discussed the relationship between firms' *internal* pressure and the corporate *capital* structure (Paligorova and Xu; 2012; Morellec, Nikolov and Schürhoff; 2012; Nicodano and Regis; 2019), there is a limited literature on firms' decisions of *debt* structure and leverage under the impact of the *external* pressure imposed by creditors and product market competition. Indeed, the external pressure of creditors affects the corporate debt structure due to 'the substitution effect', which states that firms substitute internal pressure with external pressure from banks' monitoring (Nini, Smith and Sufi; 2012; Bharath and Hertzel; 2019).

Specifically, firms adjust their pressure through changing their ways of obtaining debt according to economic conditions and firm characteristics. On the one hand, firms might be willing to pay credit spreads to debt holders for the benefits of external monitoring. On the other hand, firms reduce the external pressure of bank monitoring by substituting private bank debt with public debt (e.g., bonds and notes) from the debt market when the firms encounter intensive external pressure that is imposed by intense *product market competition*.

Our study about the effect of product market competition on firms' financing decisions is relevant to Valta (2012), Boubaker, Saffar and Sassi (2018), and Bharath and Hertzel (2019). Valta (2012) finds that market competition affects firms' costs of bank debt. Boubaker et al. (2018) reveal that the product market imposes external pressure to firms through the mechanism of bank debt monitoring. Bharath and Hertzel (2019) show that external pressure is increased by intense product market competition that affects the type of firms' debt. Different to the prior studies, we examine the effects of market competition on the details of the corporate debt structure, leverage puzzle, and costs of six types of debt.

We follow the categories and terminology in Capital IQ where we obtain data.

We focus on the six types of debt, "Commercial Paper", "Revolving Credit", "Term Loans", "Bonds and Notes", "Capital Lease", and "Other Borrowings" that gather the rest of debt. Our "Other Borrowings" comprise a small amount of other borrowings in the raw data from Capital IQ, a moderate amount of trust preferred, a few preferred securities and adjustments. This debt structure is consistent with represented prior works in Rauh and Sufi (2010), Colla, Ippolito and Li (2013), and Choi, Hackbarth and Zechner (2018). We illustrate the concept relationship between the corporate debt structure and the research problem by a flowchart Fig. 1 in Section 3.

The study is the first to examine the leverage, corporate debt structure and the costs of the six types of debt from the underlying mechanism that firms balance their pressure through adjusting different debt components with different creditors' monitoring pressures in response to the varying intensities of external pressure from product market competition. We contribute to the literature by providing an insight into the debt structure and their costs under the effects of product market competition and meanwhile accounting for a range of firm characteristics and economic conditions.

The study develops a series of hypotheses to answer the important finance questions regarding the interaction between product market competition, external pressure, the corporate debt structure, and the cost of debt: Does product market competition affect differences in debt choices and the cost of debt through the underlying channel of substitution effect? Could the product market competition mitigate or complement the leverage puzzle of the negative relationship between the firm's current profit and different types of debt? What are the effects of firm characteristics and economic conditions on the debt structure and their costs?

The study uses the quarterly data of the corporate debt structure and financial statements for the U.S. companies downloaded from Capital IQ database and Compustat database in the WRDS platform. The dataset about macroeconomic variables is obtained from the Federal Reserve Economic Data (FRED) of Federal Reserve Bank of St. Louis. The data period is from 2002 to 2019 covering the period of the 2008 financial crisis to assess the effect of monetary policy in response to the

financial crisis.[1] The fine details of the corporate debt structure allow us to dissemble the relationships between the leverage, costs, competition, firm characteristics, and economic conditions to the specific relationships between particular types of debt and these factors, which provide new insights into the corporate debt structure.

To identify product market competition, we follow the literature to measure product market competition with respect to the Herfindahl-Hirschman Index (HHI) of industry concentration. A higher level of HHI implies greater industry concentration and thereby less intense competition pressure. Based on quasi-natural experiments and using product market competition as the proxy, Bharath and Hertzel (2019) illustrate that increasing external pressure makes firms be more likely to replace bank debt with public debt due to the substitution mechanism. The degree of the substitution depends on how external pressure is relatively stronger than internal pressure. Hence, the exogenous changes in product market competition will affect firms' debt structure and leverage through imposing external pressure.

To identify the effect of product market competition, we first add the product market competition indicator to the traditional empirical models that determine the cost of debt and the leverage puzzle of the negative relationship between profitability and leverage. Next, we dissemble firms' total debt to the components of bank debt and public debt in order to reveal how product market competition impacts credit spreads and leverage through the two components. Then, we investigate six types of debt to provide details about the effects of product market competition, firm characteristics, and economic conditions on the debt structure and their costs. To this end, we firstly estimate the coefficients for the regression of various types of debt ratios in the debt structure on market competition, profitability, the product of competition and profitability, firm characteristics, and economic conditions. Then we estimate the

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[1]The study uses debt data from Capital IQ, as it provides a more specific profile of diverse types of corporate debt than another widely studied debt database, namely DealScan. Generally, DealScan provides contract details about bank (private) debt like bank loans and public debt such as bonds that are issued to the financial market. Nevertheless, DealScan does not offer data about the specific components of bank debt and public debt, such as revolving credit and capital leases, which are well organized in Capital IQ data.

slopes for the regression of various types of debt credit spreads on market competition, firm characteristics, and economic conditions. We assume that these variables are exogenous.

The remainder of this study is organised as follows. Section 2 reviews relevant theories, the literature, and the development of hypotheses. Section 3 describes our empirical strategies and a flowchart for the concept relationship of the study. Section 4 presents the data, variables, summary statistics, and the features of variables. Then, Section 5 discusses the analyses of product market competition, the debt structure, and credit spreads. Section 6 concludes. Finally, appendices gather the sample selection process and additional results.

2 Related literature and hypotheses

In this section, we will develop a series of hypotheses to study the interaction between product market competition, the corporate debt structure, and the cost of debt under firm characteristics and economic conditions. The hypotheses are related to several strands of literature as follows.

2.1 Competition and debt structure

Our study links to the stream of literature about the effect of market competition on borrower-creditor conflicts, debt financing and financing costs.

First, Laksmana and Yang (2015) find that competition reduces opportunities for sacrificing creditors' interests. Competition forces managers to invest in projects for the long-term survival of the company that avoids bankrupt losses to creditors. Kjenstad, Su and Xia (2018) point out that loan contractual terms mitigate borrower-creditor frictions in financial markets under product market competition. They provide a supplement analysis of three-stage simultaneous equation estimations, where they use the annual GDP growth as the exogenous explanatory variable for the initial spreads of loans. Sheikh (2019) reveal that market competition and corporate characteristics play important roles in affecting a positive association between borrower

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power and corporate risk such as debt default risk.

Hoberg, Phillips and Prabhala (2014) use the text descriptions of firm product to construct a new measure of competitive threats for a firm, called product market fluidity, which characterizes the product changes in rival firms relative to the firm's products. They find that fluidity raises firms' cash holdings and reduces firms' payouts to their owners in the way of either dividends or repurchases. The effect of competition on cash holdings is especially significant for firms having less access to debt markets.

Second, Boubaker et al. (2018) reveal the insightful finding that the product market imposes external pressure to firms and provides a mechanism for bank debt monitoring. They find that intensive competition in the product market make firms decrease their bank debt. Using a natural experiment setting with large reductions in import tariff, which increases competitive pressure from the product market, they discover that firm financing relies less on bank debt. They further show that competitive pressure impacts firms' debt choice more significantly for firms that experience more intensive competition, tighter financial constraints, and weaker management practices.

The impact of market competition to firms' financing decisions is indicated by the capital structure and leverage. Guney, Li and Fairchild (2011) examine the relationship between product market competition and the capital structure in both static and dynamic settings by applying several empirical methods. They show cross-industrial differences in the debt ratios and the relationship between leverages and product market competition, which is parabolic or cubic according to different industry types, firms' sizes and growth opportunities. They use the system-GMM method to reveal that firms adjust the leverages through time.

When the intensity in product market competition is above a certain level, competition promotes firms' operating performance, values, equity returns, labor productivity, value-creative acquisitions, which influence input costs including borrowing costs (Giroud and Mueller; 2011; Beiner, Schmid and Wanzenried; 2011). Waisman (2013) shows that product market competition affects the cost of bank loans. Paligorova and Yang (2014) illustrate the role of product market competition in affecting the cost of

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debt financing and the use of bond covenants.

The literature in corporate finance usually ignores the external influence of creditors such as banks on the process of financing decisions. Recently, Bharath and Hertzel (2019) show that external pressure is increased by intense product market competition while it is decreased by business combination laws such as an anti-take-over law. Their research implies that the pressure of competition affects the type of firms' debt. Namely, an exogenous increase (decrease) in pressure from the product (takeover) market has a significantly negative (positive) impact on the use of bank (public debt) financing over public debt (bank loan) issuance. These findings are consistent with the mechanism of substitution effect that depends on the relative strength of alternative external pressure.

Valta (2012) finds that firms operating in competitive product markets encounter systematically high cost of bank debt. The effect of competition is more significant in industries where small firms have financially stable rivals, in industries in which firms engage frequent strategic interactions, and in industries lacking liquidity. To show the effect of market competition on the cost of bank debt, the paper examine the proxy of product market competition and the reduction of import tariff rates, which captures exogenous changes to the environment of market competition. The proxy of competition in the paper is a dummy variable taking the value of one if the HHI at the industry level of the three-digit Standard Industrial Classification (SIC) code is in the lowest quartile for a given year.

The literature discovers that a more competitive product market that imposes pressure to firms significantly makes the firms reduce the external pressures of bank monitoring. Extending general debt in the references to the specific debt structure, we develop our hypotheses about product market competition, debt choice, and leverage puzzles for different types of debt under the effects of firm characteristics and economic conditions. For an easy exposition we use the names of various types of debt to denote the ratios of the amount of these types of debt to book assets in hypotheses and following texts, see variables definitions in Fig. 1 and Section 4.2.

Hypothesis 1, H_1^1: there is a negative relationship, $\beta_1 < 0$, between prod-

uct market competition and leverage/bank debt/revolving credit/term loans/capital leases.

Counterfactual Hypothesis 1, H_0^1: the relationship between product market competition and leverage/bank debt/revolving credit/term loans / capital leases is positive or insignificant, $\beta_1 > 0$ or $\beta_1 = 0$.

For Hypothesis H_1^1, we estimate Equation (1) in Section 3.2, where β_1 is the coefficient of the variable measuring competition. Hypothesis H_1^1 suggests that a competitive product market reduces firms' leverage through decreasing total bank debt including revolving credit and term loans from banks, through which the firms can decrease the external pressure of bank monitoring, although the firms reduce their capital leases slightly from the public market as well. Namely, product market competition complements the negative ($\beta_3 < 0$) relationship between the firms' profits and leverage/bank debt/revolving credit/term loans/capital leases by decreasing ($\beta_1 < 0$) their revolving credit/capital leases in general, see the variable definitions in Fig. 1 and Section 4.2.

Hypothesis 2, H_1^2: there is a positive relationship, $\beta_1 > 0$, between product market competition and bonds and notes/other borrowings.

Counterfactual Hypothesis 2, H_0^2: the relationship between product market competition and bonds and notes/other borrowings is negative or insignificant, $\beta_1 < 0$ or $\beta_1 = 0$.

For Hypothesis H_1^2, we estimate Equation (1) in Section 3.2, where β_1 is the coefficient of the variable measuring competition. Hypothesis H_1^2 suggests that a competitive product market makes firms raise their bonds and notes, and other borrowings from the public market, through which the firms decrease the external pressure of bank monitoring from bank debt, although the firms increase their term loans from banks as well. Namely, product market competition mitigates the negative ($\beta_3 < 0$) relationship between the firms' profits and leverages by increasing ($\beta_1 > 0$) their bonds and notes/other borrowings in general, see the variable definitions in Fig. 1 and Section 4.2.

We further investigate the fine details of corporate debt structure under the ef-

fects of product market competition, firms' characteristics like profits, and economic conditions. Meanwhile, since all types of corporate debt form the total debt that determines the leverage, our study also contributes to the literature on the leverage puzzle, which states that there is a negative relationship between the leverage and profitability (e.g. DeMarzo; 2019; Chen, Harford and Kamara; 2019; Heath and Sertsios; 2019; Eckbo and Kisser; 2020)

To begin with, we specify the leverage puzzle Hypothesis C as the condition ('C') for our hypotheses about the leverage puzzle and profitability, which are specified to be conditional on the observation that there is a negative relationship between profitability and the ratio of the corresponding type of debt over the total asset. Given the condition of the leverage puzzle, our hypotheses will examine whether the competition attenuates (mitigates) or exaggerates (complements) the leverage puzzle by increasing or decreasing the leverage and the particular types of debt.

Hypothesis c: There is a negative relationship between profitability and the ratios of all types of debt (total debt / revolving credit / term loans / commercial paper / bonds and notes / capital lease / other borrowings / bank debt / public debt) to the total asset.

Hypothesis 3, H_1^3: there is a negative relationship, $\beta_2 < 0$, between profitability and bank debt/commercial papers/other borrowings for the firms in a more competitive product market.

Counterfactual Hypothesis 3, H_0^3: the relationship between profitability and bank debt/commercial papers/other borrowings is positive or insignificant, $\beta_2 > 0$ or $\beta_2 = 0$, for the firms in a more competitive product market.

For Hypothesis H_1^3, we estimate Equation (1) in Section 3.2, where β_2 is the coefficient of the interaction term between competition and profitability. Hypothesis H_1^3 suggests that when the firms are in a more competitive product market and produce more profits, they decrease their bank debt, commercial papers, and other borrowings when their profits are high. Namely, product market competition exaggerates the negative ($\beta_3 < 0$) relationship between the firms' profits and bank debt/commercial papers/other borrowings by decreasing ($\beta_2 < 0$) these types of debt when these firms'

profits are high, see the variable definitions in Fig. 1 and Section 4.2.

Hypothesis 4, H_1^4: there is a positive relationship, $\beta_2 > 0$, between profitability and leverage/public debt/bonds and notes/capital leases for the firms in a more competitive product market.

Counterfactual Hypothesis 4, H_0^4: the relationship between profitability and leverage/public debt/bonds and notes/capital leases is negative or insignificant, $\beta_2 < 0$ or $\beta_2 = 0$, for the firms in a more competitive product market.

For Hypothesis H_1^4, we estimate Equation (1) in Section 3.2, where β_2 is the coefficient of the interaction term between competition and profitability. Hypothesis H_1^4 suggests that when the firms are in a more competitive product market and produce more profits, they raise their leverage through increasing their public debt of bonds and notes as well as capital leases for weakening the external pressure of bank monitoring. Namely, product market competition attenuates (i.e., mitigates) the negative ($\beta_3 < 0$) relationship between the firms' profits and leverage/public debt/bonds and notes/capital leases by increasing ($\beta_2 > 0$) these types of debt when these firms' profits are high, see the variable definitions in Fig. 1 and Section 4.2.

2.2 Economic conditions, bank debt, and financing costs

The literature discovers the effects of economic conditions on the cost of debt. Boubakri and Ghouma (2007) record that firms' internal and external pressure affects their credit ratings and costs of corporate bonds. They show that the difference between voting rights and cash-flow rights of the strength of internal pressure affects bond costs positively and bond ratings negatively. To measure external pressure, the proxies that they use are the preservation of the creditor rights, the existence of public and private credit registries, the extent of newspapers' circulations, and the number of days to resolve a payment dispute through courts. They show that these proxies determine debt costs and debt ratings.

Ellul, Guntay and Lel (2007) examine the external country-level economic conditions of investor protection environments that influence debt costs. The proxies are

legal environment and creditor rights index, where legal environment is obtained from a principal components analysis of the covariance matrix derived from the efficiency of the judiciary system, rule of law, risk of expropriation, corruption, the risk of contract repudiation, and financial development. The proxy of financial development is the ratio of stock market capitalization to GDP. Highly developed markts indicates high standard of investor protection. The creditor rights index measures how well creditor rights are protected aggregately under bankruptcy and reorganization laws. Recently, Platt (2020) controls for common macroeconomic variables, firm-level factors, and bond-level features to exhibit that corporate bondholders demand significantly larger credit spreads from firms facing increased competition, especially firms with assets that are difficult to redeploy.

The study pays a particular attention to bank debt and relevant costs since bank monitoring like competition also imposes external pressure to companies. When issuing bank debt, banks deserve premiums for their provisions of monitoring benefits under imperfect competition according to the following four theories of firm-bank relationship.

First, 'the relationship lending theory' presents that firms are difficult to transfer information about their quality to other banks and hence they pay higher interest rates after bank switch. Likewise, stable banks are able to charge more credit spreads due to their ability of continuing to lend during economic downturns (Cornett, McNutt, Strahan and Tehranian; 2011; Beltratti and Stulz; 2012). Second, 'the equity monitoring theory' suggests that the shareholders of banks' equity capital incentivizes banks to monitor borrowing firms (Allen, Carletti and Marquez; 2011; Mehran and Thakor; 2011). Monitoring adds value to the borrowing firms and therefore the firms are willing to pay more credit spreads.

Third, 'the financial commitment theory' states that firms value banks' ability to maintain banks' loan commitments (Boot, Greenbaum and Thakor; 1993; Ivashina and Scharfstein; 2010) and then firms would like to pay higher credit spreads because switching to other banks is more expensive. Fourth, 'the fragility monitoring theory' claims that the bank fragility of possible running depositors induces the bank

to monitor borrowers and facilitates liquidity provision (Calomiris and Kahn; 1991; Diamond and Rajan; 2001; Hubbard, Kuttner and Palia; 2002), which make the bank earn a loan spread premium.

Therefore, the relationship lending, equity monitoring, financial commitment, and fragility monitoring theories predict that borrowing firms value bank monitoring and stable future funding provision. Under these theories, firms are willing to pay higher credit spreads for bank monitoring. Admittedly, Feldhütter, Hotchkiss and Karakaş (2016) find that the corporate bond prices also include premiums due to the control rights under different states. They reveal that the premiums of corporate bonds are implied by the lower bond yields relative to the yields of the corresponding CDSs. Nevertheless, bank loans bring greater control rights to creditors than bonds, hence the bank creditors maintaining stronger covenants and higher seniority in default should obtain a higher premium.

Recently, Schwert (2020) provides direct evidence of firms' willingness to pay premiums for bank debt and highlights the role of competition in the loan market. The paper compares the costs of bank loans with those of capital market debt. After matching a sample of firms' loans with bond spreads on the same date, the paper finds that loan lenders earn a premium that is larger than the credit spreads of bonds. The large loan premium is explained by the differences between bank loans and bonds. Before providing loans, banks screen firms to overcome information asymmetry and after loan provision, banks monitor firms to ensure their repayments. Besides, banks offer valuable flexibility to firms through the lines of credit and the feasibility of relatively cheap contract renegotiation.

In short, the literature provides several interpretations of bank debt costs based on borrowing firms and banks relationship but there is not much literature on the relationship between competition and the costs of debt. Hence, one of our main contributions is to discover the effects of market competition on the costs of various types of debt.

The prior studies summarized above motivate this study to examine the costs of six types of debt and combinations through investigating the effect of product market

competition on the credit spreads of various types of debt. We capture this effect through regressing credit spreads on competition along with other firm characteristics and economic conditions.

Hypothesis 5, H_1^5: there is a positive relationship, $\beta_1 > 0$, between product market competition and the credit spread of total debt/bank debt/public debt/revolving credit/term loans/bonds and notes/commercial papers/capital lease/other borrowings.

Counterfactual Hypothesis 5, H_0^5: the relationship between product market competition and the credit spreads of total debt/bank debt/public debt/revolving credit/term loans/bonds and notes/commercial papers/capital lease/other borrowings is negative or insignificant, $\beta_1 < 0$ or $\beta_1 = 0$.

For Hypothesis H_1^5, we estimate Equation (2) in Section 3.2, where β_1 is the coefficient of the variable measuring competition. Hypothesis H_1^5 suggests that when the product market competition is high, firms have to pay higher credit spreads for borrowing various types of debt from banks or from the public market. The credit spreads of bank debt rise since the firms' risks are high in a more competitive environment. The credit spreads of public debt increase in a more competitive environment as the firms have to reduce the external monitoring pressure. Then, the firms shift bank debt with high external pressure to public debt with low external pressure. To this end, the firms pay larger costs for public debt, see the variable definitions in Fig. 1 and Section 4.2.

3 Empirical strategy

We describe our strategy for empirical study including the proxy of the key variable and econometrics setting.

3.1 Empirical research problem

We follow the categories and terminology in the data source of Capital IQ, which is generally consistent with represented prior works in Rauh and Sufi (2010), Colla et al.
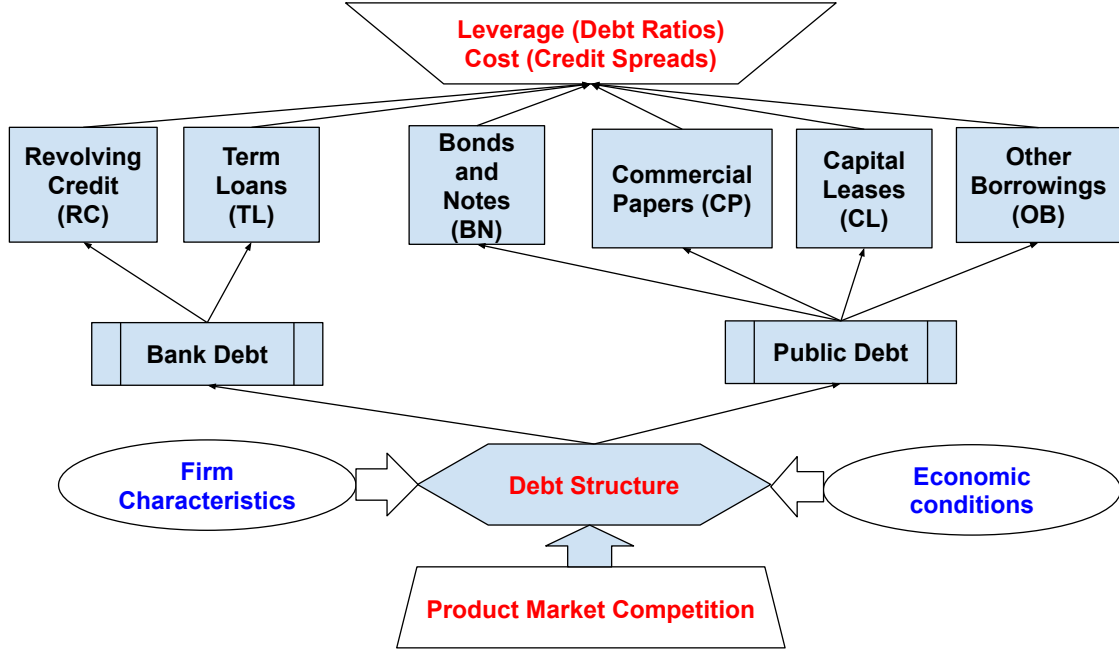
Figure 1. Corporate debt structure, leverage, and costs under product market competition, firm characteristics, and economic conditions.

Notes. The flowchart illustrates the mechanism via which product market competition affects firms' debt structure with the ratios of six types of debt to book assets as well as their credit spreads. The book leverage (BL) is defined as a firm's total debt divided by the firm's book value of total asset. The debt structure comprises of revolving credit (RC), term loans (TL), bonds and notes (BN), commercial paper (CP), capital leases (CL), and other borrowings (OB). RC and TL are categorized into bank debt (BD) whose debt holders are banks. BN, CP, CL, and OB can be referred to as public debt (PD) that are issued in the public market.

(2013), and Choi et al. (2018). Fig. 1 illustrates the concept relationship between the corporate debt structure and the research problem.

The prior work measures the product market competition by a dummy variable *Competition*, which is equal to one for the firm whose HHI is in the lowest quartile of the HHI for a given year. As pointed out by Valta (2012), the dummy variable *Competition* is considered in the analysis because it is convenient to interpret the coefficient estimates economically in terms of the effect of a high or low market competition. The interaction term *Competition×Profit* indicates the profitable firms facing high competition while the meaning of the interaction term *HHI×Profit* is not clear. Furthermore, using the dummy variable rather than the value of the HHI will

mitigate the issue of measurement problems in the HHI.

In unreported results, we use the HHI instead of the dummy *Competition* as one of the independent variable. The implications and conclusions from the regression with the HHI are similar to those using *Competition*. The results from various models including the Tobit model, OLS, fixed effects, IV are all similar between the two cases. Appendix A.4 compares the results using *Competition* and HHI.

To test hypotheses about the debt structure and the cost of debt, the study considers credit spreads, the corporate leverage, and the ratio of a particular type of debt to the book value of total asset as the dependent variable respectively. The independent variables include the product market competition that imply firms' external pressure, firms' profit, and other characteristics in the vector with one quarter lag, $\mathbf{X}_{t-1} = [\mathbf{X}_{1,f,t-1}^T \mathbf{X}_{2,t-1}^T]^T$, where $\mathbf{X}_{1,f,t-1}$ and $\mathbf{X}_{2,t-1}$ represent other corporate characteristics and economic conditions respectively, see variable definitions in 4.2. The literature usually use lagged characteristics as independent variables (e.g. Colla et al.; 2013; Strebulaev and Yang; 2013; Valta; 2012; Frank and Goyal; 2015; Badoer, Demiroglu and James; 2019; Eckbo and Kisser; 2020). Similar to the literature, we use lagged variables capture the effects of corporate characteristics and economic conditions in previous quarters on current financial policies.

3.2 Empirical equations and models

We formulate our hypotheses described in Section 2 in the forms of empirical equations as follows.

$$
\begin{aligned}
Y_{f,i,t} =\ & \beta_0 + \beta_1 Competition_{i,t-1} + \beta_2 Competition_{i,t-1} \times Profit_{f,t-1} + \beta_3 Profit_{f,t-1} \\
& + \beta^T \mathbf{X}_{t-1} + d_i + d_f + d_y + \varepsilon_{f,i,t},
\end{aligned}
\tag{1}
$$

where Y in (1) can be the ratio of $BL/BD/PD/RC/TL/BN/CP/CL/OB$, which denotes one type of debt in the corporate debt structure, to the total asset. The vectors β and $\mathbf{X}_{t-1} = [\mathbf{X}_{1,f,t-1}^T \mathbf{X}_{2,t-1}^T]^T$ capture the effects of other corporate variables ($\mathbf{X}_{1,f,t-1}$) and economic variables ($\mathbf{X}_{2,t-1}$), d_f or d_i represent firm or industry fixed

effects, and $\varepsilon_{f,i,t}$ is the disturbance term.

$$CS_{f,i,t} = \beta_0 + \beta_1 Competition_{i,t-1} + \beta^T \mathbf{X}_{t-1} + d_i + d_f + d_y + \varepsilon_{f,i,t}, \qquad (2)$$

where CS in (2) can be the credit spread of $BL/BD/PD/RC/TL/BN/CP/CL/OB$ that denotes one type of debt in the corporate debt structure. We measure the credit spread by the weighted average interest rate of a specific type of debt over LIBOR.

There is no interaction term between competition and profitability in Equation (2) about credit spreads because there is no financial theory supporting this specification. It might seem like a logic extension of Equation (1) about debt ratios to include the interaction term, but the interaction term with profitability is only meaningful when we examine the leverage puzzle about the relationship between debt ratios and profitability. Hence, we do not have the interaction with profitability in the model specifications about credit spreads.

About empirical methods, the regressions of debt ratios mainly use the Tobit regression method for censored dependent variables as we winsorize the corporate leverage and debt ratios to the unity, as shown by Tables 2 and 28 for the summary statistics and Fig. 3 for the leverage. The unity limit is similar to the practice of Lemmon, Roberts and Zender (2008) and Colla et al. (2013). We use the standard censored Tobit model (Tobin; 1958), which is also referred to as the type I Tobit model (Amemiya; 1985), and we estimate our models by Stata command *tobit*.

We use the type I Tobit model as we censor debt ratios to the unity. This is different to the 'truncated regression' with a sample selection based on a response variable, which is named as the truncated Tobit model or the type II Tobit model estimated by the Heckit method in Heckman (1976). Likewise, the Tobit model employed by our study does not belong to another sample selection problem where the selection equation is in the form of a censored Tobit form either. Namely, the type III Tobit model where the dependent variable is observable only when the dependent variable in the Tobit selection equation meets censorship, see Vella (1992) and Wooldridge (1998).

As a *comparison*, we also provide the results of other econometric models. We

study non-censored standard panel data models with firm (d_f) or industry (d_i) fixed effects to remove time-invariant factors or year (d_y) fixed effects to remove time trends. As a *benchmark*, we provide the results of ordinary least squares (OLS) regressions in each regression table. Besides, we control for the variables of firm characteristics and economic conditions in the most of model specifications.

In unreported results, we examine the Tobit model with random effects using Stata command *xttobit*. The random effects Tobit model has an additional set of time-constant explanatory variables $\mathbf{x}_i$ appearing in each time period, which solves potential unobserved heterogeneity (e.g. Wooldridge; 2010). Note that the official Stata command *xttobit* only works for random effects rather than fixed effects. Honoré (1992) provides Stata commands for Tobit models with fixed effects while there is no option for clustering standard errors.[2]

The standard errors in our empirical results are cluster-robust standard errors that relax the usual requirement of independent observations and allow dependent observations within clusters and independent observations across clusters (e.g., Gormley and Matsa; 2014). To this end, we cluster observations by quarters because one type of debt could be issued multiple times in a given quarter, which leads to correlation among the observations in the same quarter. In unreported results, we also examine the cases of clustering observations by firms or/and industries (three-digit SIC codes). For multiple cluster variables, we use the widely-used methods in Petersen (2009) and Cameron, Gelbach and Miller (2011). One might wonder whether it is necessary to cluster observations by three-digit SIC codes since the HHI index calculated from Compustat data is based on three-digit SIC codes. Our results show that it is more appropriate to cluster observations by quarters rather than industries. To incorporate the effects of industry we mainly use the model with industry fixed effects for credit spreads.

As further robustness tests, we provide the results using an Instrumental Variable (IV) and the results with three control variables accounting for executive characteristics in each regression tables. For the concern of endogeneity issue, we use

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[2]See https://www.princeton.edu/~honore/stata/.

lagged independent variables following the literature (see Section 3.1) rather than their contemporaneous values. Furthermore, we adopt the standard single-equation instrumental-variables regression with the two-stage least squares (2SLS) estimator by using the official Stata command *ivregress 2sls*. The results show that the coefficients of our main variables are robust after using an IV that solves endogeneity issues. In the spirit of Waisman (2013) and Boubaker et al. (2018), the instrumental variable for product market competition is HHI one year prior to the beginning of our sample period (*HHI_2001*).

We present the models of IV two-stage regressions for debt ratios as follows.

$$
\begin{aligned}
Competition_{i,t} = & \ \beta_0 + \beta_1 HHI_{f,2001} + \beta_2 Competition_{i,t-1} \times Profit_{f,t-1} + \beta_3 Profit_{f,t-1} \\
& + \beta^T \mathbf{X}_{t-1} + \varepsilon_{f,i,t},
\end{aligned}
\tag{3}
$$

$$
\begin{aligned}
Y_{f,i,t} = & \ \beta_0 + \beta_1 \hat{Competition}_{f,t-1} + \beta_2 \hat{Competition}_{f,t-1} \times Profit_{f,t-1} + \beta_3 Profit_{f,t-1} \\
& + \beta^T \mathbf{X}_{t-1} + \varepsilon_{f,i,t},
\end{aligned}
\tag{4}
$$

where $\hat{Competition}_{f,t-1}$ in (4) is the estimated values of $Competition_{i,t-1}$ in (3). $Y_{f,i,t}$ can be the ratio of $BL/BD/PD/RC/TL/BN/CP/CL/OB$, which denotes one type of debt in the corporate debt structure, to the total asset.

It is reasonable to use the historical measure of HHI determining product market competition since it meets both the relevance and exclusion conditions according to similar discussions in Waisman (2013) and Boubaker et al. (2018). On the one hand, the measure *HHI_2001* is negatively related to the current degree of competition in the industry to which a given firm belongs. On the other hand, the variable *HHI_2001* is highly unlikely to be directly related to a firm's debt structure and costs of debt, unless through the channel of affecting the current intensity of competition faced by the firm. Hence, these arguments conclude that the variable *HHI_2001* satisfies the necessary conditions for a valid instrument.

Besides, we use three additional variables to control the effects of executive characteristics. We construct these variables in the spirit of references on the capital structure and executive characteristics (e.g. Morellec et al.; 2012). We consider these

control variables in robustness tests only since the sample sizes of these variables are much smaller than the sizes of company fundamentals.

4   Data and variables

In this section, we describe data sources, sample selection process, variable definitions, summary statistics, and other data features.

4.1   Data sources and sample selection

The study uses the quarterly debt structure data and financial statement data of US companies downloaded from Capital IQ and Compustat Fundamentals Quarterly from the WRDS platform. We obtain the data about macroeconomic variables from the Federal Reserve Economic Data (FRED) of Federal Reserve Bank of St. Louis. We obtain 3-Month LIBOR data from the Federal Reserve Economic Data (FRED) of Federal Reserve Bank of St. Louis, which provides the data from the source: ICE Benchmark Administration Limited (IBA).[3] The data measuring executive characteristics are from Compustat Executive Compensation. The data period is from 2002 to 2019 covering the period of the 2008 financial crisis since more comprehensive data about corporate debt structure are available in the database of Capital IQ after 2002.

We carry out the sample selection process as follows in details. First, we merge debt data from Capital IQ (1,429,031 observations) with all other required data such as the company fundamentals data from Compustat. We keep 349,958 observations that match both databases in terms of firms and quarters and delete the observations that do not match from the two databases.

Second, we drop 136,202 observations where the differences between the total debt in Capital IQ and the total debt in Compustat are more than 10%, following Colla et al. (2013, p. 2120) and Choi et al. (2018, p. 499). As a result, we have 213,756

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[3]The London Interbank Offered Rate (LIBOR) is the benchmark rate of interest used in lending between banks on the London interbank market and also used as a reference for setting the interest rate on other loans.

observations left.

We investigate the differences between the two data sources further. We have the variable *Debt* from Compustat and the variable *Debt2* from Capital IQ. A comparison of the two debt variables in Fig. 5 exhibits a number of large differences. In the second step above, we drop 136,202 observations satisfying the condition of "*(Debt2 - Debt) > 0.1 Debt*". Namely, the variable *Debt2* of the deleted observations from Capital IQ is 10% higher than the counterpart variable *Debe* from Compustat.

For the convenience of *presentation*, we define an temporary variable *debt_over* = *Debt2 / Debt*. Table 1 lists the selected percentiles of *debt_over*. Note that we do not drop *debt* values greater than 1. Likewise, the temp variable *debt_over* is not the variable of *Leverage = Debt/Asset*. It is only used for demonstrating the large discrepancies between the two data sources and it is not one of our dependent variables or independent variables in the models. Hence, it is not necessary to winsorize the temporary *debt_over* as it will never be used.

We also try the way of keeping the observations with large discrepancies and do not drop observations in the above second step. Then the companies' (total) debt and leverage can be either from Compustat or Capital IQ or the average of values from the two data sources when their differences are larger than 10%. Note that this choice only affects the regressions with the dependent variable *Leverage*. The dependent variables in the regressions for various types of debt such as *Term Loans* always come from Capital IQ. Our unreported results show that keeping the observations with large discrepancies leads to worse outputs since the large differences are likely due to problematic samples. Besides, it is not appropriate to give arbitrary criteria in levels (rather than the 10% used above) or to impute debt values by the averages of the two sources because there are many observations with large differences, see the discussions in Appendix A.4.

Third, following the common practice in the literature (e.g. Colla et al.; 2013; Danis, Rettl and Whited; 2014; Badoer, Dudley and James; 2020; Schwert; 2020), we restrict the data to non-financial and non-utility firms by dropping financial firms with SIC codes 6000 to 6999 (57,108 observations deleted) and regulated utilities including

Table 1. The summary statistics of the temporary variable *debt_over*.

Notes. Table 1 displays the summary statistics of the temporary variable *debt_over = Debt2 / Debt*, where *Debt* from Compustat and *Debt2* from Capita IQ. Because the ratio of *Debt2 / Debt* has more missing values than the difference of *Debt2 - Debt* due to some small near zero *Debt* in the denominator of the ratio, we use the difference to drop inappropriate observations.

Variable	N	mean	sd	min	p1	p5	p25	p50	p75	p95	p99	max
debt_over	318,897	10.20	403	-0.44	0.57	0.90	1.00	1.01	1.38	6.04	88.43	149,010

electric, gas & sanitary Services with SIC codes 4900 to 4999 (9,465 observations deleted). Then we have 147,183 observations left in the data.

Fourth, we generate lag values of companies' characteristics following the practice of the literature (see Section 3.1), which unavoidably produces a large number of missing values of these characteristics. For example, Fig. 6 compares the frequencies of missing values for the three key variables of *HHI*, *Profit*, and *BL (Book Leverage)* before taking lag operations (the left panel) and after lag operations (the right panel). It shows that *BL* keeps the numbers of missing observations at 4,502, which come from the original 16,869 missing *Debt* values as shown by Fig. 5. These 4,502 *Debt* values still exist irrespective of the operations in the above second step about two data sources of debt because neither *Debt* nor *Debt2* have values in these observations. *HHI* and *Profit* leads to 62,513 and 67,455 missing observations. Note that both *HHI* and *Profit* share 60,275 common missing observations.

We cannot fill the missing values of *HHI* by using another methods such as that using 2-digital SIC code because HHIs generated by different methods are not consistent. We cannot fill the missing values of *Profit* by other accounting items as other items have similar missing observations. Furthermore, the definition of profit is not unique and hence generating profits with other items might be inconsistent with the one downloaded directly from Compustat, which is "operating profit" (Compustat variable "oibdpq") following the reference, see Section 4.2.

Then we delete the observations where the key variables of *HHI*, *Profit*, and *Leverage* are missing, which drops 68,444 observations in total. For other non key company

characteristics, we fill missing values firstly by their lag values that are not missing and then by 0. In the end, our final sample comprises of 78,739 firm-quarter observations and 7,097 firms for the period during 2002-2019.

In the final sample, we observe the percentiles of company characteristics carefully to determine the percentiles for winsorizing their tail values, see Tables 23, 24, 25, and 26 in Appendix A for more details. We winsorize *Cash, Size, Tangible Asset, Investment, Tax, Age, CEO Tenure, Executive Incentive, Executive Ownership, Institutional Ownership, and Institutional Breath* by using a 1% level, which variable-by-variable replaces extreme outliers below the 1st percentile by the 1st percentile, and outliers above the 99th percentile by the 99th percentile. The variable definitions are in the next section. Then we winsorize *Current Ratio* and *Earning Volatility* by the 1st and 95th percentile, *Profit* by the 5th and 99th percentile, *MV/BV* by the 1st and 85th percentile, and *Z-score* by the 15th and 95th percentile. The winsorizing process mitigates the effect of outliers and eradicate errors in the data.

We limit the leverages and debt ratios (the ratios of various types of debt to the total asset) to the unity similar to Lemmon et al. (2008) and Colla et al. (2013). In our final sample, none ratio is below zero and 25,875 ratios (not observations) above one are set to one, where 8,554 leverages above one are assigned to one, see Appendix A for more details on their percentiles. We use the standard type I Tobit regression model for these censored dependent variables.

4.2 Variable definitions

We construct the dependent variables and independent variables as follows. The lower-case symbols in brackets (e.g., 'atq') are the symbols for variables in Compustat.

To begin with, we define our dependent variables (LHS) in terms of corporate debt structure variables considering current data frameworks in Capital IQ, which are similar to prior studies in debt structure (e.g., Colla et al.; 2013; Choi et al.; 2018). *Term Loans (TL)* is the Level of TL / book assets (atq), where 'atq' is variable name of total asset in Compustat. *Revolving Credit (RC)* is the Level of RC / book assets (atq). *Commercial Paper (CP)* is the Level of CP / book assets (atq).

Bonds and Notes (BN) is the Level of BN / book assets (atq). *Capital Leases (CL)* is the Level of CL / book assets (atq). *Other Borrowings (OB)* is the Level of OB / book assets (atq). *Bank Debt (BD)* is the TL + RC. *Public Debt (PD)* is the CP + BN + OB + CL. *Book Leverage (BL)* is the ratio of book debt (dlcq + dlttq) to book assets (atq). *Credit spread (CS)* is the credit spread of the weighted average interest rate of a specific type of debt over LIBOR, which is similar to Schwert (2018).

We define the following firm characteristics in a way similar to the literature in corporate finance (e.g., Strebulaev and Yang; 2013; Danis et al.; 2014; Badoer and James; 2016; Prilmeier; 2017; Carvalho; 2018; Choi et al.; 2018; Schwert; 2018; Santos and Winton; 2019) and product market competition (e.g., Beiner et al.; 2011; Valta; 2012; Hoberg et al.; 2014; Boubaker et al.; 2018; Sheikh; 2019).

Competition is equal 1 for the firm with the HHI at the industry level of the three-digit SIC code is in the lowest quartile, which indicates that a competitive product market imposes external pressure to firms (Valta; 2012; Bharath and Hertzel; 2019). The HHI for a particular industry is the sum of squared market shares of sales for all firms in a three-digit SIC industry, where firm i's market share is its sales divided by the total sales in the industry that firm i belongs (e.g., Hoberg and Phillips; 2010; Boubaker et al.; 2018). *Profit* is defined as the operating profit (oibdpq) divided by book assets (atq).

Investment (capital expenditure) is capital expenditures (capxy) divided by book assets (atq). *Cash* is the ratio of cash and short-term investments (cheq) to book assets (atq). *Age* is the natural logarithm of the number of years passing the IPO date (Compustat variable 'ipodate') or the first year in Compustat if the value of the variable 'ipodate' is missing. *Size* is the natural logarithm of total asset adjusted to year 1982 dollars, $log(atq \times CPI_{1982}/CPI_t)$. Consumer Price Index (CPI) for all urban consumers is from the US Bureau of Labor Statistics, which can be obtained from the Federal Reserve Economic Data (FRED) of Federal Reserve Bank of St. Louis.

MV/BV (Market to Book) is the ratio of market value of assets, which is current debt (dlcq) plus long-term debt (dlttq) plus stock price (prccq) × stock number

(cshoq), to book assets (atq). _Tangible_ assets are defined as property/plant/equipment (ppentq) divided by book assets (atq). _Tax_ is defined as taxes (txtq) divided by book assets (atq). _Earning volatility (Risk)_ is the standard deviation of quarterly operating profits (oibdpq) scaled by book assets (atq) over the previous 4 quarters. _Z-score_ measures firm's distress risk as Altman (1968), which is calculated by $1.2 \times$ (working capital/total assets) $+ 1.4 \times$ (retained earnings/total assets) $+ 0.99 \times$ (sales/total assets) $+ 0.6 \times$ (market capital/total liabilities) $+ 3.3 \times$ (earnings before interest and taxes/total assets). Specifically in Compustat, the working capital is wcapq, the retained earning is req, the sale is saleq, the market capital is the stock price (prccq) $\times$ the number of stock (cshoq). The earning before interest and taxes (EBIT) is equal to the revenue (revtq) minus the sum of the operating costs (xoprq) and the depreciation (dpq). _Current ratio (liquidity)_ is defined as total current assets (actq) divided by total current liabilities (lctq).

To control the effects of executive characteristics, we consider three additional variables about executive compensations, in the spirit of references on the capital structure and executive characteristics (e.g. Morellec et al.; 2012). _CEO Tenure_ is the difference between the current year and the year becoming the CEO. We measure _Executive Incentive_ by the growth of total compensation (tdc1) for the five executives with the highest paid salary and bonus (execrankann).[4] _Executive Ownership_ is the proportion of reported shares (shrown_tot_pct/100) owned by the five highest paid executives.

Macroeconomic conditions could affect firms' debt structure and the cost of debt and therefore some of our model specifications consider the variables of macroeconomic indicators. The return of the S&P 500 index and the growth of GDP indicate the health of the stock markets and the overall economy (La Porta, Lopez-de Silanes, Shleifer and Vishny; 1997; Boubakri and Ghouma; 2007; Laksmana and Yang; 2015). Graham, Li and Qiu (2008) and Valta (2012) among others use the term spread and

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[4]An executive's total compensation includes salary, bonus, other annual, total value of restricted stock granted, total value of stock options granted using Black-Scholes, long-term incentive payouts, and all other total.

the credit spread to indicate the state of the economy and therefore of the equity markets. A strong stock market will attract more equity financing rather than debt financing. A positive and large term spread means that interest rates are currently low and are bound to rise. Credit spreads often widen during uncertain or worsening economic conditions such as recessions when credit supplies are decreasing. Therefore, we consider the following economic variables. _Growth of S&P 500_ is the quarterly return of S&P 500 index. _Growth of GDP_ is the percent growth in the real gross domestic product from the previous quarter. _Term spread_ is the difference between the 10-year Treasury yield and the 3-month Treasury yield. _Credit spread_ is the difference between BAA corporate bond yield and AAA corporate bond yield.

4.3   Summary statistics

Table 2 provides the summary statistics of debt structure and firm characteristics in our final sample during the period of 2002 to 2019 from the U.S. panel data merging Capital IQ Capital Structure - Debt and Compustat Fundamentals Quarterly. Variables are defined in Section 4.2. We obtain the summary statistics after carefully observing the percentiles of variables and winsorizing their tail values at a 1% level or a 5% level, see Section 4.1, Tables 23, 24, 25, and 26 in Appendix A for more details.

The _Age_ is the natural logarithm of the number of years passing the IPO date. The _Tax_ can be negative under several circumstances, for example, a business taking advantage of tax breaks and loopholes in the tax system, tax overpayments, and revenue losses. In addition, it is possible that the term spread is negative and is referred to as 'the curve inversion'. For instance, long-term Treasury yields were traded below short-term rates in 2019 summer, which signaled investors' increasing pessimistic views about the economic outlook and mounting risk of deflation. Similarly, the growths of the stock market and GDP can be negative when there were drops in the stock market and GDP during the period from 2002 to 2019. The CS variables could have negative minimums when the interest rates of corporate debt are lower than the proxies of risk-free rates. These facts are named as 'the negative credit risk premium puzzle' that can be explained by liquidity and limits to arbitrage, see Bhanot and

Table 2. Summary statistics of firm characteristics, macroeconomic variables, debt structure, and credit spreads defined in Section 4.2 during 2002 to 2019.

Notes. The sizes of debt related variables vary as firms do not take some types of debts sometimes.

VARIABLES	Mean	SD	Min	p25	p50	p75	Max	N
HHI	0.154	0.152	0.0279	0.0517	0.0989	0.192	1	78,739
Profit	-0.0673	0.218	-0.840	-0.0485	0.0150	0.0343	0.122	78,739
Size	4.362	3.415	-5.472	2.304	4.756	6.773	11.11	78,739
Tangible	0.309	0.295	0	0.0609	0.199	0.511	0.981	78,739
MV/BV	1.817	1.441	0	0.780	1.255	2.532	4.556	78,739
Investment	0.0325	0.0539	0	0.00316	0.0129	0.0362	0.327	78,739
Z-Score	0.389	4.263	-6.967	-0.947	0.776	2.345	9.784	78,739
Current Ratio	2.006	1.883	0	0.761	1.480	2.553	7.422	78,739
Age	3.225	1.080	0	2.708	3.892	3.989	4.060	78,739
Cash	0.199	0.252	0	0.0273	0.0901	0.259	0.980	78,739
Tax	0.00205	0.00861	-0.0408	0	1.25e-05	0.00446	0.0345	78,739
Earnings Volatility	0.0688	0.153	0	0.00493	0.0119	0.0369	0.635	78,739
Growth (S&P500)	0.0260	0.0436	-0.272	0.00978	0.0310	0.0552	0.116	78,739
Growth (GDP)	0.00557	0.00421	-0.0216	0.00363	0.00566	0.00783	0.0170	78,739
Term Spread	1.869	0.951	-0.437	1.267	1.940	2.590	3.610	78,739
Credit Spread	0.988	0.288	0.603	0.830	0.933	1.133	3.023	78,739
Leverage	0.370	0.308	1.06e-06	0.126	0.292	0.531	1	78,739
Bank Debt	0.248	0.264	3.46e-07	0.0531	0.161	0.337	1	55,771
Public Debt	0.268	0.297	3.98e-07	0.0372	0.172	0.362	1	62,863
Revolving Credit	0.120	0.153	2.88e-07	0.0242	0.0670	0.159	1	28,910
Term Loan	0.237	0.276	3.46e-07	0.0374	0.133	0.321	1	44,268
Bond and Note	0.308	0.305	2.25e-06	0.0854	0.206	0.407	1	47,309
Commercial Paper	0.0361	0.0387	2.45e-05	0.00959	0.0236	0.0488	0.289	3,128
Capital Lease	0.0339	0.0799	3.98e-07	0.00192	0.00793	0.0298	1	29,287
Other Borrowing	0.0862	0.188	7.35e-08	0.00217	0.0123	0.0721	1	17,593
Total Debt CS	6.166	3.632	-5.263	3.585	5.716	8.357	19.27	40,675
Bank Debt CS	5.348	3.707	-5.014	2.711	4.520	7.352	19.27	35,433
Public Debt CS	6.399	3.643	-5.263	3.929	6.081	8.444	19.27	37,929
Revolving Credit CS	3.889	3.050	-4.634	1.993	3.252	4.894	19.27	17,981
Term Loan CS	5.728	3.764	-5.014	3.001	5.022	7.772	19.27	31,443
Bond and Note CS	6.012	3.499	-5.263	3.694	5.743	8.012	19.27	43,857
Commercial Paper CS	0.495	1.752	-5.078	-0.168	0.285	1.293	12.77	1,903
Capital Lease CS	6.500	4.076	-3.358	3.580	5.721	8.400	19.27	17,125
Other Borrowing CS	5.482	4.191	-5.128	2.397	4.958	7.757	19.27	5,121
CEO Tenure	8.031	7.843	0	3	6	11	39	19,608
Incentives	0.200	0.718	-0.800	-0.167	0.0483	0.329	3.925	19,950
Ownership	0.0306	0.0647	0	0.00131	0.00936	0.0285	0.438	20,329
Institutional Own.	0.677	0.444	0.000393	0.354	0.714	0.906	2.733	32,752
Institutional Breath	0.0695	0.314	-0.461	-0.0395	0.0116	0.0876	2.379	27,308

Guo (2011); Godfrey and Brooks (2015), or the fact that markets participants would like to to pay for riskless investments during recessions.

Among the ratios of six types of debt values to the total asset, bonds and notes from the public market and term loans from banks take the largest mean values of 0.308 and 0.237, followed by the revolving credit of bank debt with the mean value of 0.12 and other borrowings of public debt with the mean value of 0.086. Commercial papers and capital leases have the mean values that are about one-tenth of the mean values of bonds and notes.

Table 3 describes the observation frequencies of product market competition in three ways: industry, competition, and firm size. Columns (1) to (5) (resp. Columns (6) to (10)) refer to the observations of firms under low (resp. high) product market competition, according to five quantiles of the firm size. First, comparing the total number of observations under low and high competition, we find that the numbers of observations under high competition are much more than those under low competition. Second, the number of firms in the manufacturing industry is the largest one, followed by the agriculture industry (high competition) and the service industry (low competition). The last two industries with the least number of observations are the trade and transportation industries. Third, generally there are more observations with large firm sizes under low competition, while under high competition, more observations are firms with small sizes. In short, the table shows the differences of product market competition across various industries and firm sizes, which imply that the empirical analysis needs to consider the effects of different industries.

Fig. 2 plots the frequency of three-digit Standard Industrial Classification (SIC) code. One might wonder whether it is necessary to cluster observations by three-digit SIC codes in regressions since when we calculate the HHI index using Compustat data, we carry the calculation at the industry level of the three-digit SIC code. The figure shows that the most of observations distribute almost evenly across the range of SIC codes, except for several clusters. It implies that it might not be appropriate to cluster observations by SIC codes. Our unreported results confirm that it is inappropriate to cluster observations by industries. Instead, to incorporate the effects of industry

Table 3. Table of frequencies: industry, competition, and firm size (5-quantiles)

Notes. Table 3 displays observation frequencies in three ways: industry, competition, and firm size.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Competition	Low	Low	Low	Low	Low	High	High	High	High	High
	Size 1	Size 2	Size 3	Size 4	Size 5	Size 1	Size 2	Size 3	Size 4	Size 5
	Freq	Freq	Freq	Freq	Freq	Freq	Freq	Freq	Freq	Freq
Industry	(Percent)	(Percent)	(Percent)	(Percent)	(Percent)	(Percent)	(Percent)	(Percent)	(Percent)	(Percent)
Agriculture	325	300	380	327	188	3,925	3,563	2,774	2,228	1,795
	(8.555)	(7.768)	(7.869)	(5.431)	(3.629)	(32.85)	(29.98)	(25.41)	(22.91)	(16.99)
Manufacturing	1,633	1,959	2,277	3,005	2,493	4,816	5,963	4,994	3,169	4,225
	(42.98)	(50.73)	(47.15)	(49.91)	(48.13)	(40.30)	(50.17)	(45.74)	(32.58)	(39.98)
Transportation	243	193	483	492	576	111	122	531	1,238	2,302
	(6.396)	(4.997)	(10.00)	(8.171)	(11.12)	(0.929)	(1.026)	(4.863)	(12.73)	(21.78)
Trade	257	349	762	1,298	934	253	296	748	999	898
	(6.765)	(9.037)	(15.78)	(21.56)	(18.03)	(2.117)	(2.490)	(6.850)	(10.27)	(8.498)
Service	1,341	1,061	927	899	989	2,844	1,942	1,872	2,093	1,347
	(35.30)	(27.47)	(19.20)	(14.93)	(19.09)	(23.80)	(16.34)	(17.14)	(21.52)	(12.75)
Total	3799	3862	4829	6021	5180	11949	11886	10919	9727	10567

we mainly use the model with industry fixed effects for credit spreads.

Fig. 3 plots the frequencies of firms' leverages that are categorized into two groups according to the product market competition dummy. The left side figure shows that low competition firms take leverages around 0.25 on average. On the contrary, the right side figure depicts that there are more firms under high competition keeping conservative low leverages near 0, except for the original negative leverages cut by 0 and the original large leverages trimmed by 1. The results imply that among the firms taking leverages within the unity, on average the firms under low competition borrow more amount of debt than the firms under high competition, which only borrow a small amount of debt.

We examine the distributions of HHI. Fig. 4 shows the scatter plot of HHI over 3-digit SIC codes. There are many observations with low HHI, which indicates that the corresponding firms incur high levels of product market competition. Table 4 displays the summary statistics of HHI grouped by industries. The agriculture industry has the lowest mean of HHI while the trade industry's mean HHI is the highest.
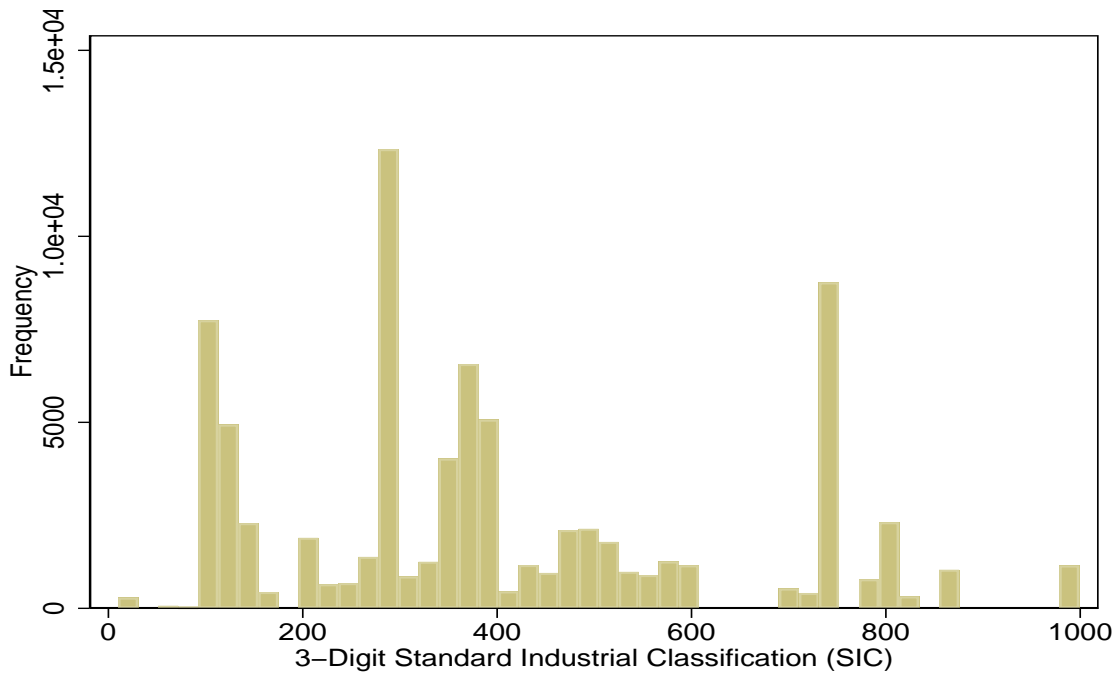
Figure 2. Frequency of observation based on the 3-digit SIC code.

Fig. 2 plots the frequencies of the observations based on the 3-digit SIC code. One bar in the histogram does not represent one industry. Instead, one bar collects some industries showing similar frequencies of observations together. The 3-digit SIC codes of the top 6 industries showing the highest peaks are: 700, 393, 328, 254, 323, and 210. No. of industries: 231 (3-digit SIC), 61 (2-digit SIC), and 5 (1-digit SIC). No. of observations: 78,739.
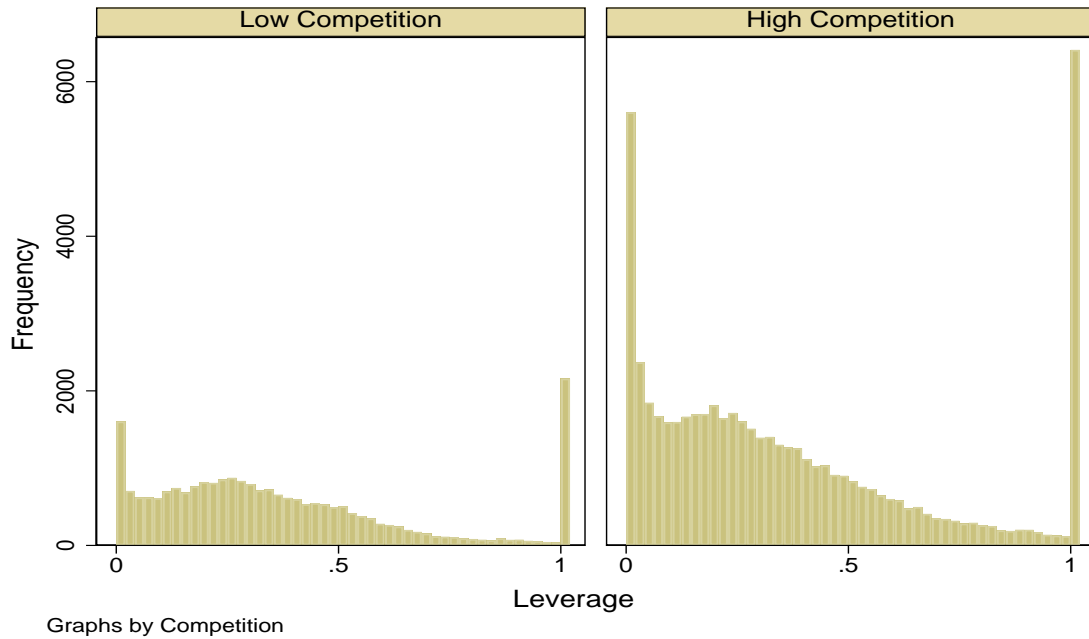
Figure 3. Frequency of leverage grouped by the product market competition.

Fig. 3 plots the frequencies of firms' leverages within $[0, 1]$ inclusive that are grouped by the product market competition dummy, which is equal 1 for the firm with the HHI in the first quartile of the HHI for a given year. No. of observations: 78,739, where there are 8,554 leverages over the unity being set to one. The leverages near zero are not zero but some very small values of low leverages near zero, see Table 2 for the summary statistics.
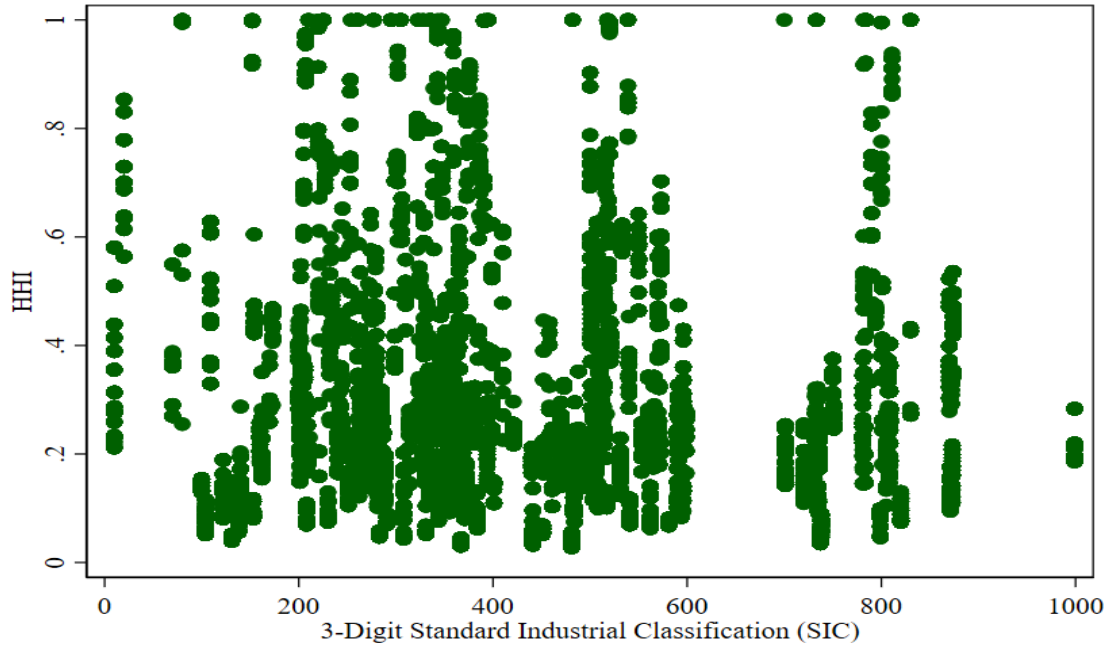
Figure 4. Scatter plot of HHI over 3-digit SIC codes.

Fig. 4 shows the scatter plot of HHI over 3-digit SIC codes. No. of observations: 78,739.

Table 4. Summary statistics of HHI grouped by industries.

Notes. Table 4 displays the summary statistics of HHI grouped by industries.

Industry	Mean	SD	Min	p25	p50	p75	Max	N
Agriculture	0.1188	0.1126	0.0395	0.0519	0.0824	0.1366	1.0	15,805
Manufacturing	0.1646	0.1664	0.0307	0.0539	0.1003	0.2140	1.0	34,534
Transportation	0.1233	0.0855	0.0279	0.0504	0.0992	0.1870	1.0	6,291
Trade	0.2454	0.1845	0.0632	0.1075	0.1795	0.3276	1.0	6,794
Service	0.1377	0.1381	0.0353	0.0425	0.0807	0.1952	1.0	15,315

5 Empirical results

5.1 Product market competition, debt structure, and the leverage puzzle

The literature documents the 'substitution effect' that firms substitute some internal pressure with external pressure from banks such as creditors' monitoring. The degree of the substitution depends on how the external pressure is relatively stronger than internal pressure.

For instance, a more competitive product market that imposes pressure to firms significantly makes the firms reduce the external pressures of bank monitoring by cutting the use of bank loans and meanwhile adding the issuance of bonds in the public market (Bharath and Hertzel; 2019). Thus, this study examines the debt structure under the effect of the product market competition. A competitive product market is indicated by the dummy variable *Competition*, which is one for the firms whose HHIs measuring industry concentration are in the lowest quartile of the HHI for a given year.

Specifically, we examine the effect of product market competition on the relationship between the profit and the ratios of various types of debt to the total book asset, including leverage. Through this way, we examine the leverage puzzle through the channel of the market competition and debt structure. In our analysis, we *mainly focus* on the Tobit regression model (without considering the fixed effects of firms or industries or time) for censored dependent variables since we limit the corporate leverage and debt ratios to the unity similar to Lemmon et al. (2008) and Colla et al. (2013).

As a *comparison*, we also provide the results of the panel data models with firm (d_f) or industry (d_i) fixed effects to remove time-invariant factors or year (d_y) fixed effects to remove time trends. As a *benchmark*, we provide the results of ordinary least squares (OLS) regressions in each regression table. Besides, we control for the variables of firm characteristics and economic conditions in the most of model

specifications. The model of quarter fixed effects cannot include our four economic variables because they are collinear with the quarter fixed effects.

The standard errors in our empirical results are cluster-robust standard errors that relax the usual requirement of independent observations and allow dependent observations within clusters and independent observations across clusters (e.g., Gormley and Matsa; 2014). To this end, we mainly cluster observations by quarters because one type of debt could be issued multiple times in a given quarter, which leads to correlation among the observations in the same quarter. In unreported results, we also examine the cases of clustering observations by firms or/and industries (three-digit SIC codes). For multiple cluster variables, we use the widely-used methods in Petersen (2009) and Cameron et al. (2011). One might wonder whether it is necessary to cluster observations by three-digit SIC codes since the HHI index calculated from Compustat data is based on three-digit SIC codes. Our results show that it is more appropriate to cluster observations by quarters rather than industries. To incorporate the effects of industry we mainly use the model with industry fixed effects for credit spreads.

It is reasonable to use the historical measure of HHI determining product market competition since it meets both the relevance and exclusion conditions according to similar discussions in Waisman (2013) and Boubaker et al. (2018). On the one hand, the measure *HHI_2001* is negatively related to the current degree of competition in the industry to which a given firm belongs. On the other hand, the variable *HHI_2001* is highly unlikely to be directly related to a firm's debt structure and costs of debt, unless through the channel of affecting the current intensity of competition faced by the firm. Hence, these arguments conclude that the variable *HHI_2001* satisfies the necessary conditions for a valid instrument.

We use three additional variables to control the effects of executive characteristics, which are constructed in the spirit of references on the capital structure and executive characteristics (e.g. Morellec et al.; 2012). We consider these control variables in robustness tests only since the sample sizes of these variables are much smaller than the sizes of company fundamentals.

To sum up, in Tables 5 to 12, we provide 9 columns for 9 regression settings for debt ratios, see the equations in Section 3.2. Column (1) is the benchmark Tobit model without *Competition* and its interaction with *Profit*. Including *Competition* and its interaction with *Profit*, Column (2) lists our main results using the Tobit model since dependent variables are censored. Column (3) is OLS. As a comparison, Columns (4) or (5) presents results with the fixed effect of firms or quarters. For robustness, Columns (6) and (7) display the first-stage and second-stage IV regressions. Finally, Column (8) is the Tobit model controlling the effects of three additional variables about executive characteristics.

Note that we focus on the results from the Tobit model in Column (2). Other columns are provided as a comparison only and they do not lead to our conclusions. For example, results on some types of debt ratios with fixed effects are not promising regardless of the key independent variable is the *Competition* that we use or HHI that we do not report. The reason is that the dependent variables of various types of debt ratios are censored following the literature, which implies that only the Tobit model is appropriate.

5.1.1 The negative relationship between product market competition, bank debt, and public debt

To begin with, Hypothesis H_1^1 states that there is a negative relationship, $\beta_1 < 0$, between product market competition and leverage/bank debt/public debt/revolving credit/term loans/capital leases. Tables 5, 6, 7, 8, and 9 show that Hypothesis 1 agrees with our results. For example, Columns (2), (3), (6), and (9) of Table 5 display that there is a significantly negative relationship, about $\beta_1 = -0.025 < 0$, in the Tobit regression, OLS regression, and quarter fixed effect model, between the leverage and the product market competition.

To reveal how the product market competition impacts the leverage through differ-ent types of debt, we study the effects of the product market competition on different components of the leverage. Through decomposing the leverage into the ratios of bank debt and public debt to the asset, we run similar analyses and obtain the re-

sults of bank debt in Table 6. It shows that the relationship between the market competition and bank debt is significantly negative at about $\beta_1 = -0.02$.

Furthermore, after investigating the details of bank debt and public debt from the prospective of six types of debt, we find that the relationships between the revolving credit and term loans of bank debt or the capital leases of public debt and the market competition is significantly negative at about $\beta_1 = -0.014$ in Table 7 for revolving credit and $\beta_1 = -0.008$ in Table 8 and Table 9 for term loans the capital leases.

The underlying mechanism for the above regression results is that a competitive product market reduces firms' leverage by decreasing total bank debt of revolving credit and term loans from banks, through which the firms can decrease the external pressures of bank monitoring, meanwhile the firms reduce their capital leases slightly from the public market as well.

In addition, the decrease in the three types of debt in a competitive product market complements the leverage puzzle. Tables 5, 6, 7, 8, and 9 exhibit that the leverage puzzle exist in bank debt, revolving credit, and term loans as the relationships between the profit and these types of debt are negative at about $\beta_3 = -0.251$, $\beta_3 = -0.117$, $\beta_3 = -0.196$, $\beta_3 = -0.14$, and $\beta_3 = -0.049$ respectively. Hence, the product market competition complements the negative ($\beta_3 < 0$) relationship between the firms' profits and leverage/bank debt/revolving credit/capital leases by decreasing ($\beta_1 < 0$) their revolving credit in general.

Table 5. Market competition and leverage

Notes: This table presents the results for regression models in Section 3.2. The competition dummy is 1 for the firm with the HHI in the lowest quartile for a year. The dependent variable is the ratio of the amount of total debt to the asset, *BL*. All variables are defined in Section 4.2. Standard errors are clustered by quarters except for IV regressions. ***: $p<0.01$, **: $p<0.05$, *: $p<0.1$.

Leverage	(1) Tobit	(2) Tobit	(3) OLS	(4) Firm	(5) Firm-Industry	(6) Quarter	(7) IV 1st	(8) IV 2nd	(9) Tobit
Competition		-0.025***	-0.024***	0.005	0.005	-0.024***		-0.004	-0.031***
		(0.002)	(0.001)	(0.004)	(0.004)	(0.001)		(0.004)	(0.005)
Competition×Profit		0.075***	0.034***	-0.031	-0.031	0.036***	-0.746***	0.054***	0.324**
		(0.015)	(0.010)	(0.019)	(0.019)	(0.010)	(0.013)	(0.010)	(0.139)
Profit	-0.192***	-0.251***	-0.150***	-0.034*	-0.034*	-0.151***	0.526***	-0.165***	0.599***
	(0.018)	(0.020)	(0.015)	(0.018)	(0.018)	(0.015)	(0.015)	(0.010)	(0.124)
Size	0.010***	0.011***	0.011***	-0.027***	-0.027***	0.013***	0.003***	0.011***	0.010***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.000)	(0.001)
Tangible	0.020***	0.028***	0.029***	-0.015	-0.015	0.026***	0.262***	0.023***	0.149***
	(0.005)	(0.004)	(0.004)	(0.012)	(0.012)	(0.004)	(0.005)	(0.004)	(0.008)
MV/BV	0.058***	0.059***	0.051***	0.026***	0.026***	0.051***	0.021***	0.050***	0.095***
	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.003)
Investment	-0.226***	-0.214***	-0.179***	-0.064***	-0.064***	-0.183***	0.186***	-0.186***	-0.419***
	(0.029)	(0.029)	(0.026)	(0.021)	(0.021)	(0.025)	(0.027)	(0.018)	(0.073)
Z-Score	-0.030***	-0.030***	-0.028***	-0.020***	-0.020***	-0.028***	-0.005***	-0.028***	-0.071***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.002)
Current Ratio	-0.025***	-0.024***	-0.024***	-0.012***	-0.012***	-0.024***	0.009***	-0.024***	0.007***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Age	-0.013***	-0.013***	-0.013***	0.046***	0.046***	-0.013***	-0.006***	-0.013***	
	(0.001)	(0.001)	(0.001)	(0.004)	(0.004)	(0.001)	(0.001)	(0.001)	
Cash	-0.165***	-0.155***	-0.124***	-0.028***	-0.028***	-0.124***	0.201***	-0.132***	
	(0.008)	(0.008)	(0.007)	(0.006)	(0.006)	(0.007)	(0.007)	(0.005)	
Tax	-0.825***	-0.888***	-1.100***	-0.602***	-0.602***	-0.902***	-1.709***	-1.042***	
	(0.133)	(0.132)	(0.130)	(0.089)	(0.089)	(0.111)	(0.157)	(0.105)	
Earnings Volatility	0.366***	0.361***	0.264***	0.075***	0.075***	0.268***	-0.038***	0.266***	
	(0.021)	(0.021)	(0.016)	(0.012)	(0.012)	(0.016)	(0.014)	(0.010)	
Growth (S&P500)	-0.036	-0.037	-0.036	-0.045	-0.045		0.007	-0.036*	0.008
	(0.041)	(0.041)	(0.040)	(0.039)	(0.039)		(0.032)	(0.022)	(0.062)
Growth (GDP)	-0.139	-0.148	-0.154	-0.128	-0.128		-0.388	-0.148	-0.714
	(0.440)	(0.439)	(0.427)	(0.309)	(0.309)		(0.346)	(0.232)	(0.752)
Term Spread	-0.002	-0.002	-0.002	-0.011***	-0.011***		0.003**	-0.002***	-0.011***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)		(0.001)	(0.001)	(0.004)
Credit Spread	0.003	0.003	0.000	-0.001	-0.001		0.009*	-0.000	-0.001
	(0.007)	(0.007)	(0.006)	(0.007)	(0.007)		(0.005)	(0.004)	(0.008)
HHI_2001 (IV)							-1.851***		
							(0.010)		
CEO Tenure									-0.000***
									(0.000)
Executive Incentives									-0.001
									(0.002)
Executive Ownership									0.039**
									(0.019)
Institutional Own.									-0.004
									(0.003)
Institutional Breath									0.006
									(0.004)
Constant	0.266***	0.353***	0.350***	0.348***	0.348***	0.339***	0.767***	0.341***	0.231***
	(0.002)	(0.013)	(0.012)	(0.023)	(0.023)	(0.008)	(0.010)	(0.007)	(0.002)
Observations	78,739	78,739	78,739	78,739	78,739	78,739	78,739	78,739	13,629
No. of Firms	7097	7097	7097	7097	7097	7097	7097	7097	7097
Predictive Margin	0.388	0.388	0.370	0.370	0.370	0.370		0.370	0.311
Predictive Median	0.346	0.346	0.344	0.307	0.307	0.346		0.343	0.319
Pseudo R-squared	0.575	0.578							-2.391
Adjusted R-squared			0.383	0.808	0.808	0.386	0.378	0.382	

Table 6. Market competition and bank debt

Notes: This table presents the results for regression models in Section 3.2. The competition dummy is 1 for the firm with the HHI in the lowest quartile for a year. The dependent variable is the ratio of the amount of total bank debt to the asset, *BD*. All variables are defined in Section 4.2. Standard errors are clustered by quarters except for IV regressions. ***: $p<0.01$, **: $p<0.05$, *: $p<0.1$.

Bank D.	(1) Tobit	(2) Tobit	(3) OLS	(4) Firm	(5) Firm-Industry	(6) Quarter	(7) IV 1st	(8) IV 2nd	(9) Tobit
Competition		-0.020***	-0.019***	-0.001	-0.001	-0.019***		-0.017***	-0.011**
		(0.002)	(0.001)	(0.004)	(0.004)	(0.001)		(0.004)	(0.005)
Competition×Profit		-0.031*	-0.036**	0.005	0.005	-0.033**	-0.624***	-0.035***	0.248**
		(0.018)	(0.014)	(0.027)	(0.027)	(0.015)	(0.018)	(0.011)	(0.115)
Profit	-0.139***	-0.117***	-0.082***	-0.064**	-0.064**	-0.086***	0.396***	-0.083***	0.255**
	(0.020)	(0.023)	(0.019)	(0.026)	(0.026)	(0.020)	(0.020)	(0.012)	(0.115)
Size	-0.015***	-0.015***	-0.014***	-0.043***	-0.043***	-0.014***	0.004***	-0.014***	-0.026***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.000)	(0.001)	(0.000)	(0.001)
Tangible	0.025***	0.031***	0.029***	-0.061***	-0.061***	0.027***	0.261***	0.029***	0.021**
	(0.004)	(0.004)	(0.004)	(0.012)	(0.012)	(0.004)	(0.006)	(0.004)	(0.009)
MV/BV	0.029***	0.030***	0.028***	0.018***	0.018***	0.028***	0.017***	0.027***	0.033***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.004)
Investment	-0.179***	-0.171***	-0.152***	0.005	0.005	-0.157***	0.242***	-0.153***	-0.241***
	(0.025)	(0.025)	(0.024)	(0.020)	(0.020)	(0.024)	(0.033)	(0.019)	(0.035)
Z-Score	-0.017***	-0.017***	-0.016***	-0.013***	-0.013***	-0.016***	-0.007***	-0.016***	-0.033***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.002)
Current Ratio	-0.020***	-0.020***	-0.018***	-0.011***	-0.011***	-0.019***	0.010***	-0.018***	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)
Age	-0.026***	-0.026***	-0.026***	0.014***	0.014***	-0.027***	-0.007***	-0.026***	
	(0.001)	(0.001)	(0.001)	(0.005)	(0.005)	(0.001)	(0.002)	(0.001)	
Cash	-0.048***	-0.040***	-0.040***	0.007	0.007	-0.040***	0.216***	-0.040***	
	(0.008)	(0.008)	(0.007)	(0.010)	(0.010)	(0.007)	(0.010)	(0.006)	
Tax	-0.258*	-0.300**	-0.408***	-0.209***	-0.209***	-0.208	-1.201***	-0.405***	
	(0.140)	(0.139)	(0.134)	(0.067)	(0.067)	(0.132)	(0.196)	(0.114)	
Earnings Volatility	0.175***	0.174***	0.136***	0.031*	0.031*	0.139***	-0.039**	0.137***	
	(0.020)	(0.020)	(0.018)	(0.017)	(0.017)	(0.018)	(0.019)	(0.011)	
Growth (S&P500)	-0.069	-0.069	-0.069	-0.051	-0.051		-0.013	-0.069***	-0.035
	(0.051)	(0.051)	(0.051)	(0.033)	(0.033)		(0.040)	(0.023)	(0.046)
Growth (GDP)	-0.213	-0.207	-0.226	-0.035	-0.035		0.036	-0.226	-0.915*
	(0.469)	(0.468)	(0.462)	(0.240)	(0.240)		(0.428)	(0.249)	(0.535)
Term Spread	-0.007***	-0.007***	-0.007***	-0.007***	-0.007***		0.004**	-0.007***	-0.005***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)		(0.002)	(0.001)	(0.002)
Credit Spread	-0.004	-0.004	-0.005	-0.001	-0.001		0.004	-0.005	0.002
	(0.007)	(0.007)	(0.007)	(0.005)	(0.005)		(0.007)	(0.004)	(0.007)
HHI_2001 (IV)							-1.886***		
							(0.013)		
CEO Tenure									0.000*
									(0.000)
Executive Incentives									0.007***
									(0.002)
Executive Ownership									0.223***
									(0.023)
Institutional Own.									0.002
									(0.005)
Institutional Breath									0.035***
									(0.008)
Constant	0.230***	0.418***	0.415***	0.423***	0.423***	0.393***	0.763***	0.414***	0.348***
	(0.002)	(0.011)	(0.011)	(0.021)	(0.021)	(0.007)	(0.012)	(0.007)	(0.002)
Observations	55,771	55,771	55,771	55,771	55,771	55,771	55,771	55,771	8,833
No. of Firms	5570	5570	5570	5570	5570	5570	5570	5570	5570
Predictive Margin	0.254	0.254	0.248	0.248	0.248	0.248		0.248	0.154
Predictive Median	0.204	0.205	0.204	0.198	0.198	0.205		0.204	0.140
Pseudo R-squared	0.885	0.889							-0.227
Adjusted R-squared			0.320	0.785	0.785	0.325	0.357	0.320	

Table 7. Market competition and revolving credit

Notes: This table presents the results for regression models in Section 3.2. The competition dummy is 1 for the firm with the HHI in the lowest quartile for a year. The dependent variable is the ratio of the amount of revolving credit to the asset, *RC*. All variables are defined in Section 4.2. Standard errors are clustered by quarters except for IV regressions. ***: $p<0.01$, **: $p<0.05$, *: $p<0.1$.

R. Credit	(1) Tobit	(2) Tobit	(3) OLS	(4) Firm	(5) Quarter	(6) IV 1st	(7) IV 2nd	(8) Tobit
Competition		-0.014***	-0.014***	0.012***	-0.013***		-0.032***	-0.038***
		(0.002)	(0.002)	(0.003)	(0.002)		(0.003)	(0.006)
Competition×Profit		0.051	0.042	0.064	0.044	0.536***	0.054***	1.037***
		(0.039)	(0.036)	(0.045)	(0.036)	(0.047)	(0.016)	(0.163)
Profit	-0.158***	-0.196***	-0.183***	-0.100**	-0.183***	-0.526***	-0.193***	-0.631***
	(0.028)	(0.036)	(0.034)	(0.043)	(0.034)	(0.051)	(0.017)	(0.114)
Size	-0.017***	-0.017***	-0.017***	-0.019***	-0.017***	0.016***	-0.017***	-0.025***
	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.001)	(0.000)	(0.001)
Tangible	0.052***	0.056***	0.056***	0.005	0.055***	0.259***	0.062***	0.002
	(0.004)	(0.004)	(0.004)	(0.012)	(0.004)	(0.010)	(0.004)	(0.007)
MV/BV	0.016***	0.016***	0.016***	0.018***	0.016***	0.021***	0.017***	0.010***
	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.003)	(0.001)	(0.002)
Investment	-0.071**	-0.063**	-0.061**	-0.015	-0.067**	0.191***	-0.051***	-0.069**
	(0.029)	(0.029)	(0.029)	(0.016)	(0.028)	(0.058)	(0.019)	(0.032)
Z-Score	-0.006***	-0.006***	-0.006***	-0.012***	-0.006***	-0.009***	-0.007***	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Current Ratio	-0.005***	-0.005***	-0.005***	-0.007***	-0.005***	0.007***	-0.005***	-0.007***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)
Age	-0.005***	-0.005***	-0.005***	0.006**	-0.005***	-0.014***	-0.005***	
	(0.001)	(0.001)	(0.001)	(0.003)	(0.001)	(0.002)	(0.001)	
Cash	-0.057***	-0.050***	-0.052***	0.055***	-0.051***	0.294***	-0.042***	
	(0.009)	(0.009)	(0.009)	(0.018)	(0.009)	(0.023)	(0.008)	
Tax	0.351***	0.332***	0.321***	-0.060	0.369***	-0.819***	0.288***	
	(0.077)	(0.076)	(0.076)	(0.060)	(0.075)	(0.297)	(0.098)	
Earnings Volatility	0.111**	0.106**	0.097**	0.107***	0.099**	-0.143***	0.093***	
	(0.049)	(0.049)	(0.047)	(0.034)	(0.047)	(0.054)	(0.018)	
Growth (S&P500)	-0.025	-0.025	-0.024	-0.021		0.018	-0.024	-0.009
	(0.025)	(0.025)	(0.025)	(0.014)		(0.060)	(0.020)	(0.018)
Growth (GDP)	-0.067	-0.068	-0.070	-0.012		0.071	-0.069	-0.299*
	(0.219)	(0.219)	(0.217)	(0.116)		(0.640)	(0.211)	(0.170)
Term Spread	-0.000	0.000	0.000	-0.000		0.014***	0.001	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)		(0.003)	(0.001)	(0.001)
Credit Spread	-0.004	-0.003	-0.003	0.002		0.015	-0.003	0.001
	(0.004)	(0.004)	(0.004)	(0.002)		(0.010)	(0.003)	(0.002)
HHI_2001 (IV)						-1.747***		
						(0.018)		
CEO Tenure								0.001***
								(0.000)
Executive Incentives								-0.002
								(0.002)
Executive Ownership								0.105***
								(0.018)
Institutional Own.								0.010**
								(0.004)
Institutional Breath								-0.002
								(0.004)
Constant	0.219***	0.223***	0.223***	0.190***	0.218***	0.651***	0.228***	0.286***
	(0.005)	(0.005)	(0.005)	(0.015)	(0.003)	(0.019)	(0.006)	(0.001)
Observations	28,910	28,910	28,910	28,910	28,910	28,910	28,910	6,147
No. of Firms	3451	3451	3451	3451	3451	3451	3451	3451
Predictive Margin	0.120	0.120	0.120	0.120	0.120		0.120	0.084
Predictive Median	0.121	0.121	0.120	0.122	0.120		0.121	0.076
Pseudo R-squared	-0.318	-0.321						-0.118
Adjusted R-squared			0.234	0.800	0.235	0.298	0.231	

Table 8. Market competition and term loans

Notes: This table presents the results for regression models in Section 3.2. The competition dummy is 1 for the firm with the HHI in the lowest quartile for a year. The dependent variable is the ratio of the amount of term loans to the asset, *TL*. All variables are defined in Section 4.2. Standard errors are clustered by quarters except for IV regressions. ***: $p<0.01$, **: $p<0.05$, *: $p<0.1$.

Loan	(1) Tobit	(2) Tobit	(3) OLS	(4) Firm	(5) Quarter	(6) IV 1st	(7) IV 2nd	(8) Tobit
Competition		-0.008***	-0.007***	-0.002	-0.007***		0.006	0.029***
		(0.002)	(0.002)	(0.005)	(0.002)		(0.004)	(0.005)
Competition×Profit		-0.008	-0.014	-0.023	-0.011	-0.697***	-0.001	-0.713***
		(0.018)	(0.014)	(0.028)	(0.014)	(0.019)	(0.012)	(0.125)
Profit	-0.146***	-0.140***	-0.104***	-0.017	-0.108***	0.466***	-0.114***	1.161***
	(0.023)	(0.027)	(0.023)	(0.028)	(0.023)	(0.021)	(0.013)	(0.144)
Size	-0.012***	-0.012***	-0.011***	-0.053***	-0.011***	0.001	-0.011***	-0.020***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.000)	(0.001)
Tangible	0.027***	0.029***	0.028***	-0.040***	0.027***	0.226***	0.024***	0.032***
	(0.005)	(0.005)	(0.005)	(0.014)	(0.005)	(0.007)	(0.004)	(0.009)
MV/BV	0.034***	0.035***	0.032***	0.018***	0.032***	0.014***	0.032***	0.043***
	(0.003)	(0.003)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.004)
Investment	-0.135***	-0.131***	-0.111***	0.020	-0.114***	0.310***	-0.117***	-0.244***
	(0.029)	(0.029)	(0.027)	(0.023)	(0.029)	(0.035)	(0.022)	(0.050)
Z-Score	-0.017***	-0.018***	-0.017***	-0.011***	-0.017***	-0.007***	-0.017***	-0.039***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.003)
Current Ratio	-0.020***	-0.020***	-0.018***	-0.009***	-0.019***	0.014***	-0.018***	0.004
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)
Age	-0.024***	-0.024***	-0.024***	0.017***	-0.024***	-0.000	-0.024***	
	(0.001)	(0.001)	(0.001)	(0.005)	(0.001)	(0.002)	(0.001)	
Cash	0.002	0.005	0.004	0.009	0.003	0.190***	-0.001	
	(0.009)	(0.008)	(0.007)	(0.011)	(0.007)	(0.010)	(0.006)	
Tax	-0.127	-0.144	-0.281**	-0.037	-0.107	-1.235***	-0.253*	
	(0.147)	(0.146)	(0.137)	(0.076)	(0.138)	(0.219)	(0.135)	
Earnings Volatility	0.208***	0.207***	0.166***	0.027	0.167***	-0.045**	0.167***	
	(0.023)	(0.023)	(0.020)	(0.018)	(0.020)	(0.020)	(0.012)	
Growth (S&P500)	-0.066	-0.066	-0.064	-0.043		-0.033	-0.064**	-0.021
	(0.043)	(0.043)	(0.042)	(0.031)		(0.044)	(0.027)	(0.045)
Growth (GDP)	-0.114	-0.112	-0.140	-0.008		0.025	-0.144	-0.720
	(0.379)	(0.380)	(0.373)	(0.239)		(0.471)	(0.289)	(0.533)
Term Spread	-0.006***	-0.006***	-0.006***	-0.007***		0.003*	-0.006***	-0.002
	(0.002)	(0.002)	(0.002)	(0.001)		(0.002)	(0.001)	(0.002)
Credit Spread	0.004	0.004	0.002	0.003		-0.001	0.002	0.011*
	(0.006)	(0.006)	(0.006)	(0.005)		(0.007)	(0.004)	(0.007)
HHI_2001 (IV)						-1.967***		
						(0.014)		
CEO Tenure								0.000
								(0.000)
Executive Incentives								0.012***
								(0.003)
Executive Ownership								0.142***
								(0.025)
Institutional Own.								-0.010**
								(0.005)
Institutional Breath								0.036***
								(0.009)
Constant	0.238***	0.340***	0.336***	0.424***	0.324***	0.787***	0.331***	0.141***
	(0.011)	(0.011)	(0.010)	(0.020)	(0.008)	(0.013)	(0.008)	(0.002)
Observations	44,268	44,268	44,268	44,268	44,268	44,268	44,268	5,913
No. of Firms	4769	4769	4769	4769	4769	4769	4769	4769
Predictive Margin	0.244	0.244	0.237	0.237	0.237		0.237	0.142
Predictive Median	0.179	0.179	0.179	0.174	0.180		0.179	0.126
Pseudo R-squared	0.767	0.768						-0.239
Adjusted R-squared			0.342	0.794	0.344	0.379	0.342	

Table 9. Market competition and capital leases

Notes: This table presents the results for regression models in Section 3.2. The competition dummy is 1 for the firm with the HHI in the lowest quartile for a year. The dependent variable is the ratio of the amount of capital leases to the asset, *CL*. All variables are defined in Section 4.2. Standard errors are clustered by quarters except for IV regressions. ***: $p<0.01$, **: $p<0.05$, *: $p<0.1$.

Lease	(1) Tobit	(2) Tobit	(3) OLS	(4) Firm	(5) Quarter	(6) IV 1st	(7) IV 2nd	(8) Tobit
Competition		-0.008***	-0.008***	0.003*	-0.008***		0.002	-0.001
		(0.002)	(0.001)	(0.002)	(0.002)		(0.002)	(0.003)
Competition×Profit		0.048***	0.048**	0.026	0.048**	-0.013	0.049***	-0.080
		(0.006)	(0.019)	(0.021)	(0.020)	(0.041)	(0.008)	(0.068)
Profit	-0.010	-0.049***	-0.049***	-0.017	-0.048***	-0.034	-0.050***	0.021
	(0.007)	(0.009)	(0.017)	(0.018)	(0.018)	(0.042)	(0.008)	(0.071)
Size	-0.003***	-0.003***	-0.003***	-0.002	-0.003***	0.004***	-0.003***	-0.005***
	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.001)	(0.000)	(0.001)
Tangible	0.075***	0.078***	0.078***	0.171***	0.076***	0.237***	0.075***	0.078***
	(0.005)	(0.004)	(0.007)	(0.032)	(0.006)	(0.010)	(0.002)	(0.016)
MV/BV	0.006***	0.006***	0.006***	0.002**	0.006***	0.023***	0.006***	0.008***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)	(0.000)	(0.001)
Investment	-0.176***	-0.173***	-0.172***	-0.058**	-0.159***	0.231***	-0.177***	-0.198***
	(0.020)	(0.020)	(0.032)	(0.028)	(0.028)	(0.053)	(0.011)	(0.067)
Z-Score	-0.002***	-0.002***	-0.002***	-0.001***	-0.002***	-0.004***	-0.002***	-0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
Current Ratio	-0.003***	-0.003***	-0.003***	-0.001**	-0.003***	-0.001	-0.003***	-0.001
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.002)	(0.000)	(0.001)
Age	-0.003***	-0.003***	-0.003***	0.015***	-0.004***	-0.000	-0.003***	
	(0.001)	(0.001)	(0.001)	(0.004)	(0.001)	(0.002)	(0.000)	
Cash	0.003	0.008**	0.008***	0.028***	0.006**	0.291***	0.003	
	(0.003)	(0.004)	(0.003)	(0.008)	(0.003)	(0.015)	(0.003)	
Tax	0.070	0.060	0.060	-0.092**	0.113**	-1.831***	0.090*	
	(0.049)	(0.050)	(0.052)	(0.041)	(0.048)	(0.266)	(0.053)	
Earnings Volatility	0.037***	0.033***	0.033***	0.009	0.034***	-0.055	0.033***	
	(0.006)	(0.007)	(0.012)	(0.010)	(0.012)	(0.038)	(0.008)	
Growth (S&P500)	0.051*	0.051*	0.051*	0.042		-0.006	0.051***	0.070*
	(0.028)	(0.028)	(0.030)	(0.028)		(0.056)	(0.011)	(0.039)
Growth (GDP)	-0.177	-0.183	-0.183	-0.086		-0.382	-0.179	-0.312
	(0.317)	(0.318)	(0.329)	(0.282)		(0.610)	(0.121)	(0.372)
Term Spread	-0.014***	-0.014***	-0.014***	-0.010***		0.006***	-0.014***	-0.015***
	(0.002)	(0.002)	(0.002)	(0.003)		(0.002)	(0.000)	(0.003)
Credit Spread	0.003	0.003	0.003	0.005		0.029***	0.003	0.004
	(0.004)	(0.004)	(0.004)	(0.004)		(0.009)	(0.002)	(0.004)
HHI_2001 (IV)						-1.978***		
						(0.018)		
CEO Tenure								-0.000**
								(0.000)
Executive Incentives								0.001
								(0.001)
Executive Ownership								-0.035***
								(0.010)
Institutional Own.								0.001
								(0.003)
Institutional Breath								-0.002
								(0.002)
Constant	0.074***	0.065***	0.065***	-0.051**	0.046***	0.738***	0.061***	0.055***
	(0.007)	(0.008)	(0.009)	(0.024)	(0.005)	(0.017)	(0.003)	(0.012)
Observations	29,287	29,287	29,287	29,287	29,287	29,287	29,287	5,832
No. of Firms	3914	3914	3914	3914	3914	3914	3914	3914
Predictive Margin	0.034	0.034	0.034	0.034	0.034		0.034	0.025
Predictive Median	0.032	0.032	0.032	0.025	0.033		0.032	0.020
Pseudo R-squared	-0.0644	-0.0660						-0.0604
Adjusted R-squared			0.135	0.752	0.156	0.355	0.132	

5.1.2 The positive relationship between product market competition, bank debt, and public debt

Next, Hypothesis 2 H_1^2 states that there is a positive relationship, $\beta_1 > 0$, between product market competition and bonds and notes/other borrowings. Tables 10 and 11 show that Hypothesis 2 agrees with our results. For example, the 'Competition' row of Table 10 displays that there is a significantly positive relationship between the bonds and notes (or other borrowings) of public debt and the market competition at about $\beta_1 = 0.004$ (or 0.011) in Table 10 (or 11). The underlying mechanism for the above regression results is that a competitive product market makes firms raise their bonds and notes, and other borrowings from the public market, through which the firms decrease the external pressures of bank monitoring from bank debt.

In addition, the increase in the two types of debt in a competitive product market mitigates the leverage puzzle. Tables 10 and 11 exhibit that the leverage puzzle exist in bonds and notes, and other borrowings as the relationships between the profit and these types of debt are negative at about $\beta_3 = -0.289$ and $\beta_3 = -0.097$ respectively. Hence, the product market competition mitigates the negative $(\beta_3 < 0)$ relationship between the firms' profits and bonds and notes/other borrowings by increasing $(\beta_1 > 0)$ their bonds and notes/other borrowings in general.

Table 10. Market competition and bonds and notes

Notes: This table presents the results for regression models in Section 3.2. The competition dummy is 1 for the firm with the HHI in the lowest quartile for a year. The dependent variable is the ratio of the amount of bonds and notes to the asset, *BN*. All variables are defined in Section 4.2. Standard errors are clustered by quarters except for IV regressions. ***: p<0.01, **: p<0.05, *: p<0.1.

Bond	(1) Tobit	(2) Tobit	(3) OLS	(4) Firm	(5) Quarter	(6) IV 1st	(7) IV 2nd	(8) Tobit
Competition		0.002	0.004**	0.013***	0.004**		0.022***	0.001
		(0.002)	(0.002)	(0.004)	(0.002)		(0.005)	(0.004)
Competition×Profit		0.088***	0.053***	-0.062**	0.054***	-0.779***	0.072***	-0.140
		(0.020)	(0.013)	(0.026)	(0.013)	(0.016)	(0.011)	(0.121)
Profit	-0.222***	-0.289***	-0.194***	-0.007	-0.194***	0.561***	-0.207***	0.744***
	(0.018)	(0.020)	(0.015)	(0.024)	(0.015)	(0.019)	(0.012)	(0.110)
Size	0.005***	0.005***	0.005***	-0.053***	0.006***	0.005***	0.005***	0.010***
	(0.001)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.000)	(0.002)
Tangible	-0.019***	-0.020***	-0.015***	-0.031**	-0.016***	0.224***	-0.020***	0.020**
	(0.006)	(0.006)	(0.005)	(0.014)	(0.005)	(0.007)	(0.005)	(0.008)
MV/BV	0.056***	0.057***	0.052***	0.020***	0.052***	0.023***	0.051***	0.094***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.003)
Investment	-0.116***	-0.117***	-0.087**	-0.085***	-0.095**	0.231***	-0.095***	0.033
	(0.043)	(0.044)	(0.040)	(0.027)	(0.041)	(0.036)	(0.023)	(0.078)
Z-Score	-0.028***	-0.028***	-0.026***	-0.018***	-0.026***	-0.006***	-0.026***	-0.060***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.002)
Current Ratio	-0.013***	-0.013***	-0.011***	-0.005***	-0.012***	0.009***	-0.011***	0.013***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Age	0.001	0.000	0.000	0.058***	0.000	-0.002	0.000	
	(0.001)	(0.001)	(0.001)	(0.005)	(0.001)	(0.002)	(0.001)	
Cash	0.020*	0.019*	0.020**	-0.001	0.021**	0.168***	0.014**	
	(0.011)	(0.010)	(0.008)	(0.012)	(0.009)	(0.010)	(0.007)	
Tax	0.095	0.107	-0.148	-0.507***	-0.060	-1.812***	-0.087	
	(0.137)	(0.138)	(0.121)	(0.103)	(0.116)	(0.213)	(0.133)	
Earnings Volatility	0.377***	0.375***	0.276***	0.064***	0.278***	-0.018	0.278***	
	(0.022)	(0.022)	(0.017)	(0.016)	(0.017)	(0.019)	(0.012)	
Growth (S&P500)	-0.009	-0.009	-0.008	-0.039		0.002	-0.007	0.013
	(0.035)	(0.035)	(0.034)	(0.030)		(0.042)	(0.026)	(0.046)
Growth (GDP)	0.164	0.159	0.144	-0.099		-0.291	0.147	-0.116
	(0.288)	(0.288)	(0.283)	(0.281)		(0.451)	(0.281)	(0.574)
Term Spread	0.004***	0.004***	0.004***	-0.003**		0.004**	0.004***	0.001
	(0.001)	(0.001)	(0.001)	(0.002)		(0.002)	(0.001)	(0.002)
Credit Spread	0.007	0.007	0.005	-0.007		0.004	0.005	-0.007
	(0.006)	(0.006)	(0.005)	(0.006)		(0.007)	(0.004)	(0.007)
HHI_2001 (IV)						-1.788***		
						(0.013)		
CEO Tenure								-0.001***
								(0.000)
Executive Incentives								-0.002
								(0.002)
Executive Ownership								-0.045**
								(0.022)
Institutional Own.								-0.009**
								(0.004)
Institutional Breath								-0.025***
								(0.006)
Constant	0.253***	0.162***	0.163***	0.351***	0.173***	0.749***	0.155***	0.143***
	(0.012)	(0.012)	(0.011)	(0.026)	(0.007)	(0.013)	(0.008)	(0.002)
Observations	47,309	47,309	47,309	47,309	47,309	47,309	47,309	10,384
No. of Firms	4651	4651	4651	4651	4651	4651	4651	4651
Predictive Margin	0.325	0.325	0.308	0.308	0.308		0.308	0.230
Predictive Median	0.223	0.223	0.223	0.244	0.224		0.224	0.214
Pseudo R-squared	0.676	0.677						-0.673
Adjusted R-squared			0.427	0.818	0.428	0.365	0.426	

Table 11. Market competition and other borrowings

Notes: This table presents the results for regression models in Section 3.2. The competition dummy is 1 for the firm with the HHI in the lowest quartile for a year. The dependent variable is the ratio of the amount of other borrowings to the asset, *OB*. All variables are defined in Section 4.2. Standard errors are clustered by quarters except for IV regressions. ***: $p<0.01$, **: $p<0.05$, *: $p<0.1$.

Other	(1) Tobit	(2) Tobit	(3) OLS	(4) Firm	(5) Quarter	(6) IV 1st	(7) IV 2nd	(8) Tobit
Competition		0.011***	0.011***	-0.011*	0.011***		0.019***	-0.015*
		(0.002)	(0.002)	(0.006)	(0.002)		(0.004)	(0.008)
Competition×Profit		-0.129***	-0.117***	-0.069	-0.116***	0.185***	-0.119***	0.363
		(0.047)	(0.044)	(0.091)	(0.043)	(0.049)	(0.019)	(0.232)
Profit	-0.203***	-0.097*	-0.093*	-0.015	-0.094*	-0.276***	-0.091***	-0.624***
	(0.035)	(0.052)	(0.050)	(0.090)	(0.050)	(0.054)	(0.021)	(0.131)
Size	-0.007***	-0.007***	-0.007***	-0.050***	-0.009***	0.011***	-0.007***	0.004***
	(0.001)	(0.001)	(0.001)	(0.004)	(0.001)	(0.001)	(0.001)	(0.001)
Tangible	0.012*	0.008	0.009	-0.093***	0.010	0.255***	0.007	0.102***
	(0.007)	(0.007)	(0.007)	(0.027)	(0.007)	(0.014)	(0.006)	(0.011)
MV/BV	0.014***	0.013***	0.013***	0.024***	0.011***	0.019***	0.013***	0.040***
	(0.003)	(0.003)	(0.002)	(0.004)	(0.002)	(0.003)	(0.001)	(0.003)
Investment	-0.035	-0.043	-0.038	-0.091*	-0.051	0.320***	-0.044	-0.256***
	(0.043)	(0.044)	(0.043)	(0.051)	(0.041)	(0.078)	(0.031)	(0.081)
Z-Score	-0.009***	-0.009***	-0.009***	-0.010***	-0.010***	-0.009***	-0.009***	-0.012***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Current Ratio	-0.017***	-0.017***	-0.016***	-0.003*	-0.015***	0.000	-0.016***	-0.001
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.003)	(0.001)	(0.002)
Age	-0.003**	-0.003**	-0.003**	-0.033***	-0.002	0.001	-0.003**	
	(0.001)	(0.001)	(0.001)	(0.007)	(0.001)	(0.003)	(0.001)	
Cash	0.064**	0.061**	0.059**	-0.038**	0.053**	0.273***	0.055***	
	(0.025)	(0.025)	(0.024)	(0.015)	(0.024)	(0.024)	(0.009)	
Tax	1.247***	1.213***	1.164***	0.056	0.804***	-0.723*	1.176***	
	(0.196)	(0.204)	(0.197)	(0.128)	(0.193)	(0.382)	(0.150)	
Earnings Volatility	0.329***	0.327***	0.309***	0.070	0.297***	0.038	0.309***	
	(0.037)	(0.037)	(0.035)	(0.051)	(0.035)	(0.049)	(0.019)	
Growth (S&P500)	-0.039	-0.039	-0.039	-0.019		0.055	-0.039	-0.017
	(0.071)	(0.071)	(0.070)	(0.043)		(0.068)	(0.027)	(0.082)
Growth (GDP)	0.416	0.421	0.424	0.064		-1.210	0.430	0.194
	(0.808)	(0.808)	(0.804)	(0.474)		(0.758)	(0.298)	(0.916)
Term Spread	0.000	0.000	0.000	-0.004		0.006**	0.000	-0.000
	(0.003)	(0.003)	(0.003)	(0.002)		(0.003)	(0.001)	(0.003)
Credit Spread	0.020*	0.020*	0.019*	0.008		0.007	0.019***	0.028**
	(0.011)	(0.011)	(0.011)	(0.007)		(0.011)	(0.004)	(0.012)
HHI_2001 (IV)						-1.868***		
						(0.021)		
CEO Tenure								0.000
								(0.000)
Executive Incentives								0.001
								(0.002)
Executive Ownership								-0.188***
								(0.021)
Institutional Own.								0.013***
								(0.004)
Institutional Breath								-0.009***
								(0.004)
Constant	0.156***	0.101***	0.099***	0.540***	0.136***	0.692***	0.096***	-0.048**
	(0.002)	(0.019)	(0.019)	(0.036)	(0.010)	(0.023)	(0.009)	(0.022)
Observations	17,593	17,593	17,593	17,593	17,593	17,593	17,593	5,639
No. of Firms	2201	2201	2201	2201	2201	2201	2201	2201
Predictive Margin	0.087	0.087	0.086	0.086	0.086		0.086	0.053
Predictive Median	0.073	0.073	0.073	0.163	0.075		0.074	0.045
Pseudo R-squared	-1.238	-1.248						-0.0595
Adjusted R-squared			0.343	0.786	0.365	0.354	0.342	

5.1.3 Profitability, competition, and the leverage puzzle

We are interested in whether product market competition affects the leverage puzzle directly via its interaction with profitability. To answer this question, we examine the interaction item between the profit and the competition indicator, $Profit \times Competition$.

Hypothesis 3 H_1^3 states that there is a negative relationship, $\beta_2 < 0$, between profitability and commercial papers/other borrowings for the firms in a more competitive product market. Tables 6, 11 and 12 show that Hypothesis 3 agrees with our results. For example, Table 6 or 11 displays that there is a significantly negative relationship at about $\beta_2 = -0.031$ or $\beta_2 = -0.129$ between the ratio of bank debt or other borrowings to assets and the interaction term. Similarly, Table 12 displays a significantly negative relationship between the ratio of commercial papers to assets and the interaction term.

On the contrary, Hypothesis 4, H_1^4, states that there is a positive relationship, $\beta_2 > 0$, between profitability and leverage/public debt/bonds and notes/capital leases for the firms in a more competitive product market. Tables 5, 9, 10, and 13 demonstrate that Hypothesis 4 agrees with our results. The results suggest that when the firms are in a more competitive product market and produce more profits, they raise their leverage through increasing their public debt of bonds and notes as well as capital leases for weakening the external pressures of bank monitoring.

To reveal how the product market competition impacts the leverage puzzle through different types of debt, we decompose the leverage into the ratios of bank debt and public debt to the asset. We discover that the relationship between public debt and the interaction term is positive at $\beta_2 = 0.078$ in Table 13. Furthermore, after investigating the details public debt, we find that the relationships between the bonds and notes or capital leases of public debt and the interaction item is significantly positive at about $\beta_2 = 0.048$ or $\beta_2 = 0.088$ in Table 9 or Table 10.

The underlying mechanism for the above regression results is that when the firms are in a more competitive product market and produce more profits, they raise their

Table 12. Market competition and commercial papers

Notes: This table presents the results for regression models in Section 3.2. The competition dummy is 1 for the firm with the HHI in the lowest quartile for a year. The dependent variable is the ratio of the amount of commercial papers to the asset (unit: %). All variables are defined in Section 4.2. Standard errors are clustered by quarters except for IV regressions. ***: p<0.01, **: p<0.05, *: p<0.1.

C. Paper	(1) Tobit	(2) Tobit	(3) OLS	(4) Firm	(5) Quarter	(6) IV 1st	(7) IV 2nd	(8) Tobit
Competition		0.090	0.429	0.339	0.461		0.043	-0.031
		(0.071)	(0.293)	(0.415)	(0.299)		(1.379)	(0.093)
Competition×Profit		-6.821***	-10.980	-22.234	-11.875	20.554***	-2.561	-5.198**
		(1.874)	(7.956)	(13.509)	(7.816)	(0.225)	(30.248)	(2.291)
Profit	-2.161	2.551	-4.598	18.663*	-3.106	-13.248***	-9.818	-0.683
	(1.402)	(2.024)	(8.196)	(11.085)	(7.931)	(0.362)	(19.584)	(2.264)
Size	-0.118***	-0.111***	-0.925***	-0.575**	-0.916***	0.014***	-0.918***	-0.122***
	(0.016)	(0.016)	(0.077)	(0.234)	(0.078)	(0.004)	(0.063)	(0.020)
Tangible	-0.302***	-0.254***	-2.202***	-2.209	-1.890***	0.128***	-2.154***	-0.626***
	(0.085)	(0.084)	(0.328)	(1.646)	(0.320)	(0.023)	(0.424)	(0.132)
MV/BV	0.208***	0.205***	1.160***	1.163***	1.241***	0.029***	1.171***	0.118*
	(0.056)	(0.056)	(0.207)	(0.290)	(0.209)	(0.009)	(0.153)	(0.064)
Investment	1.216***	1.440***	2.540	1.946	0.592	0.077	2.583	2.025**
	(0.447)	(0.446)	(2.059)	(1.872)	(2.465)	(0.150)	(2.489)	(0.833)
Z-Score	0.025	0.030	-0.233**	-1.070***	-0.300***	-0.016***	-0.241***	0.098***
	(0.030)	(0.030)	(0.098)	(0.166)	(0.109)	(0.005)	(0.090)	(0.031)
Current Ratio	-0.220***	-0.222***	-1.619***	-1.105***	-1.557***	0.034***	-1.607***	-0.250***
	(0.035)	(0.034)	(0.150)	(0.268)	(0.157)	(0.008)	(0.140)	(0.042)
Age	-0.035	-0.031	0.080	-1.555***	0.177*	-0.046***	0.068	
	(0.036)	(0.035)	(0.091)	(0.494)	(0.097)	(0.008)	(0.134)	
Cash	0.199	0.393	3.187**	4.164*	3.681***	0.063	3.222***	
	(0.303)	(0.296)	(1.336)	(2.092)	(1.291)	(0.065)	(1.077)	
Tax	1.530	0.645	42.830***	6.674	34.734***	1.649**	43.319***	
	(2.715)	(2.679)	(12.064)	(8.585)	(11.168)	(0.720)	(12.049)	
Earnings Volatility	2.728	0.888	-3.496	9.291	-5.149	2.647***	-2.136	
	(2.441)	(2.387)	(8.081)	(8.220)	(8.209)	(0.575)	(10.634)	
Growth (S&P500)	-0.415	-0.372	-4.001***	-4.581***		-0.076	-4.037***	-0.087
	(0.290)	(0.297)	(1.387)	(1.173)		(0.086)	(1.430)	(0.441)
Growth (GDP)	-1.217	-1.455	-0.005	-1.106		-0.433	-0.063	-3.154
	(3.108)	(3.125)	(14.516)	(9.785)		(1.012)	(16.774)	(3.842)
Term Spread	-0.030**	-0.027**	-0.139*	-0.167***		0.000	-0.138**	0.001
	(0.013)	(0.014)	(0.071)	(0.058)		(0.004)	(0.062)	(0.021)
Credit Spread	-0.016	-0.009	-0.149	-0.204		-0.042***	-0.165	-0.018
	(0.037)	(0.036)	(0.165)	(0.170)		(0.013)	(0.224)	(0.048)
HHI_2001 (IV)						-0.362***		
						(0.030)		
CEO Tenure								0.007*
								(0.004)
Executive Incentives								-0.106***
								(0.031)
Executive Ownership								-2.828***
								(0.584)
Institutional Own.								-0.115*
								(0.060)
Institutional Breath								-0.034
								(0.080)
Constant	2.798***	2.607***	13.572***	16.962***	12.511***	0.663***	13.768***	0.664***
	(0.236)	(0.234)	(0.928)	(2.922)	(0.888)	(0.053)	(1.102)	(0.287)
Observations	3,128	3,128	3,128	3,128	3,128	3,128	3,128	1,858
No. of Firms	261	261	261	261	261	261	261	261
Predictive Margin	1.454	1.457	3.611	3.611	3.611		3.611	1.562
Predictive Median	1.867	1.826	6.518	6.790	6.511		6.505	1.569
Pseudo R-squared	0.0663	0.0734						0.0983
Adjusted R-squared			0.194	0.591	0.198	0.813	0.194	

Table 13. Market competition and public debt

Notes: This table presents the results for regression models in Section 3.2. The competition dummy is 1 for the firm with the HHI in the lowest quartile for a year. The dependent variable is the ratio of the amount of total public debt to the asset, *PD*. All variables are defined in Section 4.2. Standard errors are clustered by quarters except for IV regressions. ***: p<0.01, **: p<0.05, *: p<0.1.

Public D.	(1) Tobit	(2) Tobit	(3) OLS	(4) Firm	(5) Quarter	(6) IV 1st	(7) IV 2nd	(8) Tobit
Competition		-0.003*	-0.003	0.012***	-0.003		0.016***	-0.001
		(0.002)	(0.002)	(0.003)	(0.002)		(0.004)	(0.004)
Competition×Profit		0.078***	0.049***	-0.059**	0.050***	-0.738***	0.068***	-0.239**
		(0.017)	(0.012)	(0.024)	(0.012)	(0.015)	(0.011)	(0.093)
Profit	-0.248***	-0.308***	-0.225***	-0.025	-0.226***	0.530***	-0.239***	0.841***
	(0.017)	(0.021)	(0.016)	(0.025)	(0.016)	(0.017)	(0.011)	(0.092)
Size	0.012***	0.012***	0.013***	-0.038***	0.013***	0.004***	0.013***	0.024***
	(0.000)	(0.001)	(0.000)	(0.003)	(0.000)	(0.001)	(0.000)	(0.001)
Tangible	0.014***	0.014***	0.018***	0.004	0.019***	0.239***	0.013***	0.085***
	(0.005)	(0.005)	(0.004)	(0.016)	(0.005)	(0.006)	(0.004)	(0.010)
MV/BV	0.055***	0.055***	0.051***	0.024***	0.051***	0.022***	0.051***	0.094***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.003)
Investment	-0.191***	-0.189***	-0.166***	-0.119***	-0.174***	0.202***	-0.174***	-0.205***
	(0.035)	(0.035)	(0.033)	(0.026)	(0.035)	(0.032)	(0.020)	(0.073)
Z-Score	-0.025***	-0.025***	-0.024***	-0.016***	-0.024***	-0.005***	-0.024***	-0.058***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.002)
Current Ratio	-0.017***	-0.017***	-0.016***	-0.005***	-0.016***	0.008***	-0.016***	0.010***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Age	0.010***	0.010***	0.010***	0.049***	0.010***	-0.005***	0.010***	
	(0.001)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.001)	
Cash	-0.046***	-0.045***	-0.033***	0.002	-0.032***	0.194***	-0.040***	
	(0.013)	(0.013)	(0.011)	(0.010)	(0.011)	(0.009)	(0.006)	
Tax	0.316***	0.314***	0.099	-0.404***	0.105	-1.693***	0.156	
	(0.119)	(0.120)	(0.108)	(0.079)	(0.110)	(0.178)	(0.113)	
Earnings Volatility	0.462***	0.459***	0.367***	0.091***	0.366***	-0.025	0.368***	
	(0.021)	(0.021)	(0.017)	(0.015)	(0.017)	(0.017)	(0.011)	
Growth (S&P500)	-0.019	-0.019	-0.016	-0.016		0.016	-0.017	0.035
	(0.026)	(0.026)	(0.024)	(0.029)		(0.036)	(0.023)	(0.028)
Growth (GDP)	0.185	0.179	0.165	-0.059		-0.548	0.173	-0.015
	(0.221)	(0.222)	(0.209)	(0.276)		(0.392)	(0.248)	(0.331)
Term Spread	0.005***	0.005***	0.005***	-0.009***		0.004***	0.005***	-0.003
	(0.001)	(0.001)	(0.001)	(0.002)		(0.002)	(0.001)	(0.002)
Credit Spread	0.008**	0.008**	0.006*	-0.000		0.010*	0.006	0.006
	(0.004)	(0.004)	(0.003)	(0.005)		(0.006)	(0.004)	(0.004)
HHI_2001 (IV)						-1.862***		
						(0.012)		
CEO Tenure								-0.001***
								(0.000)
Executive Incentives								-0.002
								(0.002)
Executive Ownership								-0.124***
								(0.019)
Institutional Own.								-0.010***
								(0.003)
Institutional Breath								-0.022***
								(0.006)
Constant	0.250***	0.081***	0.080***	0.262***	0.095***	0.762***	0.071***	0.146***
	(0.003)	(0.009)	(0.008)	(0.019)	(0.007)	(0.011)	(0.007)	(0.016)
Observations	62,863	62,863	62,863	62,863	62,863	62,863	62,863	12,523
No. of Firms	6205	6205	6205	6205	6205	6205	6205	6205
Predictive Margin	0.280	0.280	0.268	0.268	0.268		0.268	0.232
Predictive Median	0.218	0.218	0.218	0.213	0.218		0.218	0.232
Pseudo R-squared	0.679	0.680						-0.995
Adjusted R-squared			0.388	0.802	0.388	0.371	0.388	

leverage through increasing their total public debt from the public market for weakening the external pressures of bank monitoring. Namely, product market competition attenuates (i.e., mitigates) the negative ($\beta_3 < 0$) relationship between the firms' profits and leverage/public debt/bonds and notes/capital leases by increasing ($\beta_2 > 0$) these types of debt when these firms' profits are high. In fact, the firms that make profits in an intensive competition environment are in an advantage position to borrowing higher debt and taking higher leverage.

In brief, our results exhibit that the firms in a more competitive product market significantly reduce the external pressures of bank monitoring by raising bonds and notes as well as capital leases in the public market. The final effect is that product market competition attenuates the leverage puzzle of the negative relationship between profitability and leverage.

5.2   Analysis on market competition and credit spreads

Valta (2012) finds that competitive product markets systematically affect firms' costs of bank debt, especially in industries with small firms, stable rivals, frequent strategic interactions, and liquidity shortage. Bharath and Hertzel (2019) illustrate that in a more competitive product market, firms encounter high external pressure and therefore the firms reduce the external pressures of bank monitoring by shifting debt from bank loans to bonds in the public market. Platt (2020) reveals that corporate bondholders demand significantly larger credit spreads from firms facing increased competition.

The previous studies motivate this study to examine the costs of six types of debt and combinations through investigating the effect of product market competition on the credit spreads of various types of debt. We capture this effect through regressing credit spreads on competition along with other firm characteristics and economic conditions. In this section about credit spreads, there is no interaction term between competition and profitability because there is no financial theory supporting this specification. It might seem like a logic extension of the aforementioned Section 5.1 to include the interaction term here, but the interaction term with profitability is only meaningful when we examine the leverage puzzle about the relationship between debt ratios and profitability. Hence, we do not have the interaction with profitability in the model specifications about credit spreads. We measure the credit spread by the variable $CS_{f,i,t}$, which is the credit spread of the weighted average interest rate of a specific type of debt over LIBOR.

Hypothesis 5, H_1^5, states that there is a positive relationship, $\beta_1 > 0$, between product market competition and the credit spread of total debt / bank debt / public debt / revolving credit / term loans / bonds and notes / commercial papers / capital lease / other borrowings. Tables 14, 15, 16, 17, 18, 19, 20, 21, and 22 show that Hypothesis 5 agrees with our results, except for the insignificant results about the credit spread of commercial papers in Table 20.

In Tables 14 to 22, we provide 9 columns for 9 regression settings for credit spreads, see the equations in Section 3.2. Column (1) is the benchmark industry fixed-effect model without *Competition*. Including *Competition*, Column (2) lists our main results using the industry fixed-effect model. Column (3) is OLS. As a comparison, Columns (4), (5), and (6) present results with the fixed effects of firms, firms and industries, and quarters respectively. For robustness, Columns (7) and (8) display the first-stage and second-stage IV regressions. Finally, Column (9) is the industry fixed-effect model controlling the effects of three additional variables about executive characteristics.

For example, Columns (2) of Table 14 displays that there is a significant positive relationship, about $\beta_1 = 0.612 > 0$, between the credit spread of total debt and competition, in the panel-data regression models with industry-fixed effects or firm-fixed effects or firm-industry-fixed effects, and OLS regression.

To reveal how the product market competition impacts the debt costs through different types of debt, we decompose the credit spread of total debt into the credit spreads of bank debt and public debt firstly. We discover that the relationship between the credit spread of bank debt (resp. the credit spread of public debt) and competition is significantly positive at $\beta_2 = 0.473$ (resp. $\beta_2 = 0.566$) in 15 (resp. 16). Furthermore, after investigating the details of bank debt and public debt from the prospective of six types of debt, we find that the relationships between product market competition and the credit spread of revolving credit/term loans/bonds and notes/capital lease/other borrowings are all significantly positive in Tables 17, 18, 19, 21, and 22, though the β_1s of commercial papers are insignificant in Table 20.

The underlying mechanism is that when the product market competition is high, firms have to pay higher credit spreads for both bank debt and public debt. The credit spreads of bank debt rise since the firms' risks are high in a more competitive environment. The credit spreads of public debt increase in a more competitive environment as the firms have to reduce the external monitoring pressure. Then, the firms shift bank debt with high external pressure to public debt with low external pressure. To this end, the firms pay larger costs for public debt.

Table 14. Analysis about the credit spread (CS) of total debt.

Notes: This table presents the results for regression models in Section 3.2. The competition dummy is 1 for the firm with the HHI in the lowest quartile for a year. The dependent variable is the credit spread (CS) of total debt. All variables are defined in Section 4.2. Standard errors are clustered by quarters except for IV regressions. ***: $p<0.01$, **: $p<0.05$, *: $p<0.1$.

Total Debt	(1) Industry	(2) Industry	(3) OLS	(4) Firm	(5) Firm-Industry	(6) Quarter	(7) IV 1st	(8) IV 2nd	(9) Industry
Competition		0.612***	0.437***	0.370***	0.370***	0.435***		0.107	0.409***
		(0.103)	(0.114)	(0.074)	(0.074)	(0.030)		(0.067)	(0.109)
Profit	0.064	0.061	-0.015	0.047	0.047	0.072	-0.023*	-0.021	-5.689***
	(0.142)	(0.142)	(0.281)	(0.111)	(0.111)	(0.141)	(0.014)	(0.121)	(0.953)
Size	-0.370***	-0.370***	-0.398***	-0.178***	-0.178***	-0.367***	-0.002**	-0.397***	-0.221***
	(0.009)	(0.009)	(0.022)	(0.025)	(0.025)	(0.009)	(0.001)	(0.008)	(0.023)
Tangible	0.374***	0.369***	1.318***	0.261***	0.261***	1.191***	0.260***	1.415***	-0.600**
	(0.120)	(0.120)	(0.206)	(0.099)	(0.099)	(0.088)	(0.007)	(0.066)	(0.291)
MV/BV	-0.088***	-0.088***	-0.061	-0.084***	-0.084***	-0.039**	0.020***	-0.052***	-0.135***
	(0.014)	(0.014)	(0.041)	(0.018)	(0.018)	(0.015)	(0.002)	(0.014)	(0.050)
Investment	0.185	0.181	-0.028	-0.787*	-0.787*	0.156	0.151***	0.093	-4.336***
	(0.375)	(0.375)	(0.642)	(0.434)	(0.434)	(0.289)	(0.034)	(0.305)	(1.292)
Z-Score	-0.081***	-0.081***	-0.096***	-0.021***	-0.021***	-0.093***	-0.004***	-0.099***	0.002
	(0.005)	(0.005)	(0.014)	(0.006)	(0.006)	(0.005)	(0.001)	(0.005)	(0.023)
Current Ratio	-0.028**	-0.028**	0.017	-0.023**	-0.023**	0.002	0.013***	0.020*	-0.006
	(0.012)	(0.012)	(0.030)	(0.011)	(0.011)	(0.011)	(0.001)	(0.011)	(0.030)
Age	-0.007	-0.007	0.007	-0.016	-0.016	-0.007	-0.017***	0.001	
	(0.022)	(0.023)	(0.045)	(0.135)	(0.135)	(0.021)	(0.002)	(0.016)	
Cash	-0.173*	-0.176*	0.249	-0.046	-0.046	0.272***	0.158***	0.360***	
	(0.099)	(0.099)	(0.235)	(0.096)	(0.096)	(0.102)	(0.009)	(0.085)	
Tax	-17.708***	-17.768***	-21.078***	-1.957	-1.957	-19.642***	-1.893***	-22.130***	
	(2.419)	(2.395)	(3.337)	(1.643)	(1.643)	(2.033)	(0.213)	(1.911)	
Earnings Volatility	-0.362**	-0.361**	-0.313	-0.074	-0.074	-0.270	-0.067***	-0.351**	
	(0.159)	(0.160)	(0.334)	(0.155)	(0.155)	(0.171)	(0.017)	(0.156)	
Growth (S&P500)	2.170	2.152	2.346***	2.193	2.193		-0.019	2.338***	1.897
	(1.678)	(1.669)	(0.339)	(1.460)	(1.460)		(0.046)	(0.411)	(2.024)
Growth (GDP)	6.402	6.485	6.639**	6.896	6.896		-0.525	6.493	13.415
	(16.675)	(16.573)	(3.150)	(13.476)	(13.476)		(0.484)	(4.318)	(17.661)
Term Spread	0.768***	0.762***	0.762***	0.786***	0.786***		0.001	0.762***	0.921***
	(0.082)	(0.082)	(0.033)	(0.069)	(0.069)		(0.002)	(0.017)	(0.070)
Credit Spread	0.052	0.042	0.008	0.354*	0.354*		0.010	0.011	-0.144
	(0.244)	(0.244)	(0.089)	(0.185)	(0.185)		(0.008)	(0.068)	(0.296)
HHI_2001 (IV)							-1.982***		
							(0.015)		
CEO Tenure									0.010***
									(0.003)
Executive Incentives									0.020
									(0.041)
Executive Ownership									3.049***
									(0.874)
Institutional Own.									-0.210
									(0.136)
Institutional Breath									0.633***
									(0.183)
Constant	6.144***	5.721***	5.384***	4.861***	4.861***	6.869***	0.855***	5.558***	4.105***
	(0.351)	(0.347)	(0.270)	(0.589)	(0.589)	(0.065)	(0.014)	(0.126)	(0.460)
Observations	40,675	40,675	40,675	40,675	40,675	40,675	40,675	40,675	5,669
Adjusted R-squared	0.277	0.277	0.228	0.802	0.802	0.258	0.358	0.226	0.383
No. of Firms	5172	5172	5172	5172	5172	5172	5172	5172	5172
Predictive Margin	6.166	6.166	6.166	6.166	6.166	6.166		6.166	3.870
Predictive Median	5.755	5.744	5.671	6.076	6.076	5.610		5.672	3.784

Table 15. Analysis about the credit spread (CS) of bank debt.

Notes: This table presents the results for regression models in Section 3.2. The competition dummy is 1 for the firm with the HHI in the lowest quartile for a year. The dependent variable is the credit spread (CS) of bank debt. All variables are defined in Section 4.2. Standard errors are clustered by quarters except for IV regressions. ***: $p<0.01$, **: $p<0.05$, *: $p<0.1$.

Bank D.	(1) Industry	(2) Industry	(3) OLS	(4) Firm	(5) Firm-Industry	(6) Quarter	(7) IV 1st	(8) IV 2nd	(9) Industry
Competition		0.473***	0.606***	0.129**	0.129**	0.600***		0.458***	0.488***
		(0.098)	(0.116)	(0.063)	(0.063)	(0.044)		(0.072)	(0.148)
Profit	-0.047	-0.049	0.012	-0.305**	-0.305**	0.052	-0.055***	0.009	-10.607***
	(0.190)	(0.190)	(0.421)	(0.131)	(0.131)	(0.198)	(0.019)	(0.157)	(1.431)
Size	-0.370***	-0.370***	-0.434***	-0.078***	-0.078***	-0.407***	-0.001	-0.434***	-0.143***
	(0.008)	(0.008)	(0.027)	(0.023)	(0.023)	(0.008)	(0.001)	(0.008)	(0.034)
Tangible	0.497***	0.499***	1.522***	-0.110	-0.110	1.428***	0.263***	1.568***	-0.313
	(0.076)	(0.076)	(0.243)	(0.147)	(0.147)	(0.069)	(0.008)	(0.072)	(0.283)
MV/BV	-0.120***	-0.120***	-0.085	-0.048**	-0.048**	-0.070***	0.017***	-0.081***	-0.000
	(0.018)	(0.018)	(0.055)	(0.021)	(0.021)	(0.019)	(0.002)	(0.017)	(0.056)
Investment	-0.640	-0.652	-0.696	-0.884*	-0.884*	-0.539	0.228***	-0.625*	-2.440**
	(0.391)	(0.391)	(0.794)	(0.470)	(0.470)	(0.342)	(0.040)	(0.342)	(0.983)
Z-Score	-0.123***	-0.123***	-0.145***	-0.021**	-0.021**	-0.138***	-0.008***	-0.146***	-0.182***
	(0.005)	(0.005)	(0.019)	(0.009)	(0.009)	(0.005)	(0.001)	(0.006)	(0.027)
Current Ratio	-0.044***	-0.044***	0.024	-0.004	-0.004	0.006	0.015***	0.025*	0.076*
	(0.016)	(0.016)	(0.038)	(0.012)	(0.012)	(0.013)	(0.002)	(0.014)	(0.038)
Age	-0.040**	-0.040**	-0.022	0.153	0.153	-0.025*	-0.015***	-0.025	
	(0.016)	(0.016)	(0.047)	(0.120)	(0.120)	(0.013)	(0.002)	(0.016)	
Cash	0.545***	0.546***	1.205***	-0.237**	-0.237**	1.255***	0.195***	1.268***	
	(0.095)	(0.095)	(0.305)	(0.117)	(0.117)	(0.091)	(0.012)	(0.105)	
Tax	-21.007***	-21.087***	-25.667***	-3.265**	-3.265**	-23.849***	-1.310***	-25.983***	
	(3.209)	(3.203)	(3.458)	(1.420)	(1.420)	(2.847)	(0.248)	(2.102)	
Earnings Volatility	-0.698**	-0.694**	-0.680	-0.016	-0.016	-0.615**	-0.089***	-0.699***	
	(0.278)	(0.278)	(0.514)	(0.190)	(0.190)	(0.283)	(0.024)	(0.204)	
Growth (S&P500)	1.469	1.455	1.483***	1.824	1.824		-0.006	1.482***	0.490
	(1.389)	(1.381)	(0.350)	(1.269)	(1.269)		(0.051)	(0.435)	(1.403)
Growth (GDP)	0.309	0.433	0.544	5.673	5.673		-0.181	0.537	10.583
	(13.713)	(13.620)	(3.129)	(12.049)	(12.049)		(0.541)	(4.579)	(14.812)
Term Spread	0.558***	0.553***	0.530***	0.636***	0.636***		0.004*	0.530***	0.568***
	(0.074)	(0.074)	(0.037)	(0.067)	(0.067)		(0.002)	(0.019)	(0.067)
Credit Spread	-0.059	-0.064	-0.109	0.226	0.226		0.014*	-0.105	-0.106
	(0.187)	(0.186)	(0.089)	(0.172)	(0.172)		(0.008)	(0.071)	(0.182)
HHI_2001 (IV)							-1.926***		
							(0.016)		
CEO Tenure									-0.001
									(0.004)
Executive Incentives									-0.092*
									(0.054)
Executive Ownership									-2.769***
									(0.661)
Institutional Own.									-0.154*
									(0.092)
Institutional Breath									0.103
									(0.109)
Constant	6.155***	5.846***	5.437***	3.775***	3.775***	6.299***	0.799***	5.504***	3.769***
	(0.268)	(0.279)	(0.306)	(0.555)	(0.555)	(0.071)	(0.016)	(0.135)	(0.431)
Observations	35,433	35,433	35,433	35,433	35,433	35,433	35,433	35,433	5,461
Adjusted R-squared	0.306	0.306	0.249	0.831	0.831	0.267	0.345	0.249	0.324
No. of Firms	4221	4221	4221	4221	4221	4221	4221	4221	4221
Predictive Margin	5.348	5.348	5.348	5.348	5.348	5.348		5.348	3.058
Predictive Median	5.040	5.059	5.050	5.358	5.358	5.029		5.042	3.020

Table 16. Analysis about the credit spread (CS) of public debt.

Notes: This table presents the results for regression models in Section 3.2. The competition dummy is 1 for the firm with the HHI in the lowest quartile for a year. The dependent variable is the credit spread (CS) of public debt. All variables are defined in Section 4.2. Standard errors are clustered by quarters except for IV regressions. ***: $p<0.01$, **: $p<0.05$, *: $p<0.1$.

Public D.	(1) Industry	(2) Industry	(3) OLS	(4) Firm	(5) Firm-Industry	(6) Quarter	(7) IV 1st	(8) IV 2nd	(9) Industry
Competition		0.566***	0.166	0.157***	0.157***	0.161***		0.054	0.244**
		(0.095)	(0.116)	(0.059)	(0.059)	(0.039)		(0.068)	(0.120)
Profit	0.423**	0.418**	0.357	0.271**	0.271**	0.445**	-0.025*	0.354***	-3.180***
	(0.187)	(0.187)	(0.293)	(0.121)	(0.121)	(0.188)	(0.015)	(0.128)	(0.953)
Size	-0.438***	-0.438***	-0.429***	-0.202***	-0.202***	-0.398***	0.001	-0.429***	-0.363***
	(0.011)	(0.011)	(0.022)	(0.031)	(0.031)	(0.010)	(0.001)	(0.008)	(0.032)
Tangible	0.212	0.205	0.636***	0.439***	0.439***	0.486***	0.224***	0.666***	-0.138
	(0.141)	(0.141)	(0.198)	(0.123)	(0.123)	(0.093)	(0.008)	(0.068)	(0.357)
MV/BV	-0.189***	-0.189***	-0.177***	-0.163***	-0.163***	-0.150***	0.020***	-0.174***	-0.301***
	(0.021)	(0.021)	(0.045)	(0.022)	(0.022)	(0.019)	(0.002)	(0.015)	(0.066)
Investment	0.940*	0.933*	0.951	-0.472	-0.472	1.153***	0.200***	0.999***	-4.959***
	(0.503)	(0.503)	(0.700)	(0.455)	(0.455)	(0.375)	(0.038)	(0.329)	(1.485)
Z-Score	-0.060***	-0.060***	-0.070***	-0.009	-0.009	-0.067***	-0.005***	-0.071***	0.023
	(0.006)	(0.006)	(0.016)	(0.007)	(0.007)	(0.006)	(0.001)	(0.005)	(0.027)
Current Ratio	-0.048***	-0.048***	-0.037	-0.035***	-0.035***	-0.052***	0.011***	-0.036***	-0.035
	(0.014)	(0.014)	(0.033)	(0.013)	(0.013)	(0.015)	(0.001)	(0.012)	(0.036)
Age	-0.056*	-0.054*	-0.050	-0.301**	-0.301**	-0.064**	-0.013***	-0.051***	
	(0.029)	(0.029)	(0.049)	(0.150)	(0.150)	(0.026)	(0.002)	(0.017)	
Cash	-0.765***	-0.768***	-0.610**	0.036	0.036	-0.587***	0.148***	-0.574***	
	(0.153)	(0.152)	(0.264)	(0.100)	(0.100)	(0.195)	(0.011)	(0.093)	
Tax	-13.914***	-13.980***	-15.468***	-0.659	-0.659	-14.413***	-1.750***	-15.825***	
	(2.524)	(2.497)	(3.397)	(1.555)	(1.555)	(1.992)	(0.226)	(1.967)	
Earnings Volatility	-0.214	-0.217	-0.071	0.198	0.198	-0.033	-0.042**	-0.083	
	(0.216)	(0.216)	(0.376)	(0.180)	(0.180)	(0.217)	(0.019)	(0.167)	
Growth (S&P500)	3.388	3.372	3.483***	2.755*	2.755*		-0.024	3.481***	3.027
	(2.066)	(2.061)	(0.353)	(1.629)	(1.629)		(0.049)	(0.420)	(2.332)
Growth (GDP)	9.270	9.272	9.451***	10.328	10.328		-0.122	9.452**	15.881
	(20.609)	(20.516)	(3.454)	(16.010)	(16.010)		(0.514)	(4.449)	(22.142)
Term Spread	0.950***	0.944***	0.956***	0.892***	0.892***		0.003*	0.956***	1.083***
	(0.084)	(0.084)	(0.032)	(0.073)	(0.073)		(0.002)	(0.017)	(0.076)
Credit Spread	0.265	0.259	0.243**	0.444*	0.444*		0.003	0.244***	0.158
	(0.318)	(0.318)	(0.095)	(0.224)	(0.224)		(0.008)	(0.069)	(0.349)
HHI_2001 (IV)							-1.975***		
							(0.015)		
CEO Tenure									-0.005
									(0.003)
Executive Incentives									0.007
									(0.040)
Executive Ownership									2.694***
									(0.682)
Institutional Own.									0.005
									(0.124)
Institutional Breath									1.029***
									(0.174)
Constant	6.798***	6.414***	6.407***	6.149***	6.149***	8.480***	0.840***	6.464***	5.259***
	(0.437)	(0.426)	(0.285)	(0.721)	(0.721)	(0.068)	(0.015)	(0.130)	(0.558)
Observations	37,929	37,929	37,929	37,929	37,929	37,929	37,929	37,929	6,387
Adjusted R-squared	0.275	0.275	0.240	0.803	0.803	0.279	0.347	0.240	0.410
No. of Firms	4840	4840	4840	4840	4840	4840	4840	4840	4840
Predictive Margin	6.399	6.399	6.399	6.399	6.399	6.399		6.399	4.388
Predictive Median	6.270	6.256	6.246	6.468	6.468	6.102		6.247	4.433

Table 17. Analysis about the credit spread (CS) of revolving credit.

Notes: This table presents the results for regression models in Section 3.2. The competition dummy is 1 for the firm with the HHI in the lowest quartile for a year. The dependent variable is the credit spread (CS) of revolving credit. All variables are defined in Section 4.2. Standard errors are clustered by quarters except for IV regressions. ***: $p<0.01$, **: $p<0.05$, *: $p<0.1$.

R. Credit	(1) Industry	(2) Industry	(3) OLS	(4) Firm	(5) Firm-Industry	(6) Quarter	(7) IV 1st	(8) IV 2nd	(9) Industry
Competition		0.218**	0.282**	0.060	0.060	0.287***		0.316***	0.339**
		(0.083)	(0.137)	(0.061)	(0.061)	(0.038)		(0.089)	(0.153)
Profit	-0.831	-0.832	-1.345	-0.189	-0.189	-1.193**	-0.166***	-1.340***	-8.639***
	(0.558)	(0.558)	(0.935)	(0.248)	(0.248)	(0.544)	(0.054)	(0.341)	(2.632)
Size	-0.329***	-0.329***	-0.313***	0.214***	0.214***	-0.301***	0.015***	-0.313***	0.175***
	(0.013)	(0.013)	(0.042)	(0.048)	(0.048)	(0.011)	(0.002)	(0.011)	(0.038)
Tangible	0.394***	0.394***	0.649**	0.406*	0.406*	0.583***	0.271***	0.638***	-0.238
	(0.121)	(0.121)	(0.307)	(0.237)	(0.237)	(0.079)	(0.014)	(0.093)	(0.265)
MV/BV	0.011	0.011	0.011	-0.011	-0.011	0.026	0.018***	0.011	0.223***
	(0.024)	(0.024)	(0.082)	(0.032)	(0.032)	(0.024)	(0.004)	(0.025)	(0.060)
Investment	-0.287	-0.291	-0.896	-0.417	-0.417	-1.083	0.068	-0.912*	1.872*
	(0.762)	(0.761)	(1.082)	(0.696)	(0.696)	(0.669)	(0.077)	(0.485)	(0.955)
Z-Score	-0.223***	-0.223***	-0.250***	-0.073***	-0.073***	-0.236***	-0.008***	-0.250***	-0.193***
	(0.012)	(0.012)	(0.035)	(0.018)	(0.018)	(0.011)	(0.002)	(0.011)	(0.031)
Current Ratio	-0.121***	-0.121***	-0.041	0.077***	0.077***	-0.081***	0.008**	-0.041*	0.022
	(0.030)	(0.030)	(0.059)	(0.029)	(0.029)	(0.021)	(0.003)	(0.021)	(0.043)
Age	0.069***	0.068***	0.112**	0.078	0.078	0.119***	-0.020***	0.113***	
	(0.022)	(0.022)	(0.055)	(0.126)	(0.126)	(0.018)	(0.003)	(0.019)	
Cash	0.224	0.227	0.284	-0.516***	-0.516***	0.380*	0.296***	0.263	
	(0.232)	(0.233)	(0.534)	(0.161)	(0.161)	(0.191)	(0.030)	(0.192)	
Tax	-8.473**	-8.508**	-8.007**	0.798	0.798	-8.555***	-1.470***	-7.928***	
	(3.312)	(3.309)	(3.427)	(1.256)	(1.256)	(2.947)	(0.389)	(2.471)	
Earnings Volatility	1.436**	1.431**	1.466	-0.209	-0.209	1.573**	-0.136*	1.475***	
	(0.694)	(0.694)	(1.375)	(0.288)	(0.288)	(0.668)	(0.076)	(0.482)	
Growth (S&P500)	1.866	1.858	2.062***	1.646	1.646		0.033	2.061***	1.014
	(1.502)	(1.498)	(0.421)	(1.236)	(1.236)		(0.078)	(0.495)	(1.647)
Growth (GDP)	7.203	7.277	5.786	8.810	8.810		-0.152	5.803	9.320
	(14.861)	(14.829)	(3.780)	(11.940)	(11.940)		(0.827)	(5.233)	(15.320)
Term Spread	0.575***	0.572***	0.595***	0.622***	0.622***		0.021***	0.594***	0.646***
	(0.076)	(0.076)	(0.038)	(0.068)	(0.068)		(0.004)	(0.022)	(0.069)
Credit Spread	-0.062	-0.064	-0.054	0.105	0.105		0.027**	-0.056	-0.017
	(0.200)	(0.200)	(0.102)	(0.171)	(0.171)		(0.013)	(0.080)	(0.181)
HHI_2001 (IV)							-1.715***		
							(0.024)		
CEO Tenure									-0.018***
									(0.006)
Executive Incentives									-0.037
									(0.044)
Executive Ownership									-1.564*
									(0.785)
Institutional Own.									0.141
									(0.110)
Institutional Breath									-0.080
									(0.156)
Constant	4.590***	4.470***	3.975***	0.888	0.888	5.121***	0.632***	3.965***	0.588
	(0.300)	(0.305)	(0.398)	(0.697)	(0.697)	(0.109)	(0.025)	(0.157)	(0.428)
Observations	17,981	17,981	17,981	17,981	17,981	17,981	17,981	17,981	4,118
Adjusted R-squared	0.320	0.320	0.239	0.863	0.863	0.264	0.272	0.239	0.392
No. of Firms	2290	2290	2290	2290	2290	2290	2290	2290	2290
Predictive Margin	3.889	3.889	3.889	3.889	3.889	3.889		3.889	2.826
Predictive Median	3.930	3.955	3.992	3.644	3.644	3.914		3.995	2.951

Table 18. Analysis about the credit spread (CS) of term loan.

Notes: This table presents the results for regression models in Section 3.2. The competition dummy is 1 for the firm with the HHI in the lowest quartile for a year. The dependent variable is the credit spread (CS) of term loan. All variables are defined in Section 4.2. Standard errors are clustered by quarters except for IV regressions. ***: p<0.01, **: p<0.05, *: p<0.1.

Loan	(1) Industry	(2) Industry	(3) OLS	(4) Firm	(5) Firm-Industry	(6) Quarter	(7) IV 1st	(8) IV 2nd	(9) Industry
Competition		0.377***	0.543***	0.082	0.082	0.538***		0.431***	0.346**
		(0.096)	(0.128)	(0.060)	(0.060)	(0.057)		(0.075)	(0.168)
Profit	0.169	0.165	0.422	-0.299**	-0.299**	0.443**	-0.045**	0.420**	-10.419***
	(0.202)	(0.202)	(0.434)	(0.142)	(0.142)	(0.212)	(0.018)	(0.164)	(1.272)
Size	-0.363***	-0.363***	-0.455***	-0.150***	-0.150***	-0.424***	-0.003***	-0.455***	-0.384***
	(0.009)	(0.009)	(0.026)	(0.023)	(0.023)	(0.008)	(0.001)	(0.009)	(0.028)
Tangible	0.457***	0.457***	1.425***	0.104	0.104	1.339***	0.211***	1.452***	0.414
	(0.093)	(0.093)	(0.264)	(0.149)	(0.149)	(0.076)	(0.008)	(0.077)	(0.355)
MV/BV	-0.145***	-0.145***	-0.146**	-0.092***	-0.092***	-0.128***	0.015***	-0.144***	0.033
	(0.020)	(0.020)	(0.059)	(0.023)	(0.023)	(0.019)	(0.002)	(0.018)	(0.052)
Investment	-0.302	-0.317	-0.004	-0.779*	-0.779*	0.272	0.332***	0.056	-6.505***
	(0.394)	(0.393)	(0.841)	(0.408)	(0.408)	(0.329)	(0.042)	(0.375)	(1.481)
Z-Score	-0.112***	-0.112***	-0.125***	-0.012	-0.012	-0.121***	-0.008***	-0.127***	-0.136***
	(0.006)	(0.006)	(0.019)	(0.008)	(0.008)	(0.006)	(0.001)	(0.006)	(0.022)
Current Ratio	-0.028*	-0.028*	0.015	-0.005	-0.005	0.004	0.017***	0.017	-0.097**
	(0.016)	(0.017)	(0.040)	(0.012)	(0.012)	(0.013)	(0.002)	(0.015)	(0.037)
Age	-0.084***	-0.085***	-0.083*	0.050	0.050	-0.089***	-0.007***	-0.084***	
	(0.016)	(0.016)	(0.050)	(0.110)	(0.110)	(0.012)	(0.002)	(0.017)	
Cash	0.328***	0.328***	0.886***	-0.215*	-0.215*	0.896***	0.174***	0.930***	
	(0.098)	(0.098)	(0.323)	(0.127)	(0.127)	(0.094)	(0.012)	(0.112)	
Tax	-23.706***	-23.777***	-29.085***	-4.286***	-4.286***	-27.038***	-1.258***	-29.337***	
	(3.442)	(3.446)	(3.867)	(1.453)	(1.453)	(3.227)	(0.262)	(2.347)	
Earnings Volatility	-0.808***	-0.807***	-0.748	-0.170	-0.170	-0.665**	-0.102***	-0.764***	
	(0.291)	(0.291)	(0.512)	(0.172)	(0.172)	(0.290)	(0.024)	(0.213)	
Growth (S&P500)	1.581	1.573	1.518***	1.982	1.982		-0.030	1.513***	0.621
	(1.565)	(1.559)	(0.385)	(1.358)	(1.358)		(0.054)	(0.479)	(1.298)
Growth (GDP)	-0.017	0.020	1.039	5.834	5.834		-0.118	1.038	5.731
	(14.760)	(14.672)	(3.496)	(12.559)	(12.559)		(0.566)	(5.061)	(14.474)
Term Spread	0.627***	0.622***	0.599***	0.669***	0.669***		0.004	0.600***	0.545***
	(0.077)	(0.077)	(0.041)	(0.065)	(0.065)		(0.002)	(0.021)	(0.063)
Credit Spread	0.024	0.019	-0.022	0.356**	0.356**		0.011	-0.019	-0.148
	(0.210)	(0.209)	(0.099)	(0.175)	(0.175)		(0.009)	(0.077)	(0.191)
HHI_2001 (IV)							-2.013***		
							(0.017)		
CEO Tenure									0.005
									(0.004)
Executive Incentives									-0.037
									(0.047)
Executive Ownership									-2.039***
									(0.670)
Institutional Own.									-0.540***
									(0.097)
Institutional Breath									0.093
									(0.107)
Constant	6.454***	6.210***	6.064***	4.639***	4.639***	7.107***	0.819***	6.116***	6.170***
	(0.311)	(0.319)	(0.326)	(0.498)	(0.498)	(0.065)	(0.016)	(0.146)	(0.432)
Observations	31,443	31,443	31,443	31,443	31,443	31,443	31,443	31,443	3,958
Adjusted R-squared	0.285	0.285	0.226	0.833	0.833	0.245	0.364	0.226	0.395
No. of Firms	3730	3730	3730	3730	3730	3730	3730	3730	3730
Predictive Margin	5.728	5.728	5.728	5.728	5.728	5.728			3.183
Predictive Median	5.443	5.450	5.422	5.706	5.706	5.387		5.416	3.046

Table 19. Analysis about the credit spread (CS) of bond and note.

Notes: This table presents the results for regression models in Section 3.2. The competition dummy is 1 for the firm with the HHI in the lowest quartile for a year. The dependent variable is the credit spread (CS) of bond and note. All variables are defined in Section 4.2. Standard errors are clustered by quarters except for IV regressions. ***: $p<0.01$, **: $p<0.05$, *: $p<0.1$.

Bond	(1) Industry	(2) Industry	(3) OLS	(4) Firm	(5) Firm-Industry	(6) Quarter	(7) IV 1st	(8) IV 2nd	(9) Industry
Competition		0.199**	0.142	0.110*	0.110*	0.138***		0.106*	-0.171**
		(0.076)	(0.095)	(0.055)	(0.055)	(0.025)		(0.056)	(0.078)
Profit	0.405**	0.404**	0.419	0.024	0.024	0.470***	-0.035**	0.417***	-1.281
	(0.182)	(0.182)	(0.285)	(0.103)	(0.103)	(0.170)	(0.015)	(0.113)	(0.857)
Size	-0.423***	-0.423***	-0.412***	-0.136***	-0.136***	-0.366***	0.005***	-0.412***	-0.267***
	(0.012)	(0.012)	(0.019)	(0.029)	(0.029)	(0.013)	(0.001)	(0.006)	(0.019)
Tangible	0.216*	0.214*	0.515***	0.050	0.050	0.403***	0.211***	0.525***	-0.050
	(0.128)	(0.128)	(0.184)	(0.111)	(0.111)	(0.076)	(0.007)	(0.058)	(0.224)
MV/BV	-0.277***	-0.278***	-0.305***	-0.227***	-0.227***	-0.256***	0.026***	-0.304***	-0.222***
	(0.020)	(0.020)	(0.043)	(0.022)	(0.022)	(0.019)	(0.002)	(0.014)	(0.062)
Investment	-0.028	-0.031	0.199	-1.201**	-1.201**	0.139	0.233***	0.216	-3.726**
	(0.566)	(0.566)	(0.647)	(0.584)	(0.584)	(0.330)	(0.039)	(0.295)	(1.507)
Z-Score	-0.113***	-0.113***	-0.126***	-0.038***	-0.038***	-0.119***	-0.006***	-0.127***	-0.153***
	(0.007)	(0.007)	(0.016)	(0.008)	(0.008)	(0.007)	(0.001)	(0.005)	(0.024)
Current Ratio	-0.087***	-0.088***	-0.086**	-0.035**	-0.035**	-0.102***	0.010***	-0.086***	-0.160***
	(0.011)	(0.011)	(0.034)	(0.013)	(0.013)	(0.010)	(0.001)	(0.011)	(0.026)
Age	0.028	0.028	0.035	-0.009	-0.009	0.022	-0.005**	0.035**	
	(0.017)	(0.017)	(0.045)	(0.157)	(0.157)	(0.013)	(0.002)	(0.015)	
Cash	-1.422***	-1.424***	-1.370***	0.013	0.013	-1.296***	0.151***	-1.359***	
	(0.098)	(0.098)	(0.276)	(0.099)	(0.099)	(0.097)	(0.011)	(0.084)	
Tax	-19.105***	-19.092***	-20.736***	-2.282	-2.282	-17.170***	-1.883***	-20.863***	
	(3.231)	(3.221)	(3.148)	(1.829)	(1.829)	(2.182)	(0.227)	(1.705)	
Earnings Volatility	0.301	0.301	0.582	0.184	0.184	0.651***	-0.050**	0.578***	
	(0.197)	(0.197)	(0.384)	(0.148)	(0.148)	(0.184)	(0.020)	(0.150)	
Growth (S&P500)	3.679*	3.671*	3.691***	3.201*	3.201*		-0.003	3.691***	4.062*
	(2.154)	(2.152)	(0.287)	(1.734)	(1.734)		(0.045)	(0.339)	(2.156)
Growth (GDP)	8.933	8.959	8.636***	13.815	13.815		-0.363	8.632**	17.708
	(22.358)	(22.327)	(2.630)	(17.021)	(17.021)		(0.482)	(3.609)	(21.221)
Term Spread	1.118***	1.116***	1.116***	1.051***	1.051***		0.004**	1.116***	1.207***
	(0.083)	(0.083)	(0.028)	(0.072)	(0.072)		(0.002)	(0.015)	(0.074)
Credit Spread	0.348	0.345	0.308***	0.560**	0.560**		0.002	0.309***	0.259
	(0.327)	(0.326)	(0.073)	(0.252)	(0.252)		(0.007)	(0.054)	(0.313)
HHI_2001 (IV)							-1.847***		
							(0.014)		
CEO Tenure									0.000
									(0.002)
Executive Incentives									0.039
									(0.031)
Executive Ownership									-0.285
									(0.383)
Institutional Own.									-0.320***
									(0.069)
Institutional Breath									0.299***
									(0.076)
Constant	6.211***	6.083***	5.999***	4.390***	4.390***	8.363***	0.769***	6.014***	5.035***
	(0.447)	(0.432)	(0.259)	(0.798)	(0.798)	(0.071)	(0.014)	(0.108)	(0.462)
Observations	43,857	43,857	43,857	43,857	43,857	43,857	43,857	43,857	9,996
Adjusted R-squared	0.374	0.374	0.338	0.840	0.840	0.383	0.331	0.337	0.466
No. of Firms	4309	4309	4309	4309	4309	4309	4309	4309	4309
Predictive Margin	6.012	6.012	6.012	6.012	6.012	6.012		6.012	4.200
Predictive Median	6.030	6.027	6.017	6.113	6.113	5.901		6.016	4.308

Table 20. Analysis about the credit spread (CS) of commercial paper.

Notes: This table presents the results for regression models in Section 3.2. The competition dummy is 1 for the firm with the HHI in the lowest quartile for a year. The dependent variable is the credit spread (CS) of commercial paper. All variables are defined in Section 4.2. Standard errors are clustered by quarters except for IV regressions. ***: $p<0.01$, **: $p<0.05$, *: $p<0.1$.

C. Paper	(1) Industry	(2) Industry	(3) OLS	(4) Firm	(5) Firm-Industry	(6) Quarter	(7) IV 1st	(8) IV 2nd	(9) Industry
Competition		-0.226	-0.448**	0.157	0.157	-0.550***		-0.535***	0.058
		(0.163)	(0.176)	(0.212)	(0.212)	(0.067)		(0.163)	(0.215)
Profit	-12.587***	-12.749***	-22.735***	-4.878*	-4.878*	-17.243***	-3.316***	-22.907***	-20.305***
	(2.596)	(2.582)	(6.296)	(2.796)	(2.796)	(4.182)	(0.821)	(3.007)	(3.492)
Size	-0.291***	-0.296***	-0.360**	0.642***	0.642***	-0.329***	0.069***	-0.352***	-0.242***
	(0.039)	(0.040)	(0.146)	(0.193)	(0.193)	(0.054)	(0.009)	(0.035)	(0.051)
Tangible	-0.655	-0.622	0.517	-0.026	-0.026	0.392*	0.292***	0.538***	-2.358***
	(0.441)	(0.438)	(0.480)	(0.858)	(0.858)	(0.234)	(0.056)	(0.207)	(0.572)
MV/BV	0.063	0.057	-0.110	-0.139	-0.139	-0.332***	0.025	-0.110	0.311***
	(0.083)	(0.084)	(0.150)	(0.133)	(0.133)	(0.099)	(0.021)	(0.078)	(0.089)
Investment	-1.955	-1.885	-2.577	0.390	0.390	-4.409***	0.500	-2.491*	2.289
	(1.599)	(1.597)	(1.988)	(1.551)	(1.551)	(1.231)	(0.348)	(1.277)	(1.787)
Z-Score	-0.150***	-0.150***	-0.179*	-0.029	-0.029	-0.064*	0.070***	-0.172***	-0.052
	(0.050)	(0.050)	(0.100)	(0.069)	(0.069)	(0.036)	(0.013)	(0.048)	(0.065)
Current Ratio	-0.277***	-0.275***	0.039	-0.059	-0.059	-0.074	0.081***	0.045	-0.134*
	(0.082)	(0.082)	(0.139)	(0.096)	(0.096)	(0.090)	(0.021)	(0.076)	(0.072)
Age	0.318***	0.321***	0.378**	1.348***	1.348***	0.253***	-0.185***	0.367***	
	(0.082)	(0.082)	(0.186)	(0.229)	(0.229)	(0.063)	(0.018)	(0.069)	
Cash	2.124***	2.135***	2.807**	0.502	0.502	2.512***	-0.221	2.825***	
	(0.515)	(0.513)	(1.327)	(0.970)	(0.970)	(0.614)	(0.162)	(0.589)	
Tax	5.739	5.725	21.636**	7.571	7.571	22.674**	-3.769**	21.108***	
	(5.703)	(5.678)	(8.674)	(5.210)	(5.210)	(10.387)	(1.727)	(6.369)	
Earnings Volatility	-0.389	-0.843	18.560	3.142	3.142	13.159**	-10.579***	17.666***	
	(4.201)	(4.238)	(12.513)	(3.378)	(3.378)	(5.429)	(1.380)	(5.309)	
Growth (S&P500)	2.328*	2.369*	1.525*	2.316*	2.316*		0.177	1.537*	2.300*
	(1.203)	(1.216)	(0.827)	(1.239)	(1.239)		(0.216)	(0.790)	(1.178)
Growth (GDP)	-2.550	-3.101	5.465	8.696	8.696		-5.081**	4.996	-1.785
	(15.048)	(15.164)	(7.316)	(14.038)	(14.038)		(2.513)	(9.213)	(14.512)
Term Spread	0.644***	0.645***	0.584***	0.700***	0.700***		0.006	0.585***	0.629***
	(0.053)	(0.053)	(0.058)	(0.052)	(0.052)		(0.009)	(0.034)	(0.059)
Credit Spread	-0.125	-0.121	-0.201	0.099	0.099		-0.045	-0.206*	-0.137
	(0.157)	(0.158)	(0.153)	(0.161)	(0.161)		(0.033)	(0.120)	(0.150)
HHI_2001 (IV)							-1.525***		
							(0.068)		
CEO Tenure									-0.004
									(0.006)
Executive Incentives									-0.052
									(0.050)
Executive Ownership									0.558
									(1.576)
Institutional Own.									0.200
									(0.132)
Institutional Breath									-0.149
									(0.115)
Constant	2.111***	2.288***	2.649*	-11.545***	-11.545***	3.985***	0.818***	2.661***	2.719***
	(0.496)	(0.531)	(1.486)	(2.319)	(2.319)	(0.552)	(0.121)	(0.427)	(0.646)
Observations	1,903	1,903	1,903	1,903	1,903	1,903	1,903	1,903	1,187
Adjusted R-squared	0.604	0.604	0.295	0.766	0.766	0.366	0.310	0.294	0.548
No. of Firms	197	197	197	197	197	197	197	197	197
Predictive Margin	0.495	0.495	0.495	0.495	0.495	0.495		0.495	0.491
Predictive Median	2.030	2.047	2.988	-2.439	-2.439	2.508		2.968	1.059

Table 21. Analysis about the credit spread (CS) of capital lease.

Notes: This table presents the results for regression models in Section 3.2. The competition dummy is 1 for the firm with the HHI in the lowest quartile for a year. The dependent variable is the credit spread (CS) of capital lease. All variables are defined in Section 4.2. Standard errors are clustered by quarters except for IV regressions. ***: $p<0.01$, **: $p<0.05$, *: $p<0.1$.

Lease	(1) Industry	(2) Industry	(3) OLS	(4) Firm	(5) Firm-Industry	(6) Quarter	(7) IV 1st	(8) IV 2nd	(9) Industry
Competition		0.633***	0.130	0.170**	0.170**	0.114		0.081	-0.129
		(0.114)	(0.230)	(0.072)	(0.072)	(0.095)		(0.118)	(0.189)
Profit	-1.392***	-1.410***	-2.189***	0.562**	0.562**	-2.139***	-0.034	-2.186***	1.927
	(0.384)	(0.383)	(0.826)	(0.243)	(0.243)	(0.364)	(0.035)	(0.349)	(2.154)
Size	-0.378***	-0.378***	-0.305***	-0.273***	-0.273***	-0.290***	-0.000	-0.305***	-0.074
	(0.021)	(0.020)	(0.052)	(0.061)	(0.061)	(0.010)	(0.001)	(0.013)	(0.084)
Tangible	0.486*	0.496*	1.258***	0.873**	0.873**	1.169***	0.255***	1.272***	-0.624
	(0.265)	(0.265)	(0.479)	(0.388)	(0.388)	(0.134)	(0.013)	(0.138)	(0.491)
MV/BV	-0.115***	-0.116***	-0.112	-0.108***	-0.108***	-0.099***	0.018***	-0.111***	-0.197**
	(0.029)	(0.029)	(0.090)	(0.033)	(0.033)	(0.029)	(0.003)	(0.030)	(0.088)
Investment	-0.350	-0.400	-0.528	-0.782	-0.782	-0.457	0.219***	-0.503	-4.971**
	(0.869)	(0.869)	(1.647)	(0.795)	(0.795)	(0.697)	(0.066)	(0.661)	(2.226)
Z-Score	-0.029**	-0.029**	-0.041	0.013	0.013	-0.044***	-0.002**	-0.041***	-0.092***
	(0.013)	(0.013)	(0.030)	(0.011)	(0.011)	(0.014)	(0.001)	(0.010)	(0.024)
Current Ratio	-0.106***	-0.107***	-0.082	0.013	0.013	-0.085***	-0.003	-0.082***	0.359***
	(0.027)	(0.026)	(0.063)	(0.022)	(0.022)	(0.030)	(0.002)	(0.024)	(0.066)
Age	-0.012	-0.011	-0.046	-0.169	-0.169	-0.043	0.002	-0.046*	
	(0.036)	(0.036)	(0.098)	(0.153)	(0.153)	(0.031)	(0.003)	(0.026)	
Cash	0.372**	0.376**	0.891	-0.107	-0.107	0.942***	0.310***	0.920***	
	(0.186)	(0.186)	(0.596)	(0.218)	(0.218)	(0.212)	(0.020)	(0.209)	
Tax	-7.744**	-7.825**	-2.498	2.267	2.267	-4.817	-1.732***	-2.619	
	(3.302)	(3.293)	(5.812)	(1.613)	(1.613)	(3.566)	(0.342)	(3.435)	
Earnings Volatility	0.310	0.291	0.983	-0.006	-0.006	0.891	-0.043	0.979**	
	(0.671)	(0.670)	(0.989)	(0.216)	(0.216)	(0.730)	(0.050)	(0.499)	
Growth (S&P500)	2.136	2.129	2.224***	1.687	1.687		-0.047	2.222***	0.255
	(1.910)	(1.897)	(0.655)	(1.436)	(1.436)		(0.076)	(0.760)	(2.084)
Growth (GDP)	19.027	19.088	19.557***	11.946	11.946		0.307	19.567**	22.193
	(19.751)	(19.606)	(6.045)	(14.455)	(14.455)		(0.827)	(8.268)	(19.879)
Term Spread	1.126***	1.118***	1.142***	0.877***	0.877***		0.006**	1.142***	1.086***
	(0.072)	(0.072)	(0.054)	(0.068)	(0.068)		(0.003)	(0.026)	(0.084)
Credit Spread	0.411	0.403	0.428**	0.299	0.299		0.032**	0.430***	-0.000
	(0.296)	(0.295)	(0.178)	(0.209)	(0.209)		(0.013)	(0.128)	(0.263)
HHI_2001 (IV)							-2.084***		
							(0.025)		
CEO Tenure									-0.013**
									(0.005)
Executive Incentives									0.092
									(0.068)
Executive Ownership									6.316***
									(1.719)
Institutional Own.									0.764***
									(0.233)
Institutional Breath									0.891**
									(0.346)
Constant	6.406***	5.992***	5.566***	6.472***	6.472***	7.870***	0.757***	5.585***	3.173***
	(0.422)	(0.430)	(0.666)	(0.701)	(0.701)	(0.106)	(0.023)	(0.226)	(0.929)
Observations	17,125	17,125	17,125	17,125	17,125	17,125	17,125	17,125	3,496
Adjusted R-squared	0.240	0.241	0.166	0.889	0.889	0.179	0.359	0.166	0.505
No. of Firms	2664	2664	2664	2664	2664	2664	2664	2664	2664
Predictive Margin	6.500	6.500	6.500	6.500	6.500	6.500		6.500	5.026
Predictive Median	7.149	7.152	7.133	6.992	6.992	6.562		7.134	5.504

Table 22. Analysis about the credit spread (CS) of other borrowings.

Notes: This table presents the results for regression models in Section 3.2. The competition dummy is 1 for the firm with the HHI in the lowest quartile for a year. The dependent variable is the credit spread (CS) of other borrowings. All variables are defined in Section 4.2. Standard errors are clustered by quarters except for IV regressions. ***: $p<0.01$, **: $p<0.05$, *: $p<0.1$.

Other D.	(1) Industry	(2) Industry	(3) OLS	(4) Firm	(5) Firm-Industry	(6) Quarter	(7) IV 1st	(8) IV 2nd	(9) Industry
Competition		0.775***	0.352	0.049	0.049	0.366***		0.001	0.393
		(0.226)	(0.332)	(0.215)	(0.215)	(0.094)		(0.194)	(0.374)
Profit	-1.057	-1.067	-1.201	0.305	0.305	-1.245*	-0.121**	-1.208**	6.207
	(0.644)	(0.644)	(1.154)	(0.280)	(0.280)	(0.640)	(0.057)	(0.559)	(6.278)
Size	-0.354***	-0.354***	-0.433***	-0.317***	-0.317***	-0.383***	0.003	-0.431***	-0.407***
	(0.028)	(0.027)	(0.062)	(0.091)	(0.091)	(0.023)	(0.002)	(0.022)	(0.102)
Tangible	0.812***	0.820***	1.095*	0.972***	0.972***	0.997***	0.225***	1.200***	-1.154
	(0.285)	(0.284)	(0.654)	(0.285)	(0.285)	(0.210)	(0.023)	(0.232)	(1.065)
MV/BV	-0.121*	-0.121*	-0.178	-0.078	-0.078	-0.107*	-0.002	-0.172***	0.479**
	(0.067)	(0.067)	(0.168)	(0.053)	(0.053)	(0.058)	(0.006)	(0.055)	(0.200)
Investment	3.656**	3.649**	1.621	-0.812	-0.812	1.821	0.236*	1.764	0.064
	(1.573)	(1.574)	(2.347)	(0.650)	(0.650)	(1.410)	(0.123)	(1.220)	(2.462)
Z-Score	-0.220***	-0.221***	-0.194***	0.020	0.020	-0.171***	-0.007***	-0.201***	-0.285**
	(0.031)	(0.030)	(0.060)	(0.020)	(0.020)	(0.032)	(0.002)	(0.023)	(0.129)
Current Ratio	0.316***	0.320***	0.330**	0.017	0.017	0.318***	0.008	0.318***	0.694***
	(0.058)	(0.058)	(0.148)	(0.038)	(0.038)	(0.062)	(0.005)	(0.053)	(0.118)
Age	-0.076	-0.079	-0.040	0.591*	0.591*	-0.072	-0.010*	-0.052	
	(0.063)	(0.063)	(0.220)	(0.327)	(0.327)	(0.063)	(0.006)	(0.059)	
Cash	1.625***	1.639***	1.568	0.680**	0.680**	1.540***	0.270***	1.776***	
	(0.466)	(0.467)	(1.211)	(0.272)	(0.272)	(0.406)	(0.041)	(0.418)	
Tax	0.281	0.302	1.900	4.613**	4.613**	3.210	-2.486***	0.736	
	(6.363)	(6.327)	(9.150)	(2.081)	(2.081)	(6.294)	(0.665)	(6.605)	
Earnings Volatility	-5.726***	-5.759***	-5.678***	-0.416	-0.416	-5.331***	0.102	-5.670***	
	(0.729)	(0.726)	(2.070)	(0.513)	(0.513)	(0.739)	(0.075)	(0.741)	
Growth (S&P500)	2.337	2.341	2.621***	2.356	2.356		0.090	2.654**	3.931**
	(1.950)	(1.949)	(0.998)	(1.461)	(1.461)		(0.121)	(1.193)	(1.795)
Growth (GDP)	7.480	8.006	1.354	12.961	12.961		-0.689	1.271	19.839
	(22.222)	(22.317)	(10.367)	(14.664)	(14.664)		(1.331)	(13.166)	(19.006)
Term Spread	1.090***	1.090***	1.125***	0.954***	0.954***		0.010*	1.127***	0.968***
	(0.078)	(0.077)	(0.091)	(0.070)	(0.070)		(0.005)	(0.054)	(0.070)
Credit Spread	0.160	0.164	-0.126	0.212	0.212		0.016	-0.111	0.438
	(0.302)	(0.302)	(0.227)	(0.215)	(0.215)		(0.020)	(0.194)	(0.268)
HHI_2001 (IV)							-2.206***		
							(0.043)		
CEO Tenure									0.017*
									(0.010)
Executive Incentives									-0.041
									(0.085)
Executive Ownership									-12.420***
									(1.991)
Institutional Own.									-0.194
									(0.201)
Institutional Breath									0.154
									(0.188)
Constant	4.922***	4.411***	5.321***	2.831**	2.831**	7.227***	0.839***	5.507***	3.842***
	(0.560)	(0.612)	(1.247)	(1.394)	(1.394)	(0.261)	(0.039)	(0.400)	(0.944)
Observations	5,121	5,121	5,121	5,121	5,121	5,121	5,121	5,121	1,609
Adjusted R-squared	0.413	0.414	0.237	0.874	0.874	0.261	0.399	0.235	0.510
No. of Firms	798	798	798	798	798	798	798	798	798
Predictive Margin	5.482	5.482	5.482	5.482	5.482	5.482		5.482	3.940
Predictive Median	6.097	6.142	6.249	5.827	5.827	6.188		6.228	4.572

6   Conclusion

In conclusion, the study is the first to investigate firms' decisions of *debt* structure and leverage under the impact of the *external* pressure that is imposed by exogenous product market competition and bank debt. Using the details of corporate debt structure, we illustrate that the firms in a more competitive product market significantly raises the public debt of bonds and notes as well other borrowings in the public market. The final effect is that when the firms are in a more competitive product market and produce more profits, they raise their leverage through increasing their total public debt for weakening the external pressures of bank monitoring from bank debt. Namely, product market competition attenuates the negative relationship between the firms' profits and leverage and public debt. The underlying reason is that the firms that make profits in an intensive competition environment in fact are in an advantage position to borrowing higher debt and taking higher leverage.

We find that the relationships between product market competition and the credit spread of revolving credit/term loans/bonds and notes/capital lease/other borrowings are all significantly positive. The underlying mechanism is that when the product market competition is high, firms have to pay higher credit spreads for borrowing various types of debt from banks or from the public market. The credit spreads of bank debt rise due to the bank monitoring imposed by banks in a more competitive environment. The credit spreads of public debt increase in a more competitive environment as the firms have to reduce the external monitoring pressure by shifting bank debt to public debt and paying larger costs for public debt.

Appendix A   Additional results

This appendix collects additional results.

A.1 Outputs for sample selection

We investigate the differences of total debt between the two data sources: the variable *Debt* from Compustat and the variable *Debt2* from Capital IQ. A comparison of the two debt variables in Fig. 5 exhibits a number of large differences. Besides, Fig. 6 compares the frequencies of missing values for the three key variables of *HHI*, *Profit*, and *BL (Book Leverage)* before taking lag operations (the left panel) and after lag operations (the right panel). It shows that *BL* keeps the numbers of missing observations at 4,502, which come from the original 16,869 missing *Debt* values as shown by Fig. 5. *HHI* and *Profit* leads to 62,513 and 67,455 missing observations. Note that both *HHI* and *Profit* share 60,275 common missing observations.

```
. compare Debt Debt2
```

	count	minimum	difference average	maximum
Debt<Debt2	211320	-5.79e+07	-28633.32	-9.31e-10
Debt=Debt2	59336			
Debt>Debt2	62433	9.31e-10	3367.268	2999461
jointly defined	333089	-5.79e+07	-17534.54	2999461
Debt missing only	16869			
total	349958			

Figure 5. Comparison of debt values from two data sources.

Fig. 5 exhibits the discrepancies of debt values from Compustat (*Debt*) and Capita IQ (*Debt2*).

```
Missing for
      which
  variables? |   Freq.      Percent       Cum.
-------------+----------------------------------
          1__|        3        0.00        0.00
          _23|    3,766        2.56        2.56
          _2_|    6,390        4.34        6.90
          __3|      736        0.50        7.40
          ___|  136,288       92.60      100.00
-------------+----------------------------------
       Total |  147,183      100.00
```

(a) Before Taking Lags

. misschk HHI Profit BL

Variables examined for missing values

```
    #  Variable       # Missing   % Missing
    ------------------------------------------
    1  HHI                62513       42.5
    2  Profit             67455       45.8
    3  BL                  4502        3.1
```

```
Missing for
      which
  variables? |   Freq.      Percent       Cum.
-------------+----------------------------------
          123|    2,236        1.52        1.52
          12_|   60,275       40.95       42.47
          1__|        2        0.00       42.47
          _23|    1,279        0.87       43.34
          _2_|    3,665        2.49       45.83
          __3|      987        0.67       46.50
          ___|   78,739       53.50      100.00
-------------+----------------------------------
       Total |  147,183      100.00
```

(b) After Taking Lags

Figure 6. Frequencies of missing values for three main variables.

This figure displays the frequencies of missing values for three main variables.

A.2   Summary statistics before and after winsorization

Table 23. Summary statistics of firm characteristics before winsoring the tails

Notes. This table displays the summary statistics of firm characteristics before winsoring the tails.

Stats	Profit	Size	Tangible	MV/BV	Investment	Z-Score	Current R.	Age	Cash	Tax	Earn. Vol.
N	78,739	78,739	78,739	78,739	78,739	78,739	78,739	78,739	78,739	78,739	78,739
mean	-0.72502	4.35677	0.30940	88.13356	0.03742	-1.6e+02	2.41071	3.22518	0.19896	0.00089	0.95543
sd	39.83755	3.45629	0.29563	4.7e+03	0.30771	3.4e+03	8.12890	1.08012	0.25224	0.13059	55.78851
min	-9.0e+03	-7.84810	0.0	0.0	-0.92647	-4.2e+05	-0.00037	0.0	-0.04605	-3.0e+01	0.0
p1	-6.80000	-5.47241	0.0	0.0	0.0	-1.9e+03	0.0	0.0	0.0	-0.04077	0.0
p5	-0.83995	-2.01670	0.00049	0.16724	0.0	-8.7e+01	0.02210	0.69315	0.00162	-0.00667	0.00141
p25	-0.04855	2.30363	0.06095	0.77981	0.00316	-0.94655	0.76150	2.70805	0.02730	0.0	0.00493
p50	0.01500	4.75625	0.19939	1.25453	0.01293	0.77593	1.47981	3.89182	0.09006	0.00001	0.01190
p75	0.03426	6.77259	0.51097	2.53207	0.03625	2.34505	2.55281	3.98898	0.25852	0.00446	0.03688
p95	0.06698	9.45768	0.90204	25.62271	0.13759	9.78411	7.42244	4.04305	0.82626	0.01565	0.63538
p99	0.12195	11.10628	0.98115	4.1e+02	0.32673	47.68437	17.38726	4.06044	0.97980	0.03452	7.29127
max	21.75000	12.88891	2.45384	9.8e+05	63.33333	1.0e+05	1.4e+03	4.06044	1.00000	1.59264	1.4e+04

Table 24. Summary statistics of firm characteristics after winsoring the tails

Notes. This table displays the summary statistics of firm characteristics after winsoring the tails.

Stats	Profit	Size	Tangible	MV/BV	Investment	Z-Score	Current R.	Age	Cash	Tax	Earn. Vol.
N	78,739	78,739	78,739	78,739	78,739	78,739	78,739	78,739	78,739	78,739	78,739
mean	-0.06726	4.36188	0.30928	1.81748	0.03247	0.38940	2.00596	3.22518	0.19880	0.00205	0.06876
sd	0.21816	3.41510	0.29530	1.44081	0.05394	4.26348	1.88322	1.08012	0.25172	0.00861	0.15299
min	-0.83995	-5.47241	0.0	0.0	0.0	-6.96727	0.0	0.0	0.0	-0.04077	0.0
p1	-0.83995	-5.47241	0.0	0.0	0.0	-6.96727	0.0	0.0	0.0	-0.04077	0.0
p5	-0.83995	-2.01670	0.00049	0.16724	0.0	-6.96727	0.02210	0.69315	0.00162	-0.00667	0.00141
p25	-0.04855	2.30363	0.06095	0.77981	0.00316	-0.94655	0.76150	2.70805	0.02730	0.0	0.00493
p50	0.01500	4.75625	0.19939	1.25453	0.01293	0.77593	1.47981	3.89182	0.09006	0.00001	0.01190
p75	0.03426	6.77259	0.51097	2.53207	0.03625	2.34505	2.55281	3.98898	0.25852	0.00446	0.03688
p95	0.06698	9.45768	0.90204	4.55641	0.13759	9.78411	7.42244	4.04305	0.82626	0.01565	0.63538
p99	0.12195	11.10628	0.98115	4.55641	0.32673	9.78411	7.42244	4.06044	0.97980	0.03452	0.63538
max	0.12195	11.10628	0.98115	4.55641	0.32673	9.78411	7.42244	4.06044	0.97980	0.03452	0.63538

Table 25. Summary statistics of executive characteristics before winsoring the tails

Notes. This table displays the summary statistics of executive characteristics before winsorization.

Stats	CEO Tenure	Executive Incentive	Executive Own.
N	19,608	19,950	20,329
mean	8.08701	0.25899	0.03183
sd	8.08818	1.80711	0.07357
min	0.0	-1.0	0.0
p1	0.0	-0.80013	0.0
p5	0.0	-0.55189	0.0
p25	3.0	-0.16682	0.00131
p50	6.0	0.04829	0.00936
p75	11.0	0.32856	0.02847
p95	25.0	1.53221	0.14312
p99	39.0	3.92533	0.43848
max	59.0	1.1e+02	1.46681

Table 26. Summary statistics of executive characteristics after winsoring the tails

Notes. This table displays the summary statistics of executive characteristics after winsorization.

Stats	CEO Tenure	Executive Incentive	Executive Own.
N	19,608	19,950	20,329
mean	8.03131	0.20031	0.03060
sd	7.84292	0.71849	0.06473
min	0.0	-0.80013	0.0
p1	0.0	-0.80013	0.0
p5	0.0	-0.55189	0.0
p25	3.0	-0.16682	0.00131
p50	6.0	0.04829	0.00936
p75	11.0	0.32856	0.02847
p95	25.0	1.53221	0.14312
p99	39.0	3.92533	0.43848
max	39.0	3.92533	0.43848

Table 27. Summary statistics of the debt structure before winsoring the tails

Notes. This table displays the summary statistics of the debt structure before winsoring the tails.

Stats	Leverage	BankDebt	Public Debt	Credit	Loan	Bond	Paper	Lease	Other
N	78,739	55,771	62,863	28,910	44,268	47,309	3,128	29,287	17,593
mean	4.60838	1.46766	3.92206	0.24929	1.68622	3.80739	0.03611	0.03556	3.71025
sd	1.3e+02	24.01809	1.1e+02	3.11404	26.56892	58.14064	0.03865	0.15538	1.3e+02
min	0.0	0.0	0.0	0.0	0.0	0.0	0.00002	0.0	0.0
p1	0.00066	0.00049	0.00016	0.00026	0.00033	0.00071	0.00043	0.00004	0.00002
p5	0.00683	0.00454	0.00132	0.00266	0.00302	0.00593	0.00220	0.00022	0.00015
p25	0.12612	0.05312	0.03721	0.02425	0.03744	0.08540	0.00959	0.00192	0.00217
p50	0.29246	0.16109	0.17188	0.06700	0.13327	0.20599	0.02363	0.00793	0.01234
p75	0.53113	0.33742	0.36221	0.15916	0.32053	0.40653	0.04880	0.02980	0.07210
p95	3.55360	1.19677	2.70617	0.38481	1.47186	4.16088	0.11620	0.15322	0.40036
p99	47.66666	17.20930	38.34550	0.94176	20.80385	50.26611	0.19586	0.41519	5.18945
max	2.4e+04	2.7e+03	1.6e+04	1.7e+02	2.7e+03	4.9e+03	0.28926	14.85159	1.2e+04

Table 28. Summary statistics of the debt structure after winsoring the tails

Notes. This table displays the summary statistics of the debt structure before winsoring the tails.

Stats	Leverage	BankDebt	Public Debt	Credit	Loan	Bond	Paper	Lease	Other
N	78,739	55,771	62,863	28,910	44,268	47,309	3,128	29,287	17,593
mean	0.37050	0.24770	0.26783	0.11959	0.23673	0.30809	0.03611	0.03386	0.08622
sd	0.30787	0.26443	0.29671	0.15326	0.27602	0.30468	0.03865	0.07994	0.18806
min	0.0	0.0	0.0	0.0	0.0	0.0	0.00002	0.0	0.0
p1	0.00066	0.00049	0.00016	0.00026	0.00033	0.00071	0.00043	0.00004	0.00002
p5	0.00683	0.00454	0.00132	0.00266	0.00302	0.00593	0.00220	0.00022	0.00015
p25	0.12612	0.05312	0.03721	0.02425	0.03744	0.08540	0.00959	0.00192	0.00217
p50	0.29246	0.16109	0.17188	0.06700	0.13327	0.20599	0.02363	0.00793	0.01234
p75	0.53113	0.33742	0.36221	0.15916	0.32053	0.40653	0.04880	0.02980	0.07210
p95	1.0	1.0	1.0	0.38481	1.0	1.0	0.11620	0.15322	0.40036
p99	1.0	1.0	1.0	0.94176	1.0	1.0	0.19586	0.41519	1.0
max	1.0	1.0	1.0	1.0	1.0	1.0	0.28926	1.0	1.0

A.3 Correlation table and the distributions of credit spreads

Table 29 lists the correlation of debt structure and firm characteristics. Commercial papers from the public market are negatively correlated with the revolving credit and term loans of bank debt as well as the bonds and notes and capital lease of public debt. As one of bank debt, revolving credit is positively correlated with the other four types of debt, except for commercial papers. The term loans of bank debt are positively correlated with the three types of public debt: bonds and notes, capital leases, and other borrowings. Note that there is no multicollinearity issue among the variables. Some large correlation coefficients among the first 13 variables are expected, e.g., loans and bonds that are highly correlated with leverage as parts of debt. These correlations are acceptable and are not multicollinear since all of them are dependent (LHS) variables in their own regression specifications only. They are not part of independent (RHS) variables.

Figs. 7, 8, and 9 demonstrate the frequencies of credit spreads for six types of debt. The histograms display descriptive statistics in the upper right corner. In the bottom of each histogram, it displays the mean and points away from the mean by three different standard deviations. The left end and right end shows the minimum and maximum points. The credit spreads of revolving credit, commercial papers, and capital leases exhibit large peaks. Capital leases and other borrowings have large right tail values of credit spreads. The credit spreads of term loans and bonds and notes fit to the normal distribution better than the credit spreads of other types of debt.

Table 29. Correlation of debt structure, credit spreads, and firm characteristics

Notes. Table 29 displays the correlation of debt structure, credit spreads, and firm characteristics during 2002 to 2019. Section 4.2 gives the definition of the variables. The symbol * means $p < 0.05$. Note that there is no multicollinearity issue among the variables. Some large correlation coefficients among the first 13 variables are expected, e.g., loans and bonds that are highly correlated with leverage as parts of debt. These correlations are acceptable and are not multicollinear since all of them are dependent (LHS) variables in their own regression specifications only. They are not part of independent (RHS) variables.

|	Credit	Loan	Bond	Paper	Lease	Other	Credit CS	Loan CS	Bond CS	Paper CS	Lease CS	Other CS	Leverage	HHI	Profit	Size	Tangible	MV/BV	Investment	Z-Score	Current R.	Age	Cash	Tax	Earn. Vol.
Credit	1.00																								
Loan	0.07*	1.00																							
Bond	0.14*	0.38*	1.00																						
Paper	-0.07*	-0.16*	0.07*	1.00																					
Lease	0.08*	0.08*	0.09*	-0.05*	1.00																				
Other	0.21*	0.36*	0.35*	0.09*	0.28*	1.00																			
Credit CS	0.20*	0.17*	0.20*	0.02	0.02	0.25*	1.00																		
Loan CS	0.22*	0.23*	0.20*	0.19*	0.06*	0.21*	0.54*	1.00																	
Bond CS	0.17*	0.25*	0.27*	-0.17*	0.02*	0.16*	0.34*	0.45*	1.00																
Paper CS	0.38*	0.04	0.01	0.01	-0.03	0.01	0.37*	0.34*	0.44*	1.00															
Lease CS	0.06*	0.09*	0.10*	-0.18*	-0.00	0.20*	0.38*	0.40*	0.37*	0.21*	1.00														
Other CS	0.19*	0.11*	0.07*	-0.06	0.16*	0.24*	0.36*	0.47*	0.48*	0.42*	0.31*	1.00													
Leverage	0.35*	0.73*	0.83*	0.20*	0.26*	0.46*	0.22*	0.17*	0.28*	0.01	0.09*	0.15*	1.00												
HHI	0.02*	-0.06*	-0.09*	0.05*	-0.01	-0.10*	-0.07*	-0.10*	-0.04*	0.09*	-0.06*	-0.09*	-0.03*	1.00											
Profit	-0.37*	-0.47*	-0.54*	0.15*	-0.16*	-0.52*	-0.31*	-0.25*	-0.28*	-0.23*	-0.15*	-0.19*	-0.41*	0.09*	1.00										
Size	-0.41*	-0.45*	-0.46*	-0.28*	-0.16*	-0.44*	-0.38*	-0.40*	-0.43*	-0.17*	-0.23*	-0.36*	-0.29*	0.07*	0.68*	1.00									
Tangible	0.05*	-0.04*	-0.14*	-0.11*	0.16*	-0.04*	0.03*	0.07*	0.04*	0.02	0.06*	0.07*	-0.00	-0.06*	0.17*	0.41*	1.00								
MV/BV	0.22*	0.37*	0.46*	0.27*	0.10*	0.33*	0.08*	0.15*	0.11*	-0.19*	0.02*	0.11*	0.28*	-0.12*	-0.55*	-0.26*	0.02*	1.00							
Investment	0.01*	-0.02*	-0.07*	-0.05*	-0.01*	0.01	-0.00	0.03*	0.01	-0.05*	0.06*	0.05*	-0.03*	-0.07*	0.05*	0.43*	-0.05*	0.06*	1.00						
Z-Score	-0.30*	-0.45*	-0.53*	0.11*	-0.15*	-0.40*	-0.37*	-0.29*	-0.36*	-0.16*	-0.13*	-0.24*	-0.52*	0.06*	0.47*	0.00	-0.12*	0.06*	-0.12*	1.00					
Current R.	-0.14*	-0.26*	-0.27*	-0.14*	-0.08*	-0.22*	-0.14*	-0.10*	-0.20*	0.05*	-0.05*	0.04*	-0.40*	-0.03*	0.20*	-0.21*	0.00	-0.08*	-0.00	0.45*	1.00				
Age	-0.00	0.00	0.08*	0.00	-0.01	-0.00	0.05*	0.04*	0.06*	0.03	0.01	-0.05*	0.07*	0.05*	-0.10*	0.11*	0.02*	0.01*	-0.12*	-0.12*	-0.20*	1.00			
Cash	0.05*	0.12*	0.21*	-0.01	0.00	0.19*	0.08*	0.11*	0.00	0.02	0.03*	0.16*	-0.05*	-0.17*	-0.32*	-0.40*	0.41*	-0.14*	-0.00	-0.33*	0.47*	-0.18*	1.00		
Tax	-0.06*	-0.10*	-0.10*	0.16*	-0.04*	-0.07*	-0.12*	-0.14*	-0.17*	-0.10*	-0.04*	-0.10*	-0.11*	0.06*	0.18*	-0.04*	0.02*	0.01	0.20*	0.03*	0.01	-0.20*	0.47*	1.00	
Earn. Vol.	0.35*	0.44*	0.52*	0.02	0.14*	0.51*	0.27*	0.22*	0.27*	0.12*	0.14*	0.14*	0.40*	-0.06*	-0.79*	-0.14*	0.51*	-0.03*	-0.41*	-0.22*	-0.10*	0.13*	0.27*	-0.10*	1.00
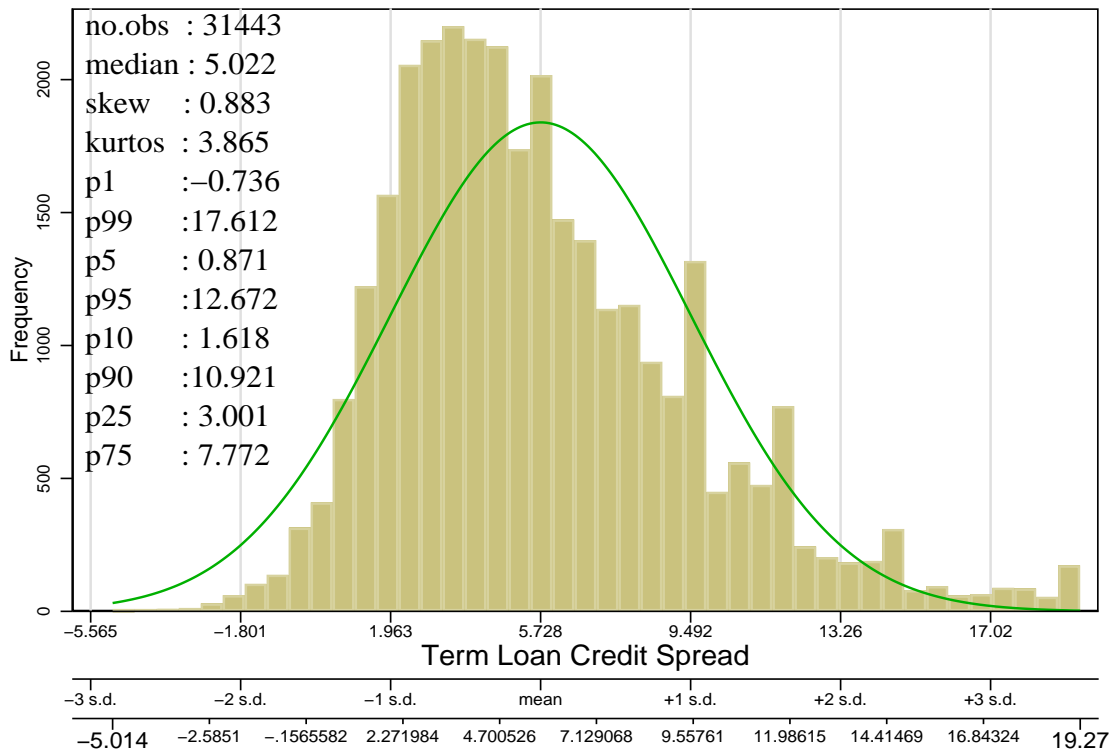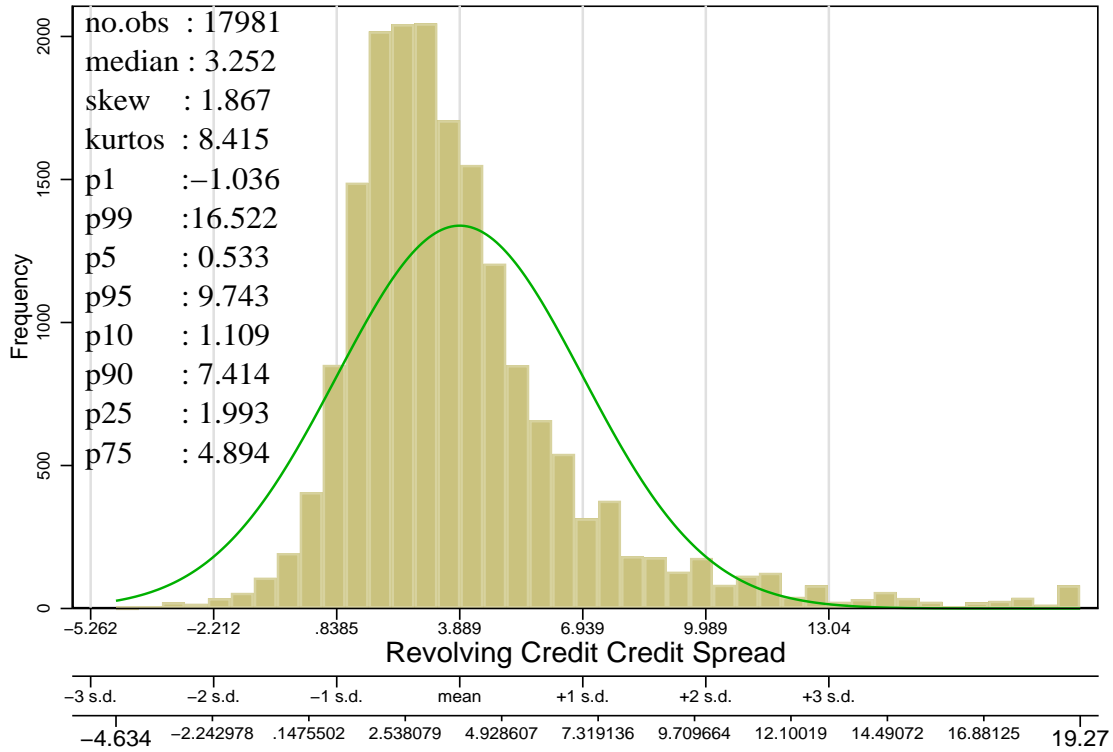
Figure 7. Frequency of credit spreads for six types of debt - Part 1/3.

Fig. 7 plots the frequencies of credit spreads for revolving credit, term loans. The number of observations varies as firms do not take some types of debts sometimes.
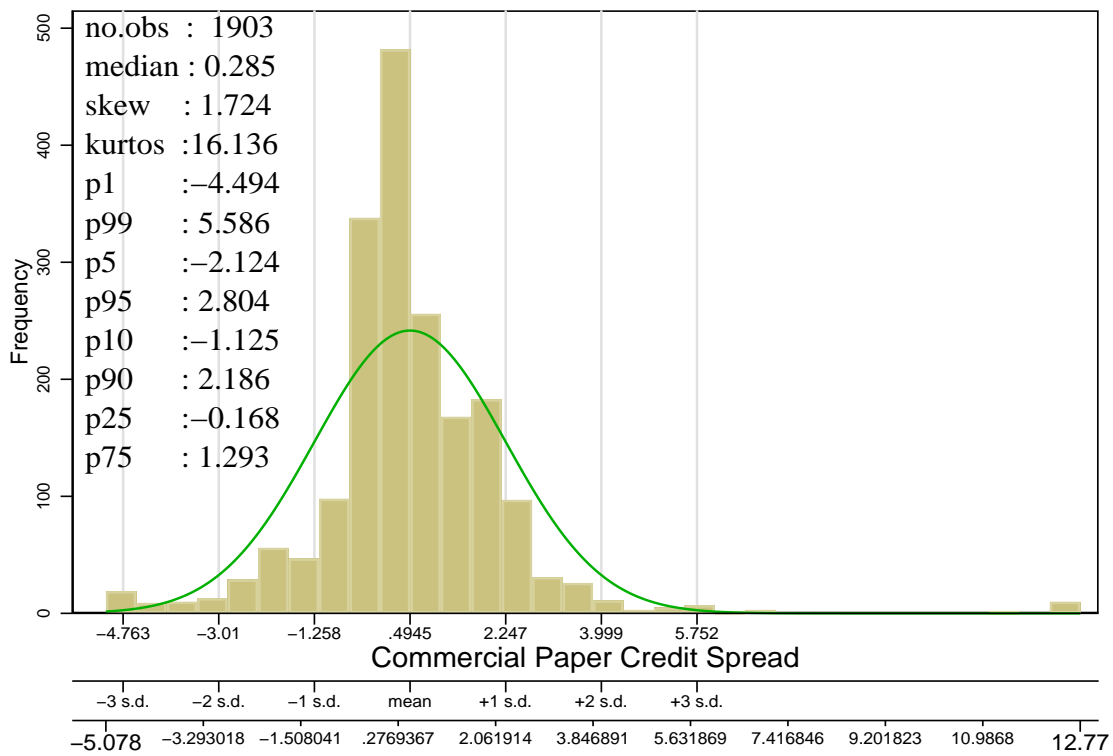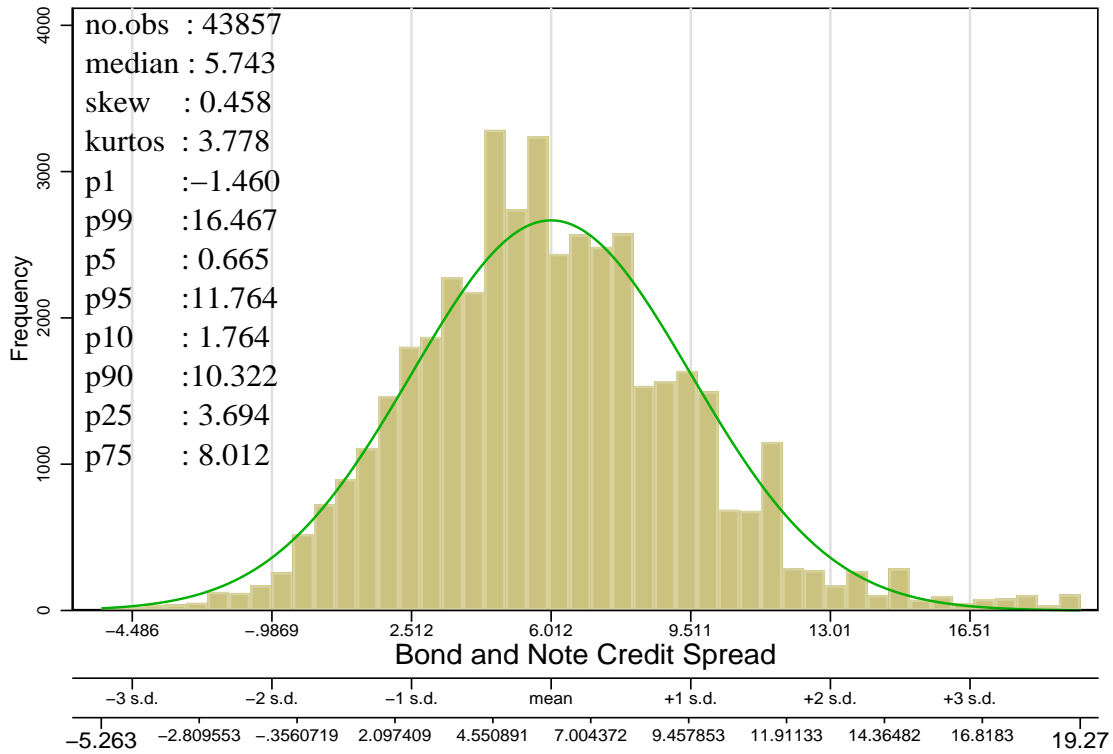
Figure 8. Frequency of credit spreads for six types of debt - Part 2/3.

Fig. 8 plots the frequencies of credit spreads for bonds and notes, commercial papers. The number of observations varies as firms do not take some types of debts sometimes.
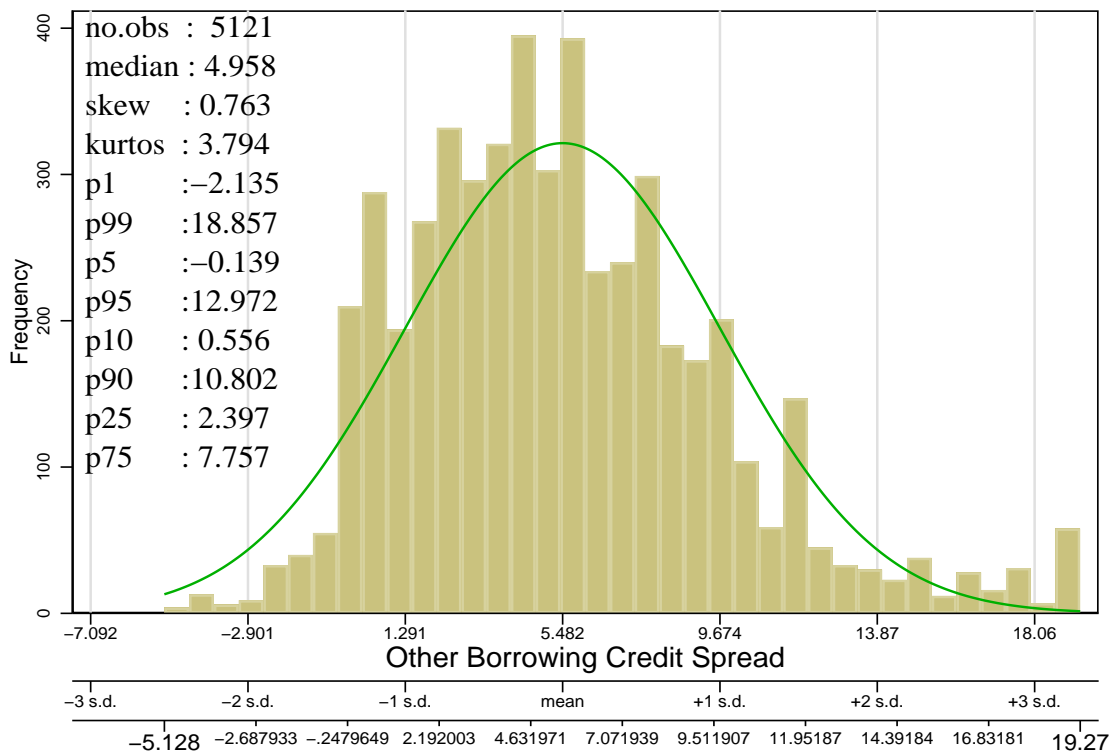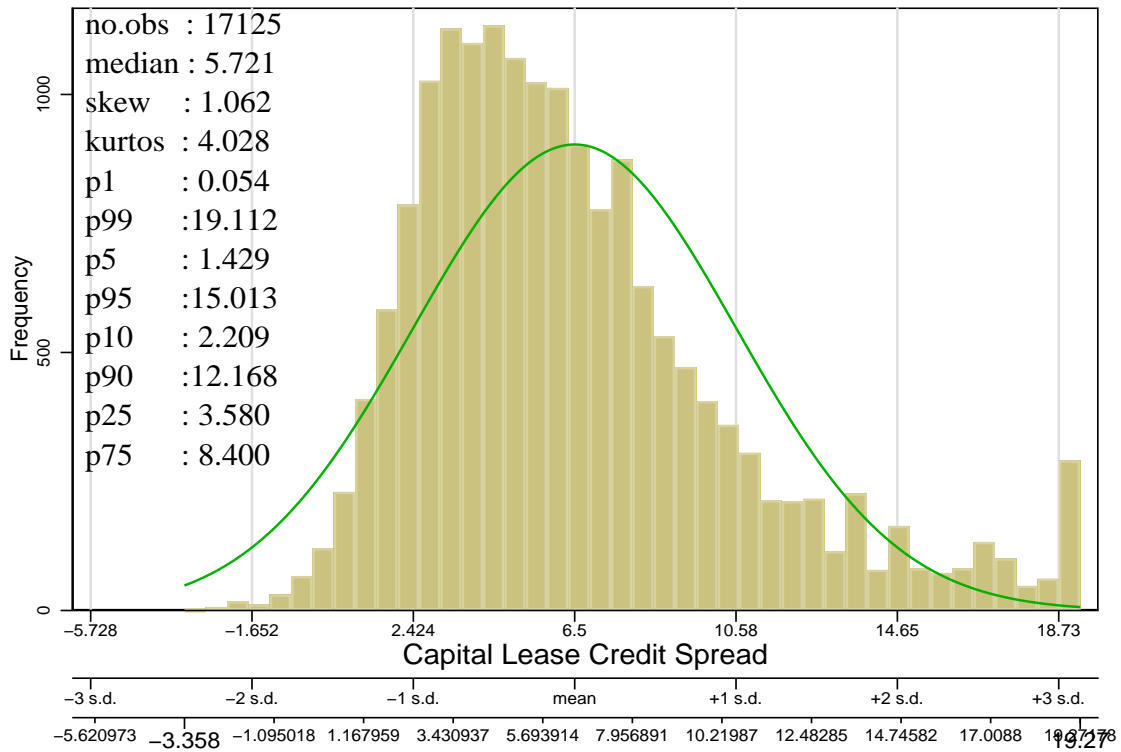
Figure 9. Frequency of credit spreads for six types of debt - Part 3/3.

Fig. 9 plots the frequencies of credit spreads for capital leases, and other borrowings. The number of observations varies as firms do not take some types of debts sometimes.

A.4   A comparison of four empirical settings

We summarize the similarities and differences among four empirical settings: (1) using the dummy *Competition* as the key independent variable and dropping the observations with the differences of total *Debt* between two data sources of Compustat and Capital IQ being over 10%; (2) Replacing *Competition* by HHI in "(1)"; (3) using *Competition* and keeping the observations with the differences and using the average of values from the two data sources when their differences are larger than 10%; (4) Replacing *Competition* by HHI in "(3)". We report the results from Case (1) in the text. The results of other cases are provided upon request.

Comparing Cases (1) and (3), we find that keeping the observations with large discrepancies leads to worse outputs since the large differences are likely due to problematic samples. It is not appropriate to give arbitrary criteria in levels (rather than the 10% used above) or to impute debt values by the averages of the two sources because there are many observations with large differences.

Comparing Cases (2) and (4), we find that the implications and conclusions from the regressions with the HHI are similar to those using *Competition*. The results from various models including the Tobit model, OLS, fixed effects, IV are all similar between the two cases. Note that we focus on the results from the Tobit model in the regressions of debt ratios. Other models are provided as a comparison only and they do not lead to our conclusions. For example, results on some types of debt ratios with fixed effects are not promising regardless of the key independent variable is the *Competition* that we use or HHI that we do not report. The reason is that the dependent variables of various types of debt ratios are censored following the literature, which implies that only the Tobit model is appropriate.

We measures the product market competition by the dummy variable *Competition* because it is convenient to interpret the coefficient estimates economically in terms of the effect of a high or low market competition. The interaction *Competition*×*Profit* indicates the profitable firms facing high competition while the meaning of the interaction term *HHI*×*Profit* is not clear. Furthermore, using the dummy variable rather

than the value of the HHI will mitigate the issue of measurement problems in the HHI.

In short, we use the first case of setting, which follows the literature, to obtain reasonable results and meanwhile provide new insights into the effects of competition on debt structure.

A.5 Econometric tests of panel data

Before we choose econometric methods of panel data analysis for credit spreads, we run some econometric tests to identify the appropriate econometric methods. We use the regressions for the credit spread of capital lease ($leaseCS$) as the examples to report the results.

A.5.1 Lagrangian multiplier test for OLS

We start with the Lagrangian multiplier test (Stata command xttest0) introduced by Breusch and Pagan to find out whether there are significant differences in panel effects across firms in the data. If the test result shows a significant 0 probability to the H0 hypothesis that there is no difference across firms, a simple ordinary least squares (OLS) is misspecified and some methods of panel data regression should be applied to analyze the data.

The result rejects Breusch and Pagan Lagrangian multiplier test for OLS.

leaseCS[gvkey,t] = Xb + u[gvkey] + e[gvkey,t]

Estimated results:

	Var	sd = sqrt(Var)
leaseCS	16.59035	4.073125
e	1.859054	1.363471
u	10.5596	3.249554

Test: Var(u) = 0

$\bar{\chi}^2(1) = 82163.38$

$[Prob > \bar{\chi}^2] = 0.0000$

A.5.2 Hausman test for random effects

To identify whether the fixed effect model or the random effect model should be appropriate to our panel data, we use Hausman test to test the H0 hypothesis that the difference in the panel data regression coefficients is not systematic. If the probability based on this hypothesis is significantly 0, the H0 hypothesis is rejected and the fixed effect method should be employed to analyze the data.

The result rejects Hausman test for random effects.

H0: difference in coefficients not systematic.

$\chi^2(16) = (b - B)'[(V_b - V_B)^{-1}](b - B) = 133.36$

$[Prob > \chi^2] = 0.0000$

A.5.3 Homoskedasticity test

We test the robustness of standard errors to heteroskedasticity and autocorrelation from the fixed effect estimation. To test groupwise heteroskedasticity, we run the modified Wald test (Stata command xttest3) to the H0 hypothesis that the standard errors have homoskedasticity, $\sigma^2(i) = \sigma^2$ for all i.

The result rejects modified Wald test for groupwise homoskedasticity in fixed effect regression model.

H0: $\sigma^2(i) = \sigma^2$ for all i

$\chi^2((2410) = 5.0e + 36$

$[Prob > \chi^2] = 0.0000$

A.5.4 Autocorrelation test

To test autocorrelation in the standard errors of the fixed effect panel regression, we use the Wooldridge test (Stata command xtserial). If the H0 hypothesis of no first-order autocorrelation is significantly rejected, we perform panel data regressions analysis by making the corresponding variance-covariance matrix (VCE) for the parameter estimates robust to heteroskedasticity in the cross section and autocorrelation in the time series within the panel. To this end, we use cluster-robust standard errors.

The result rejects the hypothesis of Wooldridge test for autocorrelation in the panel data.

H0: no first-order autocorrelation.

$F(1, 1340) = 108.291$

$[Prob > F] = 0.0000$

A.5.5   Unit-root test

It is necessary to exclude the case of all the panels in our data are non-stationarity. It is essential to examine whether the data can be viewed as stationary or not for three reasons (e.g. Brooks; 2019). First, the stationarity of a series affect its behaviour, e.g., a shock will not die away for a nonstationary series. Second, non-stationary data might result in spurious regressions that have a high r-square value but the dependent variable and the independent variables are in fact totally unrelated. Third, the standard assumptions for asymptotic analysis is invalid if the data are not stationary. In this case, the usual t-ratios do not follow a t-distribution, which makes it impossible to carry out hypothesis tests about the regression parameters.

We take a unit-root test on capital lease data for examining whether there is at least one panel of capital lease that is stationary. We use a Fisher-type test developed by Phillips and Perron with 3 Newey-West lags. If the statistic results show that the H0 hypothesis of all panels having unit roots is significantly rejected then there is at least one stationary panel of data.

Fisher Test for panel unit root using an augmented Dickey-Fuller test (3 lags)

H0: unit root.

$\chi^2(1158) = 1541.4879$

$[Prob > \chi^2] = 0.0000$

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