Inflexibility and Leverage*

Olivia Lifeng Gu   Dirk Hackbarth   Tong Li

August 13, 2019

Abstract

We examine whether a firm's inflexibility (i.e., inability to adjust its scale in response to profitability shocks) influences its financial policy. Based on a firm's historical range of operating costs-to-sales ratio, scaled by the volatility of its sales growth, we find robust evidence that inflexible firms adopt a lower level of financial leverage compared with flexible firms. This effect is much more pronounced among value firms where the inflexibility to scale down during economic downturns is relatively more important. Following a positive credit supply shock induced by staggered state-level bank branching deregulation or the introduction of credit default swap (CDS), inflexible firms increase leverage more than flexible firms. These results suggest that operating flexibility plays an important role in shaping corporate financial policies.

JEL Classifications: G32, G33.

Keywords: Bankruptcy, Capital Structure, Inflexibility, Bank Deregulation, CDS.

*We are grateful to Philip Bond, Yom Bui, Francesco D'Acunto, Jarrad Harford, Timothy Johnson, Evgeny Lyandres, Peter Mackay, Carolin Pflueger, Michael Schwert, Alexander Wagner, Michael Weber, and seminar participants at the University of Oregon and the FMA 2019 Asia/Pacific Conference for helpful comments. Olivia Lifeng Gu is with the University of Hong Kong, email: oliviagu@hku.hk; Dirk Hackbarth is with the Questrom School of Business, Boston University, CEPR, and ECGI, email: dhackbar@bu.edu; and Tong Li is with the University of Hong Kong, email: litong17@hku.hk. All errors are our own.

1 Introduction

Since Modigliani and Miller (1958), financial economists have considered numerous characteristics to explain firms' financial policies.[1] Yet, operating flexibility is a relatively underexplored determinant of capital structure. Empirical evidence on the role played by a company's flexibility for its financial policy is, however, limited, potentially due to the lack of easily replicable and generally robust measures of flexibility.

In this paper, we document the relation between a firm's financial leverage ratio and its inflexibility, both in a multivariate regression framework and in a setting utilizing a credit supply shock, the Interstate Banking and Branching Efficiency Act (IBBEA). To do so, we employ a novel proxy of firm-level inflexibility, the standardized firm-level range measure of costs over sales, that Gu, Hackbarth, and Johnson (2018) derive from a neoclassical (real options) model of a firm with assets-in-place and options to contract and expand. Notably, these authors empirically validate that their firm-level inflexiblity measure proxies for adjustment frictions. Options are valuable because productivity varies exogenously over time, but the firm incurs adjustment costs if it increases or decreases its scale. Therefore, a firm's inflexibility is closely related to an observed range of its cost-to-sales ratio (or inverse profitability) while not adjusting its scale, which suggests that the historical range of its operating costs-to-sales ratio, scaled by its sales growth volatility, measures a firm's inflexibility.[2]

Consistent with economic intuition, inflexible firms are less likely to contract in recessions or expand during economic booms, which has largely two effects. First, inflexibility to downsize in bad times (reduce quasi-fixed operating costs) leads to higher default risk. Second, inflexibility to scale up in good times (produce more when profit margins are high) results in lower taxable income and thus limits tax shields of debt. Hence, all else equal, inflexible firms should take less debt than flexible firms. That is, our first hypothesis is a negative relation between inflexibility and financial leverage.[3]

[1] See, e.g., Kraus and Litzenberger (1973) for trade-off theory, Myers and Majluf (1984) for pecking-order theory, and Baker and Wurgler (2002) for market-timing theory. Frank and Goyal (2009) examine empirically their importance.

[2] The idea of measuring ranges or inaction regions relates to dynamic capital structure models (Strebulaev, 2007). Following Hackbarth and Johnson (2015), scale refers to a firm's productive factors that generate quasi-fixed operating costs, such as physical capital, labor, raw materials, and other commitments. Hence our theory-grounded and easy-to-construct inflexibility measure not only captures a firm's inability to adjust capital but also other dimensions of inflexibility.

[3] See, e.g., Mauer and Triantis (1994) or Aivazian and Berkowitz (1998) for models, in which the firm's ability to better control operational risks in bad states implies better credit terms from lenders and hence higher debt taking. Similarly, Appendix B of Hackbarth and Johnson (2015) shows that more flexible firms are more valuable, which provides them with a bigger debt capacity.

Furthermore, we consider whether firms may respond differentially to a credit supply shock driven by inflexibility. An exogenous increase in credit access may affect firms' debt taking through a few channels. First, a positive credit supply shock motivates banks to lend more to riskier firms and even actively search for borrowers with low leverage ratios. Second, a positive shock makes it easier for riskier firms to obtain bank credit even when they are close to default. Thus, a credit supply shock likely lowers borrowing costs for firms. Given that inflexible firms tend to be underlevered and face higher pre-event credit constraints to fund their business activities such as valuable investment opportunities, higher benefits of debt, on the margin, increase debt taking, but even more so for inflexible firms.[4] In contrast, flexible firms already are, on average, at or closer to their leverage targets and hence respond less to a credit supply shock. That is, our second hypothesis is a stronger relation between credit supply shocks and financial leverage among inflexible firms.

For a large sample of U.S. public firms from 1970 to 2017, we estimate ordinary least squares (OLS) regressions of leverage on inflexibility, where leverage is the ratio of either long-term or total debt over the market value of assets. Consistent with the first hypothesis, we find that a one-standard-deviation increase in inflexibility is associated with a 1.41% (1.73%) decrease in long-term (total) leverage, which corresponds to 6.39% (6.06%) of the average long-term (total) leverage ratio.[5] And the negative relation is statistically significant at the 1% level. These baseline results still hold when the continuous inflexibility measure is replaced with an indicator for high inflexibility. Moreover, we document that contraction inflexibility is more important than expansion inflexibility in determining financial leverage ratios. To address potential concerns on the errors-in-variables problem, we follow Erickson, Jiang, and Whited (2014) to estimate linear cumulant equations. We establish the results are similar to those obtained from the OLS regressions, indicating that measurement error is not a severe issue in our study. Furthermore, results from two-stage least squares (2SLS) regressions with instrumental variables suggest that our baseline results do not suffer from serious endogeneity bias.

[4] With the data on credit lines collected by Sufi (2009), we find that the average credit line usage rate for inflexible firms (firms in the top quintile based on our inflexibility measure) is higher than that for flexible firms (bottom quintile): 33.00% vs 22.35%. The gap between these two groups is significantly different from zero (t = -3.23). In addition, the density curves in Figure B.3 show that the distribution of credit line usage rate for inflexible firms lies to the right of the distribution of usage rate for flexible firms. These results suggest that inflexible firms are relatively more credit constrained.

[5] Figures 1 charts the univariate relation between inflexibility and leverage ratio. It reveals that leverage declines nearly monotonically from 28% (36%) for the most flexible group to 18% (26%) for the most inflexible group. The effect of inflexibility cannot be subsumed by other determinants of leverage. Indeed, Figure 2 shows that the unexpected leverage ratios (i.e., leverage residuals) after adjusting for previously documented relevant factors exhibit an even more remarkably decreasing pattern.

Because a firm's historical, scaled range of costs over sales is, by construction, relatively persistent over time, it is challenging to identify an exogenous shock to our inflexibility measure. Instead, we examine if flexible and inflexible firms respond differently to an exogenous credit supply shock. In particular, we exploit exogenous variation created by the staggered interstate bank branching deregulation in the United States. The Riegle-Neal Interstate Banking and Branching Efficiency Act (IBBEA) represents a positive credit supply shock (Rice and Strahan, 2010). Consistent with our second hypothesis, we find that more inflexible firms choose larger increases in leverage after banking deregulation. Furthermore, our results from the dynamic estimation show that there is no significant difference prior to banking deregulation. As a placebo test, we re-estimate the difference-in-difference specification for randomized samples with different deregulation years and do not find a significant relation.

To further support the robustness of our results, we carry out additional, auxiliary tests. First, motivated by the fact that the deregulation is an exogenous shock to credit provided by banks, we directly examine the changes in firms' borrowings from banks. The results show, as we would expect, that inflexible firms experience a larger increase in their bank-debt-related leverage ratios than flexible firms after banking deregulation. Second, we focus on heterogeneity in firms' dependence on external financing as measured by cash holdings, external financing needs (Demirgüç-Kunt and Maksimovic, 1998), and financial constraints (Kaplan and Zingales, 1997). We expect to find a stronger interaction effect for firms that depend more on external financing and, indeed, the differential effect of bank deregulation on less flexible firms is larger among external financing dependent firms. Third, we show that our results are robust to various specifications such as controlling different fixed effects, using alternative industry definitions, and introducing additional control variables including stock return volatility, firm age, operating leverage (Novy-Marx, 2011), and proxies for market power (price-cost margin, Compustat-based Herfindahl index, and the Herfindahl index constructed by Hoberg and Phillips (2010)). Using the introduction of credit default swaps (CDS), we also confirm that inflexible firms increase leverage ratios more than flexible firms following an increase in credit supply.

This paper contributes to several strands of research. Firstly, it adds to the literature on capital structure determinants. A firm's financial policy is a key topic for financial economists, corporate decision makers, and investors, because it can influence not only the rate of return a company earns for its shareholders, but also whether or not a firm can survive economic downturns. As a result, researchers have paid considerable attention to the explanations of capital structure decisions. Notwithstanding an extensive list of characteristics to explain the observed variations, empirical models' ability to capture most variations remains unresolved.[6] In this paper, we focus on inflexibility as an important and heretofore underexplored capital structure determinant. Notably, we empirically examine to what extent a firm's inflexibility explains cross-sectional variations in capital structure choices.

Secondly, this paper contributes to a growing literature on the role of flexibility in financial economics. Early studies on risk management (Ho, 1984; Hirshleifer, 1991; Kamara, 1993) suggest that production flexibility can significantly affect firms' hedging behavior. More recently, asset pricing research shows theoretically and empirically that flexibility is an important determinant of firms' risk and return profiles (Hackbarth and Johnson, 2015; Gu, Hackbarth, and Johnson, 2018). More closely related to our paper, a few studies investigate the impacts of flexibility on corporate financing decisions. MacKay (2003) shows that financial leverage is negatively associated with volume flexibility based on census data for firms in 18 manufacturing industries, while Reinartz and Schmid (2016) documents a positive relation using a flexibility measure that is specific to energy utility firms. Serfling (2016) focuses on employment flexibility and finds that the increase in firing costs arising from the adoption of state-level wrongful discharge laws leads to lower financial leverage. The recent important work by D'Acunto, Liu, Pflueger, and Weber (2018) shows that the frequency with which firms adjust product prices helps explain variations in capital structure, with higher price stickiness associated with lower leverage. Due to limitations on the availability of the price stickiness measure, their investigation is constrained to a limited sample of relatively large firms. Compared with existing studies, our analysis has a couple of distinct features that allow us to provide more reliable and robust evidence. First, we adopt a theory-grounded proxy for inflexibility that is based on real option theories. This measure is easy to construct and applicable to any sector. Second, our sample covers all firms with publicly available accounting data. The use of the whole universe helps mitigate potential concerns on selection bias. Taken together, our paper represents the most comprehensive

[6] For research surveys, see Harris and Raviv (1991) or Graham and Leary (2011), and an incomplete list of prior works is Myers (1977), Myers (1984), Bradley, Jarrell, and Kim (1984), Titman and Wessels (1988), Stulz (1990), Rajan and Zingales (1995), Baker and Wurgler (2002), Fama and French (2002), Frank and Goyal (2003), MacKay (2003), MacKay and Phillips (2005), Faulkender and Petersen (2005), Hackbarth, Miao, and Morellec (2006), Kayhan and Titman (2007), Hackbarth (2008), Lemmon, Roberts, and Zender (2008), Frank and Goyal (2009), Bhamra, Kuehn, and Strebulaev (2010), Faulkender, Flannery, Hankins, and Smith (2012), Danis, Rettl, and Whited (2014), Schwert and Strebulaev (2014), Simintzi, Vig, and Volpin (2015), Serfling (2016), Moon and Phillips (2017), D'Acunto, Liu, Pflueger, and Weber (2018), and Korteweg, Schwert, and Strebulaev (2018).

empirical investigation so far on the relation between inflexibility and corporate capital structure.

Finally, our results also add to the literature that has practitioner relevance to aid corporate executives' decision-making process (Denis and McKeon, 2016). Nowadays, many firms finance their investment projects with external funds, of which debt financing makes up a large proportion, especially for large projects (Elsas, Flannery, and Garfinkel, 2014). For inflexible firms, a high level of financial leverage could result in serious distress and even bankruptcy during recessions. Thus, adopting a relatively low leverage ratio is relatively more beneficial for more inflexible firms, because this low-leverage policy provides them with more protections against unfavorable situations.

The rest of the paper proceeds as follows. Section 2 develops our hypotheses. Section 3 describes the data and variables. Section 4 reports the baseline results on the relation between inflexibility and financial leverage. Section 5 augments these results by exploiting bank deregulation. Section 6 provides additional supporting evidence. Finally, Section 7 concludes.

2 Hypothesis Development

Existing theoretical research has provided implications for the relation between inflexibility and financial leverage. For example, Mauer and Triantis (1994) show that flexibility lowers default risk and increases debt capacity as well as benefits of tax shields in a dynamic framework. In their model, firms facing price fluctuations could adjust their production capacity by paying operating adjustment costs and alter their capital structure by paying recapitalization costs. Consistent with the tradeoff theory (Robichek and Myers, 1966; Kraus and Litzenberger, 1973), the optimal capital structure decisions in this setting are determined by a tradeoff between the tax benefits and the bankruptcy costs of debt financing. One crucial conclusion from Mauer and Triantis (1994)'s model is that the value of tax shields increases with firm's production flexibility. Flexible firms have lower operating adjustment costs and thus higher ability to scale down operations in difficult times which allows them to reduce operating losses. Consequently, firms with lower adjustment costs could enjoy higher benefits of interest tax shields and maintain a higher level of financial leverage. Similar conclusions also hold in a discrete-time model (Aivazian and Berkowitz, 1998).

Inflexible firms are associated with high adjustment costs, and thus it is difficult for them to scale down and reduce quasi-fixed operating costs in unfavorable situations. This inflexibility could result in serious distress or even bankruptcy[7]. Therefore, it is more reasonable for an inflexible firm to adopt a low level of leverage. In contrast, it is easy for a flexible firm with low adjustment costs to shrink in size during economic downturns. The resulting lower expected financial distress costs grant flexible firms higher debt capacity. On the other hand, during economic booms, flexible firms can quickly expand to increase profitability and a high debt level brings them more tax shields.

In a setting that is the basis for our inflexibility measure, Appendix B of Hackbarth and Johnson (2015) shows that more flexible firms are more valuable, which provides them with a bigger debt capacity. Observe that inflexibility on the expansion option side creates incentives for lower leverage along the lines of the debt overhang problem (Myers, 1977), whereas inflexibility on the contraction side increases the risk associated with fixed costs so that fixed interest payments are less desirable for a firm following trade-off theory. In other words, a more flexible firm in their setting has larger expansion option values and expects to invest sooner in good times and/or has larger contraction option values and expects to be divest sooner in bad times, so that any detrimental effect of debt is on the margin smaller than for an inflexible firm.

Nomininal (price) rigidities are an important, plausible source of a firm's inflexiblity. To this end, Gorodnichenko and Weber (2016), Weber (2015), and D'Acunto, Liu, Pflueger, and Weber (2018) suggest that firms with rigid output prices are hence more exposed to macroeconomic shocks, making inflexibility a viable candidate to explain persistent differences in financial leverage across firms. All above arguments suggests a negative relation between inflexibility and financial leverage.

Hypothesis 1 *Firms with higher inflexibility have lower financial leverage ratios.*

Despite the theoretical foundations, there are few empirical tests on this hypothesis because it is hard to measure flexibility properly. Moreover, the sparse empirical evidence is limited to certain industries such as manufacturing industries (MacKay, 2003) and the regulated utilities sector (Reinartz and Schmid, 2016). In this paper, we employ the firm-level inflexibility measure developed based on a neoclassical model in Gu, Hackbarth, and Johnson (2018) to gauge a firm's inflexibility.

[7] We find that higher inflexibility is associated with higher future default risk (Table B.7 in the Appendix). In particular, higher inflexibility predicts lower Z-score (Mackie-Mason, 1990) and higher failure probability (Campbell, Hilscher, and Szilagyi, 2008).

This measure can be easily constructed for the whole universe of public firms and allows us to test the theoretical implications in a much broader context.

We would like to note that although the inflexibility measure is time-varying, the time-series variation is not very large since firms' inflexibility by nature is highly persistent.[8] Due to its persistence, it is almost impossible to find an exogenous shock for the inflexibility itself. This means our setting does not allow us to perfectly identify the causal effects of inflexibility on leverage. Instead, what we could do is to consider the responses of flexible and inflexible firms to a positive shock to credit supply. If indeed inflexible firms adopt lower leverage, then they are, on average, farther from leverage targets than flexible firms. Therefore, the effect of an increase in funds availability could be different for flexible and inflexible firms. This paper explores this question by exploiting the positive credit supply shock induced by staggered state-level bank deregulation in the United States.

We suspect that the deregulation may affect financial leverage through a few channels. First, bank deregulation increases competition among banks (Rice and Strahan, 2010; Amore, Schneider, and Žaldokas, 2013). Under competitive pressure, banks might be willing to lend more to riskier firms and even actively search for borrowers with low leverage ratios. Second, the deregulation makes it easier for inflexible firms to get access to bank loans even when they are close to default. Hence a credit supply shock likely lowers borrowing costs for firms. Given that inflexible firms tend to be underlevered and face higher pre-event credit constraints, higher benefits of debt, on the margin, increase debt taking, but even more so for inflexible firms, because this way they can ameliorate more their under-leverage problem to fund their business activities such as valuable investment opportunities. In contrast, flexible firms already are, on average, at or closer to their leverage targets and hence respond less to a credit supply shock.[9]

Hypothesis 2 *Inflexible firms increase financial leverage ratios more than flexible firms following a positive shock in credit supply.*

[8] In untabulated results, we find that the auto-correlation coefficient of the inflexibility proxy is 0.97.

[9] In unreported simulations, we examine the effect of a credit supply shock in form of a reduction in the debt's risk premium over the risk-free rate in a standard trade-off model of capital structure choice without flexibility by exploring firm variation in bankruptcy costs. If lenders require compensation above the risk-free rate and if a supply shock reduces this premium, then the shock leads firms with lower pre-event leverage ratios because of higher bankruptcy costs to increase leverage ratios relatively more than firms with higher pre-event leverage ratios because of lower bankruptcy costs. Hence, for a given reduction in the debt's risk premium, firms with less pre-event leverage have higher percentage responses in leverage than firms with more leverage.

3 Data and Measures

This section describes our data sources and variable constructions. Our sample includes the U.S. public firms from 1970 to 2017. We obtain financial data from Compustat Annual Industrial Files (Compustat) and the stock return data from the Center for Research in Security Prices (CRSP) database. We exclude financial firms (Standard Industrial Classification (SIC) codes 6000 to 6999), utility firms (SIC codes 4900 to 4999), and firms without a share code of 10 or 11. The information on CDS trading is obtained from Markit, one of the largest providers of CDS pricing data. We also utilize the data on bank debt in Capital IQ database where the data is available since 1976. Table A.1 in the Appendix provides the detailed description of variable definitions.

3.1 Inflexibility Measure

To gauge a firm's inflexibility level, we adopt a firm-level inflexibility measure which is based on a continuous-time, partial-equilibrium model developed in Hackbarth and Johnson (2015). The model assumes a firm has repeated options to expand or contract its scale, by paying adjustment costs, in response to permanent productivity shocks. In this setting, the firm's cash flow per unit time is

$$\Pi_t = \theta_t^{1-\gamma} A_t^{\gamma} - m A_t, \tag{1}$$

where A represents the firm's composite scale, $\gamma \in (0, 1)$ governs returns to scale, $m > 0$ denotes the operating cost per unit of A, and θ is the productivity process with $d\theta/\theta = \mu dt + \sigma dW^{\theta} - dN$.

The firm faces quasi-fixed and variable adjustment costs for both expansion and contraction. The model assumes that the variable cost of increasing A by ΔA is $P_L \Delta A$, with $P_L \geq 1$, while the variable cost of decreasing scale by the same amount is $P_U \Delta A$, with $P_U \leq 1$.[10] Moreover, the upward and downward adjustments incur quasi-fixed costs of $F_L \theta^{1-\gamma} A^{\gamma}$ and $F_U \theta^{1-\gamma} A^{\gamma}$, respectively, where $F_L \geq 1$ and $F_U \geq 1$. In this model, the firm's objective is to maximize its market value of equity by choosing a scale adjustment policy. The presence of adjustment costs implies that the optimal policy is to adjust A discretely.

[10] P_L can be viewed as the purchase price of machinery with $P_L > 1$ representing installation costs and P_U may be viewed as rescale price with $P_U < 1$ reflecting the costly disposal.

Hackbarth and Johnson (2015) show that the re-scaled productivity $Z_t \equiv A_t/\theta_t$ is a single state variable in the firm's value maximization problem. In particular, the optimal policy can be characterized by the (upper) contraction boundary (denoted by U), the (lower) expansion boundary (denoted by L) for Z, and the corresponding optimal amounts of adjustment once hitting these boundaries. This suggests that the firm can be viewed as living in Z space over the interval $[L, U]$, and this interval captures flexibility of the firm. Flexible firms (with lower adjustment costs) will adjust scale more often and bring Z closer to its optimal value, while inflexible firms (with higher adjustment costs) will wait longer before altering its scale to respond to changes in economic conditions. Thus, a firm's inflexibility can be captured by its inaction region which is the distance between U and L, $\log(U/L)$. And the model implies this range should be scaled by the volatility of productivity shocks, σ, since firms in more volatile business will optimally wait longer to exercise their adjustment options but this effect is unrelated to firms' inflexibility level.

Empirically, the width of the firm's inaction region is proxied by the range of its operating costs over sales (Gu, Hackbarth, and Johnson, 2018). This range, which is equivalent to the range of profitability over sales, is monotonic in the width of the inaction region of the state variable Z under the model assumptions. In line with the model, they scale this range by the volatility of the changes in logarithm of sales over assets. The sales-to-assets ratio is an estimate of productivity and the change in the logarithm of this ratio is proportional to $\Delta \log(Z)$, whose volatility is σ. Therefore, firm i's inflexibility level in year t is calculated as follows:

$$Inflex_{i,t} = \frac{\max_{i,t_0,t}\left(\frac{OPC}{Sales}\right) - \min_{i,t_0,t}\left(\frac{OPC}{Sales}\right)}{\mathrm{std}_{i,t_0,t}\left(\Delta \log\left(\frac{Sales}{Assets}\right)\right)}, \tag{2}$$

where $\max_{i,t_0,t}\left(\frac{OPC}{Sales}\right) - \min_{i,t_0,t}\left(\frac{OPC}{Sales}\right)$ is the range of firm's operating costs (Compustat item XSGA + COGS) over sales (Compustat item SALE) during the period from year t_0 to year t, and $\mathrm{std}_{i,t_0,t}\left(\Delta \log\left(\frac{Sales}{Assets}\right)\right)$ is the standard deviation of the annual growth rate of sales over assets (Compustat item AT) during the period from year t_0 to year t. Since the information in the distant past may not be relevant now, we adopt a rolling-window methodology to construct the inflexibility measure, where year t_0 is the starting year of each estimation window. Therefore, our inflexibility measure is time-varying.[11] In our calculation, we use a 20-year estimation window. We also require

[11] Our results still hold if the inflexibility proxy is collapsed into a time-invariant measure (Table B.3 in the Appendix).

that at least 10-year data are available for a firm since using too few data points may add noise to the inflexibility measure.

This inflexibility measure is significantly correlated with various variables that potentially capture certain aspects of adjustment costs for capital or labor, including the asset resalability index, the inflexible employment measure, and the industry-level unionization rate.[12] More importantly, the measure is available for all public firms over nearly 50 years. This striking feature enables us to conduct reliable investigations on how operating flexibility explains the cross-sectional variations in capital structure decisions.

3.2 Leverage Measures

In this paper, we mainly focus on two measures of financial leverage. One is the ratio of long-term debt to market value of assets (*LDM*), and the other is the ratio of total debt to market value of assets (*TDM*). *LDM* is defined as long-term debt (Compustat item DLTT) divided by market value of assets. As in Danis, Rettl, and Whited (2014), we calculate the market value of assets as the sum of long-term debt and debt in current liabilities (Compustat item DLC) minus cash holding (Compustat item CHE) and plus the market value of equity (Compustat item CSHO × PRCC_F). And *TDM* is computed as the book value of total debt (Compustat item DLTT + DLC) divided by the market value of assets.

For robustness checks, we also conduct the analysis using alternative definitions for financial leverage. Following Frank and Goyal (2009), we define *LDM1* and *TDM1* in which the long-term debt and total debt are scaled by the sum of market value of equity (Compustat item CSHO × PRCC_F), book value of total debt, and total preferred stock (Compustat item PSTKL) minus deferred taxes and investment tax credit (Compustat item TXDITC). In addition, following Klasa, Ortiz-Molina, Serfling, and Srinivasan (2018), we calculate *LDM2* (*TDM2*) as the long-term debt

[12] Table 4 in Gu, Hackbarth, and Johnson (2018) shows that the firm-level inflexibility measure is significantly negatively related to the industry-level *resalability index* in Balasubramanian and Sivadasan (2009), the *redeoloyability index* in Kim and Kung (2017), and the firm-level *capital reallocation rate* defined in Eisfeldt and Rampini (2006). The measure is significantly positively related to the industry-level *inflexible employment* measure in Syverson (2004) and the industry-level *unionization rate*. We also find that the inflexibility measure is significantly negatively correlated with the flexibility proxy proposed by Grullon, Lyandres, and Zhdanov (2012) which is the convexity of firm value with respect to earnings surprises. Moreover, double-sorts on inflexibility and operating leverage in Gu, Hackbarth, and Johnson (2018)'s Table 8 indicate that inflexibility and operating leverage are distinct variables. Economically, inflexibility reflects a historical range of realized costs over sales scaled by a firm-specific volatility and hence is an indirect measure of adjustment costs, whereas operating leverage is an inverse proxy for a firm's contemporaneous profitability.

(total debt) divided by the sum of market value of equity (Compustat item CSHO × PRCC_F) and the difference between total assets (Compustat item AT) and total common equity (Compustat item CEQ). Finally, we use the ratio of long-term debt and total debt to the book value of total assets, denoted as *LDA* and *TDA*, respectively. The results associated with these alternative leverage measures are reported in Appendix B.

3.3 Control Variables

Existing studies establish that firms' capital structure decisions could be affected by a number of factors. Frank and Goyal (2009) empirically examine the relation between financial leverage and more than twenty previously documented factors and conclude that the most reliable explanatory variables are median industry leverage, market-to-book assets ratio, tangibility, profits, log of assets, and expected inflation. They show that larger firms, less profitable firms, firms with more tangible assets, and firms with higher book-to-market ratio have higher leverage ratios. In addition, the leverage ratio of a firm is positively associated with that of its peers within the same industry. They also find that firms tend to maintain high leverage when inflation is expected to be high. Based on their analysis, we use these factors as control variables in this paper.[13] Specifically, we define these variables as follows. Profitability (*Profit*) is the ratio of operating income before depreciation (Compustat item OIBDP) to total assets. Firm size (*Size*) is the logarithm of total assets. Book-to-market ratio (*B/M*) is book value of total assets divided by market value of assets where the market value of assets is calculated in the same way as in *LDM*. Assets tangibility (*Tangible*) is the ratio of net property, plant, and equipment (Compustat item PPENT) to total assets. Industry median leverage (*IndustLev*) is the median value of total market leverage (*TDM*) in a certain industry (four-digit SIC codes level) and a certain year.

3.4 Summary Statistics

Table 1 presents the summary statistics for our major variables. To avoid the impacts of outliers, we winsorize the continuous variables at the 1^{st} and 99^{th} percentiles. Panel A shows the descriptive statistics. The average of the inflexibility measure (*Inflex*) is 0.017.[14] The mean of long-term (total)

[13] The expected inflation is excluded because it is a constant for all firms in a certain year and thus is absorbed by the year fixed effects.

[14] We scale the original inflexibility measure by 100.

leverage ratio is around 22% (29%). The average firm has return on assets (*Profit*) of 10.9% and firm size around $244 million. The mean of book-to-market ratio (*B/M*) is 1.284, with the standard deviation equal to 1.004. On average, around one-third of the assets are tangible.

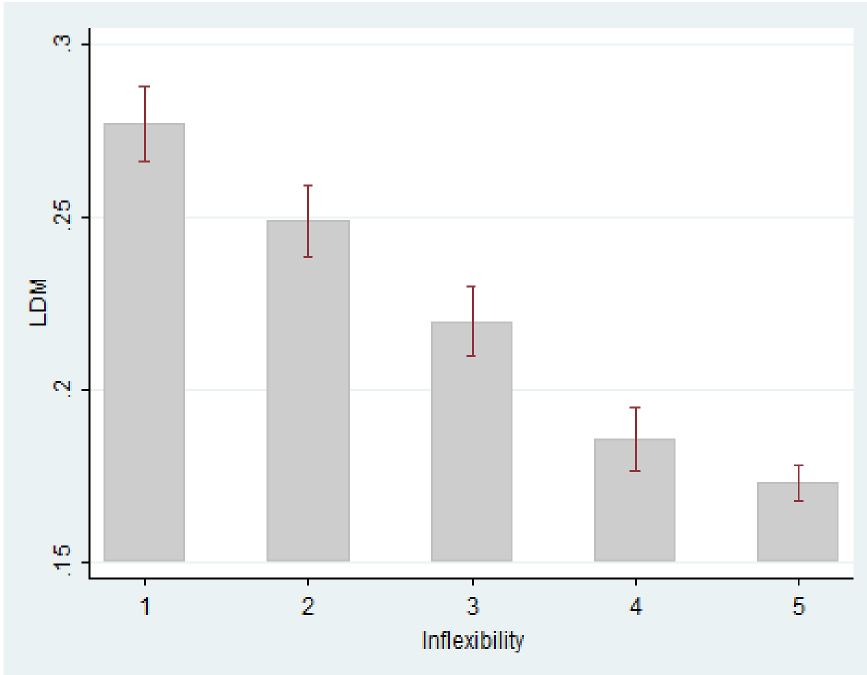
[Insert Table 1 Here]

Panel B of Table 1 reports the pairwise correlation among the variables. It shows that inflexible firms tend to have lower leverage ratios which is consistent with our hypothesis. And the inflexibility measure is significantly correlated with other determinants of capital structure. Compared with flexible firms, the inflexible firms are smaller and less profitable. And the less flexible firms tend to have lower book-to-market ratio and less tangible assets.

Figure 1 illustrates the relation between inflexibility and leverage ratios. We first compute time-invariant inflexibility measure as the time-series average of *Inflex* over the sample period for each individual firm and then divide firms into five groups based on their inflexibility level. Figures 1a and 1b show the average long-term leverage ratio (*LDM*) and the average total leverage ratio (*TDM*) for firms in each group, respectively. The patterns in the figures are fairly striking: going from the most flexible firms (Group 1) to the most inflexible firms (Group 5), the long-term leverage ratio decreases dramatically from around 28% to nearly 18%. And the total leverage ratio exhibits a similar pattern.

One concern with Figure 1 is that the variation in leverage ratios across inflexibility-sorted groups might capture the cross-sectional differences in other underlying factors associated with financial leverage such as profitability and firm size. To adjust for previously identified determinants of leverage, we conduct an additional test on unexpected leverage following the literature (e.g., Lemmon, Roberts, and Zender, 2008). In particular, we examine the relation between inflexibility and residual leverage, where the residual leverage is residuals from the regression of leverage on the control variables specified in Section 3.3. Firms are sorted into quintiles based on the inflexibility measure, and the average residual leverage ratios for firms in each group are plotted in Figure 2. We find the average residuals decrease monotonically and strongly with inflexibility. For example, the mean of residual total leverage ratio declines from about 2.5% in the most flexible group to -4% in the most inflexible group. This decreasing pattern indicates that firms with higher inflexibility tend to have lower financial leverage ratios, even after controlling other firm characteristics.

a. Long-term Leverage Ratio



b. Total Leverage Ratio

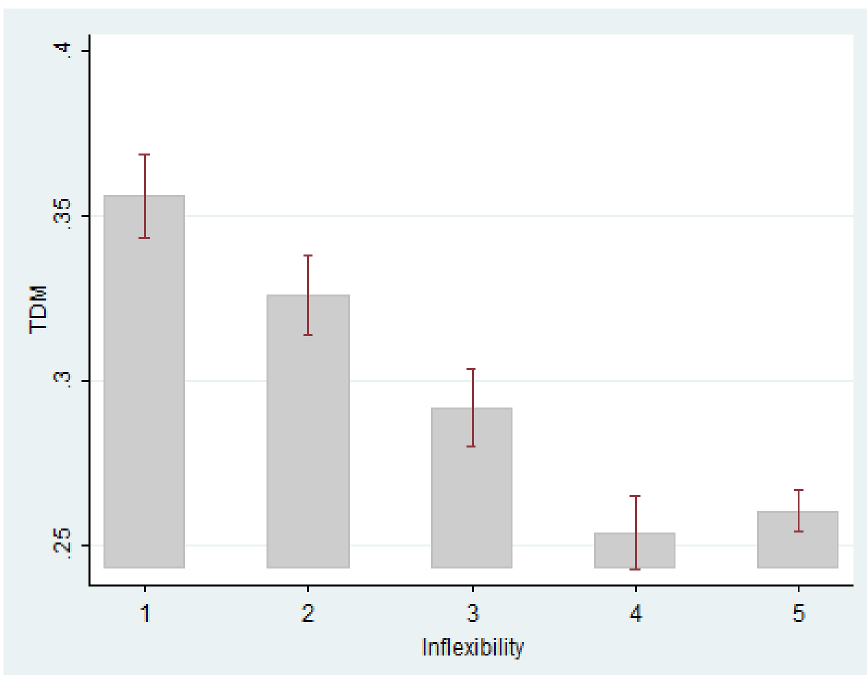
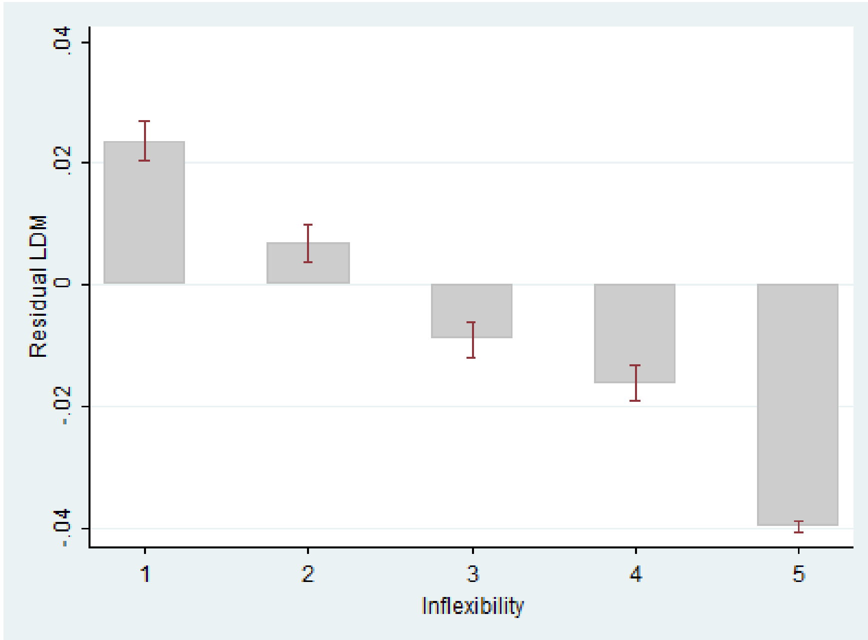


Figure 1
Inflexibility and Leverage Ratios
This figure demonstrates the univariate relation between inflexibility and leverage ratios. In the top plot (subfigure a), leverage is the ratio of long-term debt to market value of assets (*LDM*). In the bottom plot (subfigure b), leverage is the ratio of total debt to market value of assets (*TDM*). The sample period is from 1970 to 2017.

a. Residual Long-term Leverage Ratio



b. Residual Total Leverage Ratio

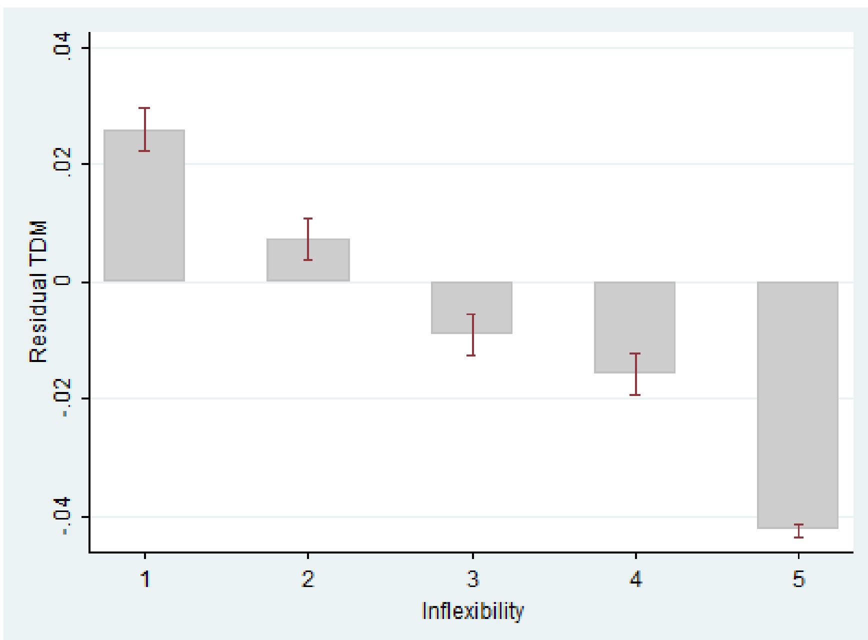


Figure 2

Inflexibility and Residual Leverage Ratios

This figure demonstrates the univariate relation between inflexibility and residual leverage ratios. The residual leverage is the residuals from the regression of leverage on profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), assets tangibility (*Tangible*), and industry median leverage (*IndustLev*). Leverage is the ratio of long-term debt to market value of assets (*LDM*) in the top plot (subfigure a) and the ratio of total debt to market value of assets (*TDM*) in the bottom plot (subfigure b). The sample period is from 1970 to 2017.

We also investigate the responses of leverage to changes in inflexibility by employing the time-varying feature of this measure. Figure B.1 in the Appendix plots average changes in leverage ratios following a firm's largest decrease (Negative Group) and largest increase (Positive Group) in inflexibility over the sample period. For comparison, we also plot the average leverage change following the year when a firm experienced its smallest change in inflexibility (Almost Zero Group). We find that the average change in Negative Group is larger than that in the control group, while the Positive Group has a lower mean value relative to the control group. This indicates, compared to the benchmark situation with almost no inflexibility change, a firm adopts higher leverage after decreases in inflexibility and lower leverage following increases in inflexibility. This finding further supports the negative relation between inflexibility and financial leverage. We also find the responses of leverage appear to be asymmetric: firms adjust leverage more following a decrease in inflexibility. For example, the average change of total leverage ratio (subfigure b) in the Negative Group is 0.38% higher than that in the control group while the mean value of leverage changes in the Positive Group is only 0.09% lower than the benchmark. This asymmetry is in line with the expectation that it is relatively easier for firms to adjust leverage when they become more flexible.

In addition to time-series comparisons, we conduct cross-sectional comparisons. Every year, we identify firms with bottom 1% decrease (Negative Group) and top 1% increase (Positive Group) in inflexibility. Figure B.2 plots the average changes in leverage ratios for these firms. As a control group, we include the Almost Zero Group which contains firms with the smallest 1% absolute change in inflexibility in each year. We find firms with large decreases in inflexibility tend to make larger positive adjustments in leverage compared with firms with nearly no inflexibility change. For firms with large increase in inflexibility, they adjust their leverage less aggressively relative to those in the control group. The differences across these three groups also show firms respond to inflexibility changes asymmetrically. The patterns are consistent with those in Figure B.1.

4 Inflexibility and Leverage

4.1 Baseline Analysis

To investigate the relation between inflexibility and financial leverage, we first run the following OLS regression:

$$Leverage_{i,t} = \alpha + \beta Inflex_{i,t-1} + \gamma' X_{i,t-1} + \tau_t + \tau_j + \epsilon_{i,t}, \tag{3}$$

where $Leverage_{i,t}$ is the leverage ratio (*LDM* or *TDM*) for firm i in year t. $Inflex_{i,t-1}$ is firm i's inflexibility measured in year $t-1$. $X_{i,t-1}$ represents a set of control variables, including profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), assets tangibility (*Tangible*), and industry median leverage (*IndustLev*). τ_t is year fixed effects. τ_j denotes industry fixed effects where industries are defined at the four-digit SIC codes level.

[Insert Table 2 Here]

Table 2 reports the results from this baseline regression. In Columns (1) to (5), financial leverage is measured by the ratio of long-term debt to market value of assets (*LDM*). In Columns (6) to (10), it is measured by the ratio of total debt to market value of assets (*TDM*). Columns (1) and (6) show the results from the univariate regression of leverage on inflexibility. We find that the coefficients on *Inflex* are negative (-0.843 and -0.942) and significant at the 1% level based on the robust standard errors clustered at firm level.[15] In Columns (2) and (7), we incorporate year fixed effects and industry fixed effects to take into account the effects of time-varying common shocks facing all firms and factors that are specific to a certain industry. Although with a smaller magnitude, the coefficients on *Inflex* remain negative (-0.439 and -0.375) and statistically significant (t = -9.12 and -6.74). In Columns (3) and (8), we add a set of control variables to the univariate regressions. The results show that the presence of other determinants of capital structure does not eliminate the role of inflexibility: the coefficients on *Inflex* are -0.455 (t = -9.26) and -0.624 (t = -10.65).

We report the estimation results from the full baseline model of Equation (3) in Columns (4) and (9). In both regressions, the negative coefficients (-0.442 and -0.542) on inflexibility are economically

[15] Our results are robust to clustering standard errors at industry or industry and year level. Table B.2 in the Appendix shows the results with standard errors clustered at industry and year level.

large and statistically significant (t = -8.81 and -9.06). These coefficients correspond to a 1.41% decrease in *LDM* and 1.73% decrease in *TDM* for a one-standard-deviation increase in *Inflex*. Compared with the average long-term (total) leverage ratio, this means a 6.39% (6.06%) decrease. Finally, we replace the continuous inflexibility measure with an indicator which equals one if a firm's inflexibility is above the median in the sample in a certain year, and zero otherwise. This accounts for the possible nonlinear relation between inflexibility and leverage. As shown in Columns (5) and (10), the coefficients on these dummies are also significantly negative. In summary, the results from the baseline regressions show that inflexible firms tend to have lower financial leverage and this evidence supports our conjecture. We also find that these results are robust to alternative definitions of financial leverage. In Appendix B, we report the regression results of Equation (3) for six leverage measures including both book leverage and market leverage. The results show that coefficients on inflexibility are consistently negative and significant in these estimations (Panel A of Table B.1 in the Appendix).

4.2 Measurement Error

Erickson, Jiang, and Whited (2014) suggest that measurement error could be a concern in studies on the determinants of capital structure decisions. Indeed, they show that the inference about several factors in leverage regressions could change dramatically once the measurement error problem is taken into account. To address this concern, they propose to use linear cumulant equations instead of the ordinary least squares methods. In this paper, we follow their work to check the robustness of our baseline results after considering the potential mismeasurement in regressors. As in Erickson, Jiang, and Whited (2014), we assume that there is measurement error in book-to-market ratio (*B/M*) and assets tangibility (*Tangible*). We also assume that the inflexibility measure (*Inflex*) is mismeasured.

[Insert Table 3 Here]

Table 3 reports the cumulant estimators. The left panel uses *LDM* as the dependent variable while the right panel employs *TDM*. In each panel, we report the results for the third, fourth, and fifth cumulants. We also present the baseline OLS results in the first column for comparison. The results show that the coefficients on inflexibility are still negative and significant at the 1% level, regardless of which order of cumulants is used. More importantly, compared with the benchmark from OLS regressions, the magnitude of the coefficients becomes much higher, indicating that measurement errors significantly bias our baseline results downward. For other variables except book-to-market ratio (B/M), the results from linear cumulant equations are generally similar to those from OLS regressions.

4.3 Instrumental Variables Estimation

One may be concerned that our baseline results suffer from the issue of reverse casuality or omitted variables. For example, firms with limited debt capacity would maintain low leverage and may not have enough funds to increase scale in economic booms, which leads to higher inflexibility. Alternatively, if some omitted variables affect both a firm's leverage and its inflexibility, then inflexibility would not be exogenous to capital structure decisions. To address these issues, it is ideal to exploit exogenous shocks to inflexibility. However, inflexibility is highly persistent and such shocks are not readily available. Therefore, we resort to the instrumental variables (IV) approach to alleviate potential concerns.

We use two instrumental variables for inflexibility. The first one is the 5-year lagged value of inflexibility. We believe that it is a valid instrumental variable for the following reasons. Since the inflexibility measure is persistent over time, we expect a high correlation between the current value of inflexibility and its long-term lagged values. However, there seems no clear channel through which the lagged inflexibility could affect current leverage beyond its correlation with the current value of inflexibility. Our second instrument variable is the 2-year lagged industry-median value of inflexibility. To the extent that scale inflexibility is an industry-specific characteristic, there should be a strong correlation between a firm's inflexibility and the industry-level inflexibility measure. At the same time, it is hard to imagine that industry-level inflexibility could directly influence firm-level leverage. Moreover, using industry-level inflexibility as the instrumental variable reduces the concern that the instrumental variable may be affected by unobservable firm-specific characteristics.

[Insert Table 4 Here]

With these instrumental variables, we run 2SLS regressions and the results from the second-stage regressions are reported in Table 4. Columns (1) and (2) show that the negative relation between leverage ratios and inflexibility is still statistically significant when the 5-year lagged inflexibility is used as the instrumental variable. In columns (3) and (4), lagged industry-level inflexibility is used as the instrumental variable. Again, we find that firms with higher inflexibility are associated with lower financial leverage. Overall, the results from 2SLS regressions with instrumental variables confirm the negative relationship between inflexibility and financial leverage, suggesting that our baseline OLS results do not suffer from a severe endogeneity problem.

4.4 Expansion vs Contraction

The inflexibility in both expansions and contractions could induce firms to adopt low leverage ratios. It would be interesting to distinguish the effect of expansion inflexibility on financial leverage from that of contraction inflexibility. Ideally, we need to measure expansion and contraction inflexibility separately. However, the theoretical model which guides the construction of our inflexibility measure does not provide such implications. Instead, what we could do is to examine the effects of inflexibility in subsamples where the importance of expansion option and contraction option differs. Specifically, we focus on differential impacts of our inflexibility proxy on financial leverage among value and growth firms. Since growth firms usually face many valuable investment opportunities, they are likely to be far away from the contraction boundary. Therefore, it is relatively rare for growth firms to exercise contraction options, and presumably, for growth firms, the variation in our inflexibility proxy mainly reflects the variation of firms' inflexibility to expand. Conversely, contraction options are more important to value firms than expansion options because value firms are usually equipped with much unproductive capital which might be difficult to get rid of during economic downturns but can certainly be utilized in economic booms. Thus, value firms are likely to be far away from the expansion boundary and the variation in our inflexibility proxy for value firms may capture much of the variation in these firms' contraction inflexibility.

To investigate whether expansion and contraction inflexibility exert asymmetric effects on financial leverage, we compare the coefficients on inflexibility from leverage regressions in growth firms and value firms. In particular, we sort firms into quartile groups based on their book-to-market ratio. The indicator variables, BM_2, BM_3, and BM_4 are defined to be equal to one if a firm is in the second, third, and fourth quartile, respectively, and zero otherwise. We introduce these dummy variables and their interactions with our inflexibility measure into Equation (3). The coefficients on interaction terms are of our interest.

[Insert Table 5 Here]

The first three columns in Table 5 present results from regressions of long-term leverage ratio. Regardless of whether to include control variables and fixed effects, the coefficients on *Inflex* are consistently negative and significant, suggesting that there exists a negative relationship between inflexibility and long-term leverage ratio in growth firms (firms in the lowest book-to-market quartile). More importantly, the coefficients on the interaction term, $Inflex \times BM_4$ are negative and highly significant. For example, after controlling for other determinants of leverage and fixed effects (shown in Column (3)), the coefficient on $Inflex \times BM_4$ is -0.684 (t = -5.98). The evidence indicates that the impact of inflexibility on leverage is much stronger for value firms where contraction options tend to dominate than growth firms for which expansion options are likely to be more important. As shown in Columns (4) to (6), the stronger effects in value firms also hold for total leverage ratio (*TDM*). To conclude, our findings imply that contraction inflexibility rather than expansion inflexibility plays a larger role in determining financial leverage.

5 Inflexibility, Bank Deregulation, and Leverage

5.1 Institutional Background

With the passage of the 1927 MacFadden Act, banks in the United States were prohibited from expanding geographically, and these restrictions were enforced well until the 1970s. In 1970, only 12 states allowed banks to open intrastate branches with no restrictions, and 16 states strictly forbade any branching (Rice and Strahan, 2010). In addition to restrictions on branching, a bank was also prohibited to acquire banks located outside its home state.

The regulatory situation started to change in 1970s and the banking sector in the United States had experienced widespread deregulations since then. The wave of deregulation regarding interstate banking was led by Maine which passed a law in 1978 permitting bank holding companies in other states to enter. The action of Maine was followed gradually by other states and all states but Hawaii had passed similar laws by 1992. However, these deregulations still did not permit the opening of branches across state boundaries. These restrictions were finally relaxed with the passage of the Riegle-Neal Interstate Banking and Branching Efficiency Act (IBBEA) in 1994. The IBBEA has been shown to increase competition among banks (Rice and Strahan, 2010; Jiang, Levine, and Lin, 2016), expand the supply of credit (Amore, Schneider, and Žaldokas, 2013), lower the cost of capital (Rice and Strahan, 2010) and reduce financial market frictions (Matvos, Seru, and Silva, 2018).[16]

While the IBBEA initiated the nationwide deregulation regarding interstate branching, it left the state authority with substantial freedom to implement the new law. Specifically, states are allowed to set interstate branching regulations regarding four crucial provisions: a) the minimum age of the target institution, b) de novo interstate branching, c) the acquisition of individual branches, and d) a statewide deposit cap. The more barriers a state lifts, the higher level of deregulation it implements. Based on these four aspects, Rice and Strahan (2010) construct a time-varying index for interstate branching restrictions from 1994 to 2005. The index value for a given state represents the number of the above-mentioned barriers this state implements. Thus, this branching restrictiveness index ranges from zero to four with higher value indicating less deregulation. In our empirical analysis, we follow D'Acunto, Liu, Pflueger, and Weber (2018) and treat one state as deregulated state if it removed at least one of the four restrictions, i.e., if the index value for that state is lower than four.[17]

5.2 Basic Results

To exploit the variation created by IBBEA, we estimate the following regression model:

$$Leverage_{i,t} = \alpha + \beta Inflex_{i,t-1} \times Dereg_{i,t} + \theta_1 Inflex_{i,t-1} + \theta_2 Dereg_{i,t} + \gamma' X_{i,t-1} + \tau_t + \tau_j + \epsilon_{i,t}, \quad (4)$$

where $Dereg_{i,t}$ is an indicator for bank deregulation which equals one if firm i is headquartered in a state that had implemented the deregulation (branching restrictiveness index below four) in or before year t, and zero otherwise. Other variables are defined in the same way as in Equation (3). The variable of interest is the interaction term, $Inflex_{i,t-1} \times Dereg_{i,t}$. We expect its coefficient,

[16] In this paper, we focus on the deregulation related to IBBEA. The results reported in the Appendix B (Table B.5) suggest that our findings remain unchanged after controlling the potential impacts from the earlier bank deregulatory events.

[17] The results are similar if we replace the deregulation dummy with the continuous deregulation index (Table B.4).

β, to be positive since more inflexible firms experience a larger increase in funds available after the deregulation and thus a larger increase in financial leverage.

Table 6 reports the estimation results of Equation (4). The leverage is measured by long-term leverage ratio (*LDM*) in the left panel (Columns (1) to (4)) and total leverage ratio (*TDM*) in the right panel (Columns (5) to (8)). In each panel, we present the results for the regression without either controls or fixed effects, the regression with year and industry fixed effects, the regression with control variables but no fixed effects, and the regression incorporating both control variables and fixed effects.

[Insert Table 6 Here]

In all specifications, the coefficient on the interaction term is positive and significant at the 1% level. For example, after control variables and fixed effects are added (Columns (4) and (8)), the coefficient β in the regression of *LDM* and *TDM* is estimated to be 0.478 and 0.470, respectively. And the corresponding t-statistics based on robust standard errors clustered at firm level are 4.89 and 3.96. These results support our hypothesis that more inflexible firms would increase leverage more after the bank deregulation. In Panel B of Table B.1 in the Appendix, we show that this conclusion is robust to alternative measures of financial leverage.

5.3 Dynamic Effect Estimation

The results in the previous subsection strengthen our baseline results about the relation between inflexibility and financial leverage. However, there may be potential problems with the results. First, although the bank deregulation represents a plausibly exogenous shock to credit supply, one may be still concerned about the possibility of reverse causality. This problem arises if changes in leverage ratio could somehow trigger deregulation. Another concern is that there might exist some pre-deregulation trends in leverage between flexible and inflexible firms. And if this is true, our previous results could be driven by these trends even in the absence of the shock. To address these issues, we follow Bertrand and Mullainathan (2003) to investigate the dynamics of the inflexibility-leverage relation surrounding the bank deregulation. Specifically, we estimate the following model:

$$
\begin{aligned}
Leverage_{i,t} \;=\;& \alpha + \beta_1 Before2_{i,t} \times Inflex_{i,t-1} + \beta_2 Before1_{i,t} \times Inflex_{i,t-1} + \beta_3 Current0_{i,t} \times Inflex_{i,t-1} \\
&+\; \beta_4 After1_{i,t} \times Inflex_{i,t-1} + \beta_5 After2_{i,t} \times Inflex_{i,t-1} + \theta_1 Before2_{i,t} + \theta_2 Before1_{i,t} \\
&+\; \theta_3 Current0_{i,t} + \theta_4 After1_{i,t} + \theta_5 After2_{i,t} + \theta_6 Inflex_{i,t-1} + \gamma' X_{i,t-1} + \tau_t + \tau_i + \epsilon_{i,t} \qquad (5)
\end{aligned}
$$

where $Before2_{i,t}$ and $Before1_{i,t}$ are indicators for two years and one year before the deregulation, respectively. $Current0_{i,t}$ is an indicator for the deregulation year. $After1_{i,t}$ is an indicator for one year after the deregulation. $After2_{i,t}$ is an indicator which equals one in two years or more post-deregulation, and zero otherwise. Other variables are defined in the same way as in Equation (3). If the role of bank deregulation is not spurious, we expect not to observe any effects before bank deregulation. In other words, if the effect of bank deregulation is true, β_1 and β_2 should be insignificant and at the same time, β_3, β_4, and β_5 are expected to be positive and significantly different from zero.

[Insert Table 7 Here]

Table 7 presents the dynamic effects of bank deregulation. In the first column, we report the results for long-term leverage ratio (*LDM*). The estimated coefficients of $Before2_{i,t} \times Inflex_{i,t-1}$ and $Before1_{i,t} \times Inflex_{i,t-1}$ are not significant at the conventional significance level, indicating that there is no difference in the change of leverage between flexible and inflexible firms prior to the positive shock to credit supply. This also verifies that the trends in leverage of flexible and inflexible firms are parallel before the deregulation events. Consistent with our previous results, we find that the estimates of β_3, β_4, and β_5 are positive (0.308, 0.274, and 0.244) and statistically significant (t = 2.58, 2.27, and 2.18). As shown in the second column, using total leverage ratio (*TDM*) as the dependent variable yields similar results. Overall, the results in Table 7 suggest that the effect of bank deregulation emerges starting from the year of deregulation which mitigates concerns on reverse causality.

5.4 Placebo Test

The results so far indicate that bank deregulation serves as a good setting to identify the relation between leverage and inflexibility. To further validate our empirical framework, we conduct a placebo test in this subsection. Following Cornaggia, Mao, Tian, and Wolfe (2015), we randomly assign a deregulation year to each state in the sample while maintaining the distribution of deregulation years in Rice and Strahan (2010). We then re-estimate Equation (4) with this randomized sample. This randomization process is repeated for 100 times.

[Insert Table 8 Here]

Table 8 shows the summary statistics of the coefficients and the corresponding t-statistics for the main variable of interest, *Inflex*×*Dereg*. It reports the mean, standard deviation, minimum, 25^{th} percentile, median, 75^{th} percentile, and maximum. We find that although the mean and median of the coefficients are positive, they have much smaller magnitude compared to those reported in Table 6. In addition, the distribution of t-statistics shows that most of the coefficients are statistically insignificant. These conclusions hold for alternative leverage measures and model specifications. The insignificance after randomization confirms that our previous results are unlikely to be driven by chance and that we could make a reliable inference relying on bank deregulation.

6 Further Evidence

In this section, we provide further evidence to support our arguments. First, we turn from short-term debt and total debt to bank debt. Second, we examine how the results vary across firms with different levels of external financing dependence. Third, we show that our conclusions are robust to a variety of model specifications. Finally, we explore the differential effects of CDS introduction among flexible and inflexible firms.

6.1 Inflexibility and Bank Debt

Since we argue that bank deregulation is an exogenous shock to bank credit, it is interesting to investigate changes in financial leverage associated with bank debt. To provide more direct evidence on changes in bank debt, we use data on bank debt from Capital IQ database, and define bank-debt-related leverage ratio as total bank debt scaled by market value of assets.

In Table 9, we report the estimation results of Equation (4) with bank-debt-related leverage ratio as the dependent variable. In Column (1), bank-debt-related leverage is regressed on our inflexibility measure, deregulation dummy, the interaction term as well as control variables. The coefficient on the interaction term is positive (0.115) and significant ($t = 3.46$). And the results remain robust after adding year and industry (four-digit SIC codes level) fixed effects (Column (2)): the coefficient estimate is 0.069 with a t-statistic of 2.78. Our results are similar if we define industry fixed effects with Fama and French (1997) 48-industry classification (Column (3)) or incorporate industry-by-year fixed effects in the regression (Column (4)). Overall, the significantly positive coefficients on *Inflex*×*Dereg* suggest that inflexible firms experience a larger increase in their bank debt compared with flexible firms when facing more credit supply from banks.

[Insert Table 9 Here]

6.2 Inflexibility, Leverage, and External Financing Dependence

In this subsection, we offer additional supporting evidence for our choice of deregulation shock by exploiting the cross-sectional variations in firms' dependence on external financing. If our results on the interaction term really come from the effect of bank deregulation, we would expect this effect to be stronger for firms that depend more heavily on external financing. To verify this view, we rely on three measures of external financing dependence. The first one is cash holding (*Cash*), defined as cash holding (Compustat item CHE) scaled by book value of total assets. The second measure is external financing needs (*EFN*) scaled by total assets where the external financing needs is proposed by Demirgüç-Kunt and Maksimovic (1998) and calculated as net growth rate of sales (Compustat item SALE) times total assets minus the product of gross sales growth rate and retained earnings (Compustat item RE). And the last proxy is Kaplan and Zingales (1997)'s financial constraint index (*KZ Index*). Since firms with lower cash holding, higher external financing needs, and higher financial constraints are likely to depend more on external financing, we suspect that the shock of bank deregulation exerts larger impacts on these firms.

To investigate the heterogeneous effects, we sort firms into five quintiles each year based on the measures of external financing dependence. We then estimate Equation (4) with the subsamples of the lowest and the highest quintiles. The results are shown in Table 10. Panels A and B present the results for long-term leverage ratio (*LDM*) and total leverage ratio (*TDM*), respectively.

[Insert Table 10 Here]

In Columns (1) and (2) of each panel, the sorting variable is cash holding. Consistent with our expectation, we find that the magnitude of the coefficient on *Inflex*×*Dereg* in the low cash holding group is larger than that in the high cash holding group. For example, in the regressions of *TDM*, the coefficient on the interaction term is 0.694 (t = 2.29) in the lowest cash quintile and 0.239 (t = 1.59) in the highest cash quintile. The sorting variable in Columns (3) and (4) is the *EFN*-to-assets ratio. We find that the coefficients on *Inflex*×*Dereg* are significantly positive in the high *EFN* group (Column (4)). However, in the low *EFN* group (Column (3)), these coefficients have much smaller magnitude and are not significant at 10% level. When the sample is split by *KZ Index*, we find that the magnitude of coefficients is higher in the financially constrained firms (Column (6)) than in the financially unconstrained firms (Column (5)).

Taken together, the results in Table 10 show that the effects of deregulation on the relation between leverage and inflexibility are stronger in firms with higher external financing dependence. Our conclusions from the subsample analysis remain the same if we examine the role of external financing dependence by introducing additional interaction terms to Equation (4). These results are reported in Appendix B (Table B.6).

6.3 Robustness Tests

6.3.1 Alternative Fixed-effects Specifications

This subsection investigates whether our results are robust to alternative model specifications. To identify differences from firms in the same industry in a certain year, we incorporate industry-by-year fixed effects. The estimation results are reported in Columns (1) and (4) of Table 11. From Panel A, we find that the regressions of leverage on inflexibility produce quantitatively similar results to those in our baseline case. In particular, the coefficient estimates on inflexibility are -0.439 (t = -7.95) and -0.534 (t = -8.16) in the regressions of long-term leverage ratio (*LDM*) and total leverage ratio (*TDM*), respectively. In the estimation results of regressions exploiting the bank deregulation (Panel B), the coefficients on *Inflex*×*Dereg* are similar to those presented before.

[Insert Table 11 Here]

In Columns (2) and (5) of Table 11, we add state fixed effects to the original estimation models. This specification allows us to identify differences between firms headquartered in the same state. It is an essential investigation especially for regressions of Equation (4) which involves the state-level bank deregulation. We find that the results from both baseline models (Panel A) and regressions exploiting the deregulation shock (Panel B) are robust to the inclusion of state fixed effects.

In another robustness test, we rerun the regressions with industries classified by the Fama and French (1997) 48-industry definition. As shown in Columns (3) and (6), using this alternative definition does not change our conclusions. In the regressions of Equation (3) (Panel A), there still exists a significantly negative relation between financial leverage and inflexibility. In the regressions with bank deregulation (Panel B), the coefficients on the interaction term remain positive (0.465 and 0.430) and significant at the 1% level (t = 4.78 and 3.70).

6.3.2 Additional Control Variables

We now consider several additional control variables. Previous studies (Gu, Hackbarth, and Johnson, 2018) document that stock return volatility varies with firm-level inflexibility with less flexible firms associated with higher return volatility. On the other hand, although the relation is far from conclusive, several existing studies (e.g., Lemmon, Roberts, and Zender, 2008; Frank and Goyal, 2009; D'Acunto, Liu, Pflueger, and Weber, 2018) treat volatility as one determinant of financial leverage. To alleviate the concern that our results are driven by the omission of volatility, we include return volatility (*Vol*) as an additional control variable. It is the annualized stock return volatility calculated as the standard deviation of daily stock returns in the previous calendar year. In the calculation, we require at least 60 daily observations are available. We also control for the logarithm of firm age (*log(Age)*) since old firms may have better access to capital and thus adopt different capital structure decisions compared with younger ones (Faulkender and Petersen, 2005). The age of a firm is the number of years since its first appearance in Compustat.

In addition, we explicitly include operating leverage (*OL*) in our regressions to take into account the previously-documented substitution effect between operating leverage and financial leverage. Recent research (Chen, Harford, and Kamara, 2019) also shows that operating leverage helps explain the negative relation between profitability and financial leverage. Following Novy-Marx (2011), we define operating leverage as operating costs (Compustat item COGS + XSGA) divided by total assets.

Furthermore, prior studies document that product market competition could drive the firm's financing decisions (e.g., Sullivan, 1974; Miao, 2005). To show that the effects of inflexibility are distinct from those of industry competition, we incorporate two variables. One is price-to-cost margin (*Price-Cost Margin*), defined as one minus the ratio of cost of goods sold (Compustat item COGS) to net sales. This variable captures firm-level market power. And the other variable is the Herfindahl index (*HHI*) which measures industry concentration.

The results are presented in Columns (2) and (5) of Table 12. The regression coefficients from our baseline specifications are shown in Columns (1) and (4) for comparison. The results in Panel A show that the presence of additional control variables does not affect the negative relation between financial leverage and inflexibility. For example, the estimated coefficient on *Inflex* in the regression of long-term leverage ratio is -0.478 (t = -8.30) which is close to the estimate of -0.442 (t = -8.81) obtained in the baseline case. In the regressions utilizing bank deregulation, as shown in Panel B, both the magnitude and significance of the coefficients on *Inflex*×*Dereg* are similar to those in our baseline regressions.

[Insert Table 12 Here]

In our analyses above, the Herfindahl index is computed based on sales data from Compustat. However, Ali, Klasa, and Yeung (2009) raise concerns on the biases in Compustat-based industry concentration proxies. To mitigate these concerns, we also control the Herfindahl index constructed by Hoberg and Phillips (2010) which is calculated based on both public and private firms. The results are presented in Columns (3) and (6) of Table 12. There still exists a strong negative relation between inflexibility and leverage ratios. And in the bank deregulation regressions, the coefficients on the interaction term remain positive (0.478 and 0.432) and significant at the 1% level (t = 3.50 and 2.75).

6.4 Introduction of CDS

We now provide additional supporting evidence for our second hypothesis by exploiting the impacts of CDS inception. CDS contracts offer buyers (usually creditors) protection against borrowers' default. In particular, CDS enables the buyer to swap borrowers' credit risk with the seller by allowing the buyer to ask for reimbursement from the seller in the case of borrower default. Clearly, CDS is an important tool for lenders to hedge against borrowers' default risk. Once CDS contracts are introduced for debt of a firm, lenders should be less concerned about potential defaults and thus they may increase credit supply to the underlying firm (Saretto and Tookes, 2013). We expect that the effects of CDS introduction on financial leverage to be larger among inflexible firms than flexible firms because inflexible firms tend to be underlevered and in greater need of funds to finance their business activities.

We identify the inception date of CDS contracts for a firm using Markit database, which provides CDS pricing data since 2001. We merge the CDS trading information with our main datasets by manually checking the name and ticker of companies. In our sample, 606 unique firms are matched with CDS data and 6,029 firm-year observations are associated with CDS trading. To examine the differential effects of CDS inception, we introduce a CDS trading dummy (*CDS*) and its interaction with inflexibility (*Inflex*×*CDS*) into Equation (3), where *CDS* is equal to one if a firm has CDS traded on its debt in a given year, and zero otherwise.

[Insert Table 13 Here]

The regression results are presented in Table 13. In Columns (1) and (2), we regress long-term leverage ratio (*LDM*) on inflexibility (*Inflex*), CDS trading dummy (*CDS*), the interaction between them (*Inflex*×*CDS*), together with control variables. Consistent with our expectation, the coefficients on the interaction term are positive and statistically significant, suggesting that inflexible firms increase leverage more than flexible firms following the introduction of CDS. We also replace the continuous inflexibility measure with the indicator variable for high inflexibility (*Inflex_Median*). As shown in Columns (3) and (4), the coefficients on the interaction term (*Inflex_Median*×*CDS*) are still significantly positive. We obtain similar and even stronger results for total leverage ratio (shown in Columns (4) to (8)). Overall, our evidence shows that the increase in credit supply arising from CDS introduction exerts greater influences on financial leverage of inflexible firms than that of flexible firms.

7 Conclusion

This paper examines how a firm's inflexibility (i.e., inability to adjust its scale in response to profitability shocks) shapes its financial policy. Using a firm-level inflexibility measure based on real option theories, we show that inflexible firms have lower financial leverage relative to flexible firms. The results hold after addressing potential measurement error and endogeneity issues. Notably, our findings suggest that contraction inflexibility exert a larger impact on financial leverage compared with expansion inflexibility. Moreover, we exploit the staggered state-level deregulation of bank branching to test whether an exogenous shock to credit supply affects financial leverage of inflexible firms more than that of flexible firms. This conjecture is supported by our findings. Further analysis validates the empirical framework and shows that our conclusions are robust to different model specifications as well as alternative leverage measures. The analysis exploring the introduction of CDS yields same conclusions.

The results in this paper highlight the importance of operating inflexibility and aid out understanding of cross-sectional variation in corporate capital structure. Although previous studies have documented that flexibility affects a firm's risk management and its stock returns, the evidence on the relation between inflexibility and financial leverage is mixed and limited. By examining a large sample of most U.S. public firms over almost 50 years, we provide many new and useful insights on this topic.

Overall, our results suggest that operating flexibility is an important determinant of a firm's financial policy. Therefore, our research could offer useful guidance for practitioners as well as regulators. By assessing a firm's inflexibility, corporate executives are supposed to adopt a more favorable leverage level which is beneficial to the development of their firm. Our results also suggest that inflexibility is a significant factor for regulators to consider when making regulatory decisions on corporate financial policies.

References

Aivazian, Varouj A, and Michael K Berkowitz, 1998, Ex post production flexibility, asset specificity, and financial structure, *Journal of Accounting, Auditing & Finance* 13, 1–20.

Ali, Ashiq, Sandy Klasa, and Eric Yeung, 2009, The limitations of industry concentration measures constructed with compustat data: Implications for finance research, *Review of Financial Studies* 22, 3839–3871.

Amore, Mario Daniele, Cedric Schneider, and Alminas Žaldokas, 2013, Credit supply and corporate innovation, *Journal of Financial Economics* 109, 835–855.

Baker, Malcolm, and Jeffrey Wurgler, 2002, Market timing and capital structure, *Journal of Finance* 57, 1–32.

Balasubramanian, Natarajan, and Jagadeesh Sivadasan, 2009, Capital resalability, productivity dispersion, and market structure, *Review of Economics and Statistics* 91, 547–557.

Bertrand, Marianne, and Sendhil Mullainathan, 2003, Enjoying the quiet life? corporate governance and managerial preferences, *Journal of Political Economy* 111, 1043–1075.

Bhamra, Harjoat S, Lars-Alexander Kuehn, and Ilya A Strebulaev, 2010, The aggregate dynamics of capital structure and macroeconomic risk, *Review of Financial Studies* 23, 4187–4241.

Bradley, Michael, Gregg A Jarrell, and E Han Kim, 1984, On the existence of an optimal capital structure: Theory and evidence, *Journal of Finance* 39, 857–878.

Campbell, John Y, Jens Hilscher, and Jan Szilagyi, 2008, In search of distress risk, *Journal of Finance* 63, 2899–2939.

Chen, Zhiyao, Jarrad Harford, and Avraham Kamara, 2019, Operating leverage, profitability, and capital structure, *Journal of Financial and Quantitative Analysis* 54, 369–392.

Cornaggia, Jess, Yifei Mao, Xuan Tian, and Brian Wolfe, 2015, Does banking competition affect innovation?, *Journal of Financial Economics* 115, 189–209.

D'Acunto, Francesco, Ryan Liu, Carolin Pflueger, and Michael Weber, 2018, Flexible prices and leverage, *Journal of Financial Economics* 129, 46–68.

Danis, András, Daniel A Rettl, and Toni M Whited, 2014, Refinancing, profitability, and capital structure, *Journal of Financial Economics* 114, 424–443.

Demirgüç-Kunt, Asli, and Vojislav Maksimovic, 1998, Law, finance, and firm growth, *Journal of Finance* 53, 2107–2137.

Denis, David J., and Stephen B. McKeon, 2016, Proactive leverage increases and the value of financial flexibility, *Journal of Applied Corporate Finance* 28, 17–28.

Eisfeldt, Andrea L, and Adriano A Rampini, 2006, Capital reallocation and liquidity, *Journal of Monetary Economics* 53, 369–399.

Elsas, Ralf, Mark J. Flannery, and Jon A. Garfinkel, 2014, Financing major investments: Information about capital structure decisions, *Review of Finance* 18, 1341–1386.

Erickson, Timothy, Colin Huan Jiang, and Toni M Whited, 2014, Minimum distance estimation of the errors-in-variables model using linear cumulant equations, *Journal of Econometrics* 183, 211–221.

Fama, Eugene F, and Kenneth R French, 1997, Industry costs of equity, *Journal of Financial Economics* 43, 153–193.

Fama, Eugene F, and Kenneth R French, 2002, Testing trade-off and pecking order predictions about dividends and debt, *Review of Financial Studies* 15, 1–33.

Faulkender, Michael, Mark J Flannery, Kristine Watson Hankins, and Jason M Smith, 2012, Cash flows and leverage adjustments, *Journal of Financial Economics* 103, 632–646.

Faulkender, Michael, and Mitchell A Petersen, 2005, Does the source of capital affect capital structure?, *Review of Financial Studies* 19, 45–79.

Frank, Murray Z, and Vidhan K Goyal, 2003, Testing the pecking order theory of capital structure, *Journal of Financial Economics* 67, 217–248.

Frank, Murray Z, and Vidhan K Goyal, 2009, Capital structure decisions: which factors are reliably important?, *Financial Management* 38, 1–37.

Gorodnichenko, Yuriy, and Michael Weber, 2016, Are sticky prices costly? evidence from the stock market, *American Economic Review* 106, 165–99.

Graham, John R., and Mark T. Leary, 2011, A review of empirical capital structure research and directions for the future, *Annual Review of Financial Economics* 3, 309–345.

Grullon, Gustavo, Evgeny Lyandres, and Alexei Zhdanov, 2012, Real options, volatility, and stock returns, *Journal of Finance* 67, 1499–1537.

Gu, Lifeng, Dirk Hackbarth, and Tim Johnson, 2018, Inflexibility and stock returns, *Review of Financial Studies* 31, 278–321.

Hackbarth, Dirk, 2008, Managerial traits and capital structure decisions, *Journal of Financial and Quantitative Analysis* 43, 843–881.

Hackbarth, Dirk, and Timothy Johnson, 2015, Real options and risk dynamics, *Review of Economic Studies* 82, 1449–1482.

Hackbarth, Dirk, Jianjun Miao, and Erwan Morellec, 2006, Capital structure, credit risk, and macroeconomic conditions, *Journal of Financial Economics* 82, 519–550.

Harris, Milton, and Artur Raviv, 1991, The theory of capital structure, *Journal of Finance* 46, 297–355.

Hirshleifer, David, 1991, Seasonal patterns of futures hedging and the resolution of output uncertainty, *Journal of Economic Theory* 53, 304–327.

Ho, Thomas SY, 1984, Intertemporal commodity futures hedging and the production decision, *Journal of Finance* 39, 351–376.

Hoberg, Gerard, and Gordon Phillips, 2010, Real and financial industry booms and busts, *Journal of Finance* 65, 45–86.

Jayaratne, Jith, and Philip E Strahan, 1996, The finance-growth nexus: Evidence from bank branch deregulation, *Quarterly Journal of Economics* 111, 639–670.

Jiang, Liangliang, Ross Levine, and Chen Lin, 2016, Competition and bank opacity, *Review of Financial Studies* 29, 1911–1942.

Kamara, Avraham, 1993, Production flexibility, stochastic separation, hedging, and futures prices, *Review of Financial Studies* 6, 935–957.

Kaplan, Steven N, and Luigi Zingales, 1997, Do investment-cash flow sensitivities provide useful measures of financing constraints?, *Quarterly Journal of Economics* 112, 169–215.

Kayhan, Ayla, and Sheridan Titman, 2007, Firms histories and their capital structures, *Journal of Financial Economics* 83, 1–32.

Kim, Hyunseob, and Howard Kung, 2017, The asset redeployability channel: How uncertainty affects corporate investment, *Review of Financial Studies* 30, 245–280.

Klasa, Sandy, Hernan Ortiz-Molina, Matthew Serfling, and Shweta Srinivasan, 2018, Protection of trade secrets and capital structure decisions, *Journal of Financial Economics* 128, 266–286.

Korteweg, Arthur, Michael Schwert, and Ilya Strebulaev, 2018, Proactive capital structure adjustments: Evidence from corporate filings, Working paper, University of Southern California.

Kraus, Alan, and Robert H Litzenberger, 1973, A state-preference model of optimal financial leverage, *Journal of Finance* 28, 911–922.

Lemmon, Michael L, Michael R Roberts, and Jaime F Zender, 2008, Back to the beginning: persistence and the cross-section of corporate capital structure, *Journal of Finance* 63, 1575–1608.

MacKay, Peter, 2003, Real flexibility and financial structure: An empirical analysis, *Review of Financial Studies* 16, 1131–1165.

MacKay, Peter, and Gordon M Phillips, 2005, How does industry affect firm financial structure?, *Review of Financial Studies* 18, 1433–1466.

Mackie-Mason, Jeffrey K, 1990, Do taxes affect corporate financing decisions?, *Journal of Finance* 45, 1471–1493.

Matvos, Gregor, Amit Seru, and Rui C Silva, 2018, Financial market frictions and diversification, *Journal of Financial Economics* 127, 21–50.

Mauer, David C, and Alexander J Triantis, 1994, Interactions of corporate financing and investment decisions: A dynamic framework, *Journal of Finance* 49, 1253–1277.

Miao, Jianjun, 2005, Optimal capital structure and industry dynamics, *Journal of Finance* 60, 2621–2659.

Modigliani, Franco, and Merton H. Miller, 1958, The cost of capital, corporation finance and the theory of investment, *American Economic Review* 48, 261–297.

Moon, S. Katie, and Gordon Phillips, 2017, Outsourcing through purchase contracts and firm capital structure, Working paper, Dartmouth College.

Myers, Stewart C, 1977, Determinants of corporate borrowing, *Journal of Financial Economics* 5, 147–175.

Myers, Stewart C, 1984, The capital structure puzzle, *Journal of Finance* 39, 574–592.

Myers, Stewart C, and Nicholas S Majluf, 1984, Corporate financing and investment decisions when firms have information that investors do not have, *Journal of Financial Economics* 13, 187–221.

Novy-Marx, Robert, 2011, Operating leverage, *Review of Finance* 15, 103–134.

Rajan, Raghuram G, and Luigi Zingales, 1995, What do we know about capital structure? some evidence from international data, *Journal of Finance* 50, 1421–1460.

Reinartz, Sebastian J, and Thomas Schmid, 2016, Production flexibility, product markets, and capital structure decisions, *Review of Financial Studies* 29, 1501–1548.

Rice, Tara, and Philip E Strahan, 2010, Does credit competition affect small-firm finance?, *Journal of Finance* 65, 861–889.

Robichek, Alexander A, and Stewart C Myers, 1966, Problems in the theory of optimal capital structure, *Journal of Financial and Quantitative Analysis* 1, 1–35.

Saretto, Alessio, and Heather E Tookes, 2013, Corporate leverage, debt maturity, and credit supply: The role of credit default swaps, *Review of Financial Studies* 26, 1190–1247.

Schwert, Michael, and Ilya Strebulaev, 2014, Capital structure and systematic risk, Working paper, University of Pennsylvania.

Serfling, Matthew, 2016, Firing costs and capital structure decisions, *Journal of Finance* 71, 2239–2286.

Simintzi, Elena, Vikrant Vig, and Paolo Volpin, 2015, Labor protection and leverage, *Review of Financial Studies* 28, 561–591.

Strebulaev, Ilya A, 2007, Do tests of capital structure theory mean what they say?, *Journal of Finance* 62, 1747–1787.

Stulz, ReneéM, 1990, Managerial discretion and optimal financing policies, *Journal of Financial Economics* 26, 3–27.

Sufi, Amir, 2009, Bank lines of credit in corporate finance: An empirical analysis, *Review of Financial Studies* 22, 1057–1088.

Sullivan, Timothy G, 1974, Market power, profitability and financial leverage, *Journal of Finance* 29, 1407–1414.

Syverson, Chad, 2004, Product substitutability and productivity dispersion, *Review of Economics and Statistics* 86, 534–550.

Titman, Sheridan, and Roberto Wessels, 1988, The determinants of capital structure choice, *Journal of Finance* 43, 1–19.

Weber, Michael, 2015, Nominal rigidities and asset pricing, Working paper, University of Chicago.

Appendix

This appendix consists of two parts. In Appendix A, Table A.1 provides the definition of variables used in the paper, including ten leverage measures, two inflexibility measures, and some additional variables.

Appendix B reports additional results. Figure B.1 illustrates time-series comparison of response of leverage ratios to changes in inflexibility. Figure B.2 illustrates cross-sectional comparison of response of leverage ratios to changes in inflexibility. Figure B.3 compares the credit line usage rates of flexible and inflexible firms. In Table B.1, we replicate our main results using alternative leverage measures. Table B.2 reports the results of baseline regressions and bank deregulation regressions with standard errors clustered at industry and year level. Table B.3 reports the results of baseline regressions and bank deregulation regressions with time-invariant inflexibility measure, where the time-invariant measure is calculated as the time-series average of inflexibility over the sample period for each individual firm. Table B.4 reports the results for robustness tests where the deregulation dummy is replaced by the deregulation index. Table B.5 eliminates the potential impacts from other bank deregulatory events. Table B.6 investigates the role of external financing dependence on the relation between leverage and inflexibility together with bank deregulation using interaction terms. Table B.7 shows the relation between inflexibility and default risk.

Appendix A

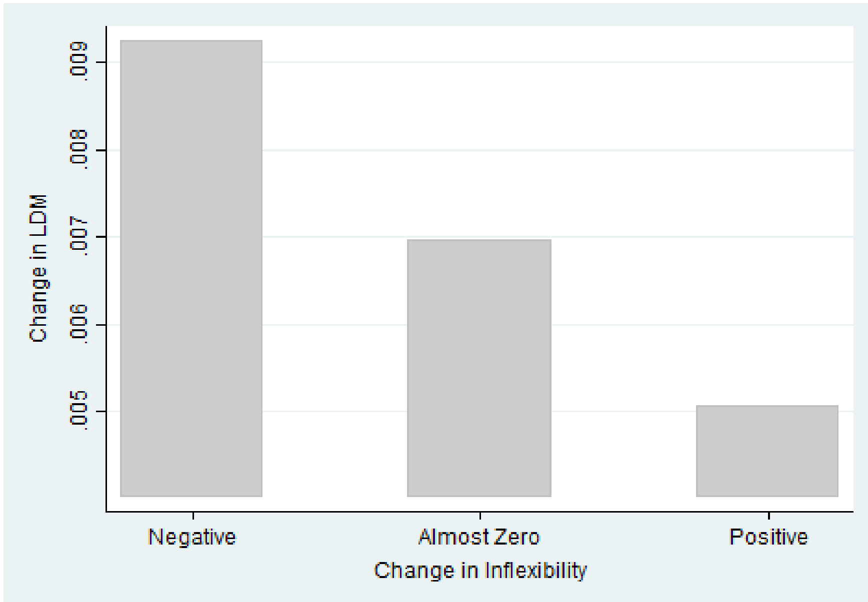
Table A.1

Variable Definition

Leverage Measures	
LDM	Long-term debt (Compustat item DLTT) divided by market value of assets, where the market value of assets is computed as the sum of long-term debt and debt in current liabilities (Compustat item DLC) minus cash holding (Compustat item CHE) and plus the market value of equity (Compustat item CSHO × PRCC_F)
TDM	Total debt (Compustat item DLTT + DLC) divided by market value of assets (defined as in LDM)
LDM1	Long-term debt divided by market value of assets, where the market value of assets is computed as the market value of equity (Compustat item CSHO × PRCC_F) plus total debt and total preferred stock (Compustat item PSTKL) minus deferred taxes and investment tax credit (Compustat item TXDITC)
TDM1	Total debt divided by the market value of assets (defined as in LDM1)
LDM2	Long-term debt divided by market value of assets, where the market value of assets is computed as the market value of equity (Compustat item CSHO × PRCC_F) plus total assets and minus total common equity (Compustat item CEQ)
TDM2	Total debt divided by the market value of assets (defined as in LDM2)
LDA	Long-term debt scaled by book value of total assets
TDA	Total debt scaled by book value of total assets
Inflexibility Measures	
Inflex	Inflexibility measure calculated as the range of firms operating costs over sales divided by the standard deviation of the annual growth rate of sales over assets
Inflex_Median	Dummy variable which equals one if a firm's inflexibility is above the sample median in a certain year, and zero otherwise
Other Variables	
B/M	Book value of total assets divided by market value of assets (defined as in LDM)
Cash	Cash holding scaled by book value of total assets
CDS	Dummy variable which equals one if firm i has CDS traded on its debt in year t, and zero otherwise
Dereg	Dummy variable which equals one if firm i is headquartered in a state that had implemented the deregulation (branching restrictiveness index below four) in or before year t, and zero otherwise
DeregIndex	Branching restrictiveness index from Rice and Strahan (2010)
EFN	External financing needs scaled by total assets, where external financing needs, as in Demirgüç-Kunt and Maksimovic (1998), is defined as net growth rate of sales (Compustat item SALE) times total assets minus gross sales growth rate times retained earnings (Compustat item RE)
FP	Failure probability based on the third column in Table IV in Campbell, Hilscher, and Szilagyi (2008), where the annual failure probability is calculated as the average of monthly values over the year
HHI	Herfindahl index based on sales (Compustat item SALE)
HP HHI	Fitted Herfindahl index provided by Hoberg and Phillips (2010)
IndustLev	The median value of total market leverage (TDM) in a certain industry and a certain year
Inter	Dummy variable which equals one in years after the state implemented the interstate banking deregulation, and zero otherwise
Intra	Dummy variable which equals one in years after the state implemented the intrastate branching deregulation, and zero otherwise
KZ Index	Financial constraint index constructed in Kaplan and Zingales (1997)
log(Age)	Logarithm of firm age, where age is the number of years since a firm's first appearance in Compustat
OL	Operating costs (Compustat item COGS + XSGA) divided by total assets
Price-Cost Margin	One minus the ratio of cost of goods sold (Compustat item COGS) to sales
Profit	The ratio of operating income before depreciation (Compustat item OIBDP) to total assets
Size	Logarithm of total assets
Tangible	The ratio of net property, plant, and equipment (Compustat item PPENT) to total assets
Vol	Annualized stock return volatility calculated from daily data in the previous calendar year where the calculation requires at least 60 daily observations
Z	Modified Z-score proposed by Mackie-Mason (1990): 1.2 × Working Capital (Compustat item WCAP) / Total Assets + 1.4 × Retained Earings (Compustat item RE) / Total Assets + 3.3 × EBIT / Total Assets + Sales / Total Assets

Appendix B

a. Change in Long-term Leverage Ratio



b. Change in Total Leverage Ratio

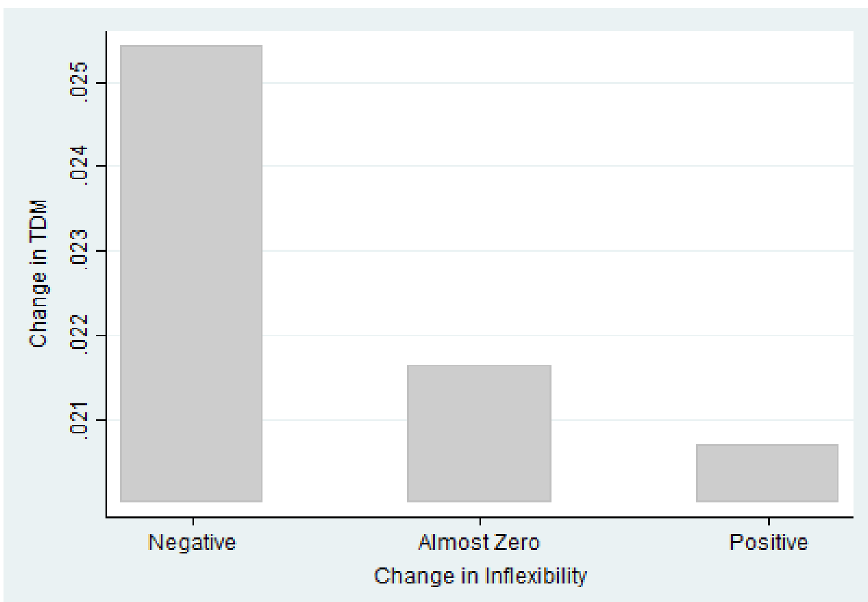
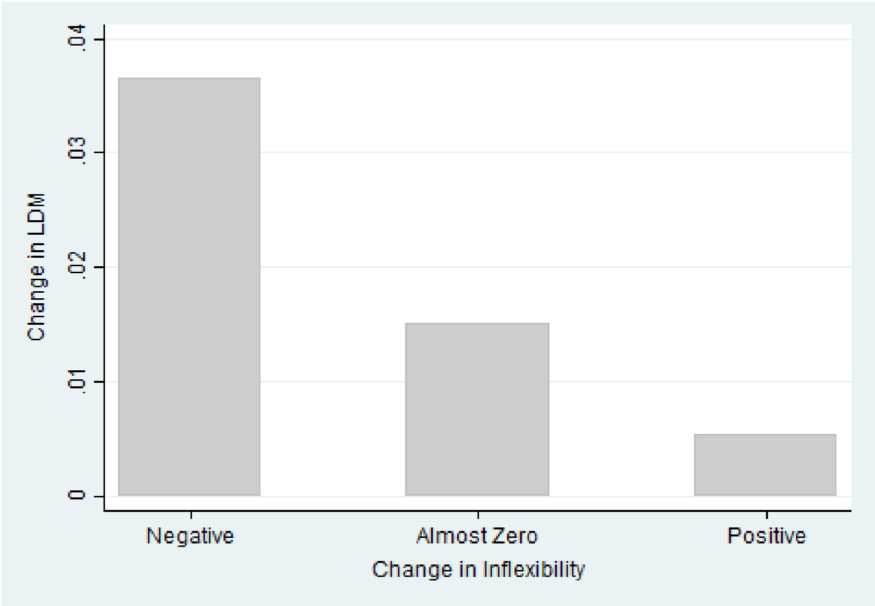


Figure B.1

Response of Leverage Ratios to Changes in Inflexibility: Time-series Comparison

This figure illustrates the relation between changes in inflexibility and changes in leverage ratios by time-series comparison. For each firm, we identify the largest decrease in inflexibility (Negative Group), the largest increase in inflexibility (Positive Group), and the smallest absolute change in inflexibility (Almost Zero Group) over the sample period. And the average changes in leverage ratios are plotted for each group. In the top plot (subfigure a), leverage is the ratio of long-term debt to market value of assets (*LDM*). In the bottom plot (subfigure b), leverage is the ratio of total debt to market value of assets (*TDM*). The sample period is from 1970 to 2017.

a. Change in Long-term Leverage Ratio



b. Change in Total Leverage Ratio

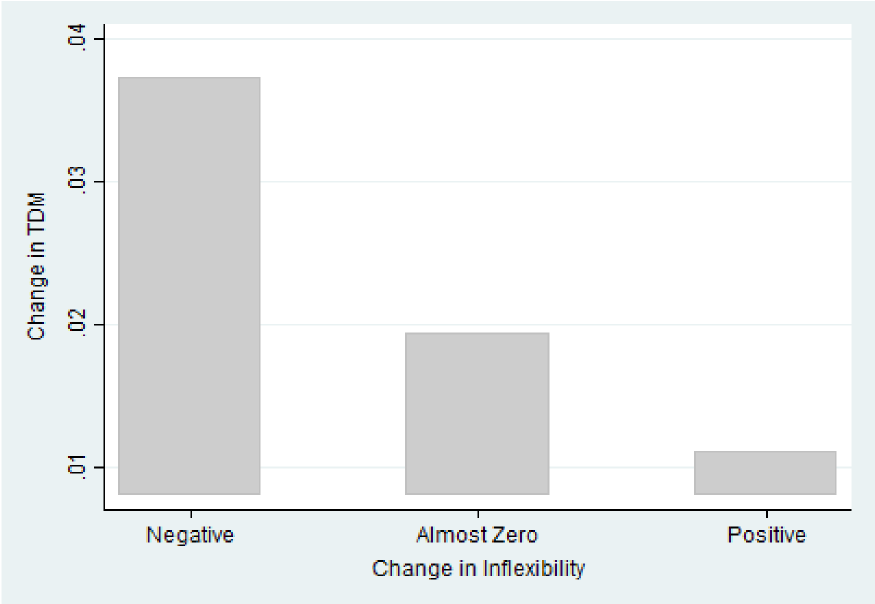


Figure B.2

Response of Leverage Ratios to Changes in Inflexibility: Cross-sectional Comparison

This figure plots the relation between changes in inflexibility and changes in leverage ratios by cross-sectional comparison. In each year, we identify firms with bottom 1% decrease in inflexibility (Negative Group), top 1% increase in inflexibility (Positive Group), and the smallest 1% absolute change in inflexibility (Almost Zero Group). And the average changes in leverage ratios are plotted for each group. In the top plot (subfigure a), leverage is the ratio of long-term debt to market value of assets (*LDM*). In the bottom plot (subfigure b), leverage is the ratio of total debt to market value of assets (*TDM*). The sample period is from 1970 to 2017.

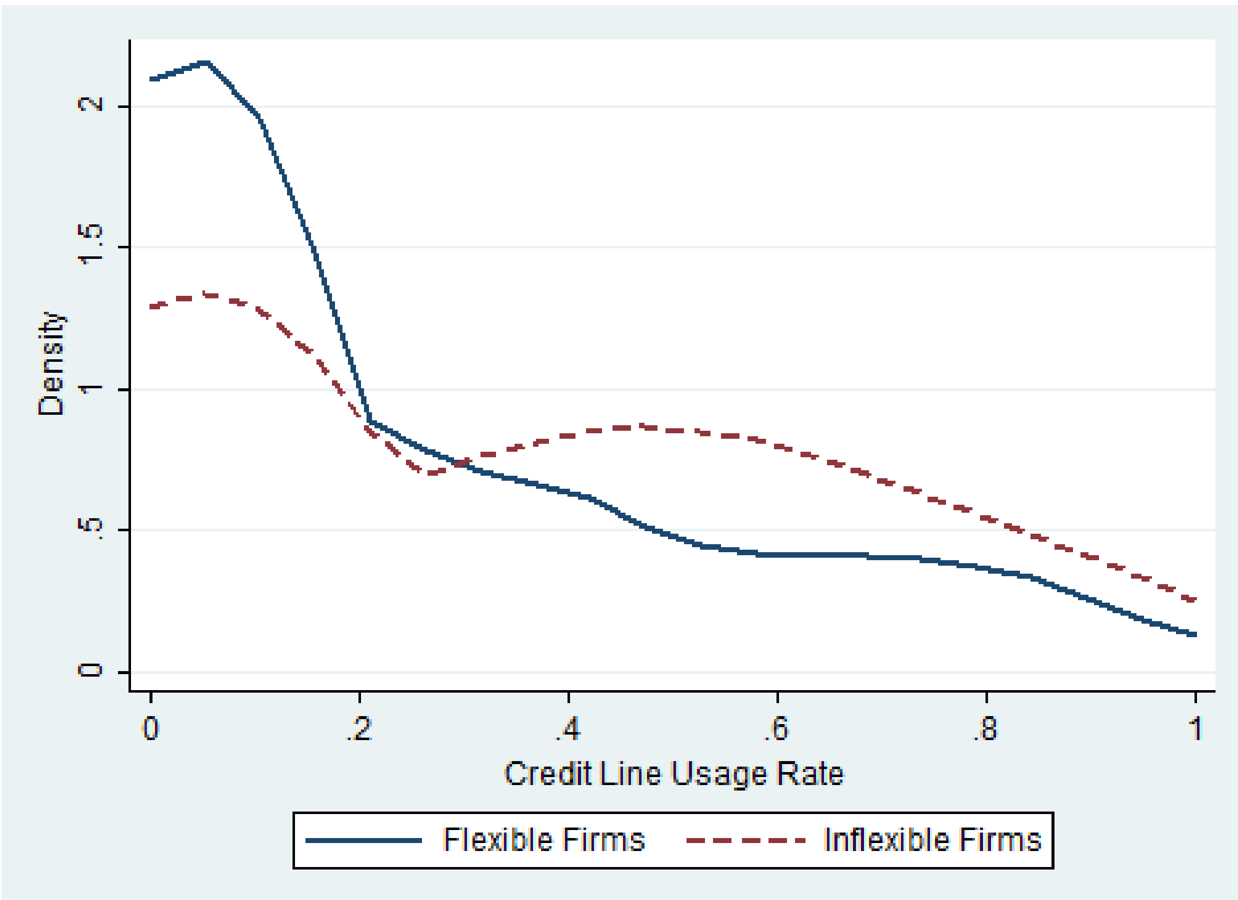


Figure B.3
Credit Line Usage Rate: Flexible Firms and Inflexible Firms

This figure demonstrates the density of credit line usage rates for flexible firms (bottom quintile) and inflexible firms (top quintile). The sample period is from 1996 to 2003, due to the availability of Sufi (2009)'s credit line data.

Table B.1

Alternative Leverage Definitions

This table reports regression results for alternative measures of leverage. Panel A shows the effects of inflexibility on leverage as in Table 2 and Panel B displays the effects of inflexibility together with bank deregulation on leverage as in Table 6. *LDM1* and *LDM2* are long-term debt scaled by market value of assets. *TDM1* and *TDM2* are total debt scaled by market value of assets. *LDA* is long-term debt scaled by book value of total assets, and *TDA* is total debt scaled by book value of total assets. The control variables include profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), assets tangibility (*Tangible*), and industry median leverage (*IndustLev*). The detailed variable definitions are provided in Appendix Table A.1. Year and industry (four-digit SIC codes level) fixed effects are included. The sample period is from 1970 to 2017. *t*-statistics based on standard errors clustered at firm level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: Inflexibility and leverage

	LDM1	TDM1	LDM2	TDM2	LDA	TDA
Inflex	-0.434***	-0.546***	-0.314***	-0.389***	-0.295***	-0.330***
	(-9.40)	(-10.01)	(-8.71)	(-9.21)	(-6.19)	(-5.82)
Profit	-0.183***	-0.270***	-0.123***	-0.183***	-0.147***	-0.237***
	(-19.35)	(-21.59)	(-17.24)	(-19.62)	(-13.63)	(-17.82)
Size	0.019***	0.015***	0.012***	0.008***	0.018***	0.014***
	(18.02)	(12.62)	(15.28)	(9.49)	(19.74)	(14.40)
B/M	0.017***	0.023***	0.002**	0.003***	-0.018***	-0.024***
	(11.44)	(12.31)	(2.50)	(2.58)	(-17.69)	(-20.21)
Tangible	0.188***	0.185***	0.145***	0.146***	0.147***	0.147***
	(14.01)	(11.76)	(14.16)	(12.19)	(12.75)	(11.05)
IndustLev	0.344***	0.436***	0.244***	0.309***	0.241***	0.302***
	(29.45)	(32.82)	(28.77)	(32.07)	(25.05)	(27.98)
Constant	-0.056***	0.013	-0.002	0.060***	0.025***	0.110***
	(-7.01)	(1.29)	(-0.33)	(8.18)	(3.50)	(13.16)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	77,555	77,555	80,985	80,977	81,031	81,020
Adjusted R^2	0.329	0.336	0.301	0.308	0.260	0.248

Panel B: Inflexibility, bank deregulation, and leverage

	LDM1	TDM1	LDM2	TDM2	LDA	TDA
Inflex*Dereg	0.446***	0.438***	0.313***	0.302***	0.314***	0.200*
	(5.02)	(4.13)	(4.46)	(3.64)	(3.17)	(1.74)
Inflex	-0.778***	-0.883***	-0.558***	-0.624***	-0.540***	-0.486***
	(-9.20)	(-8.78)	(-8.50)	(-8.07)	(-6.14)	(-4.85)
Dereg	-0.008	-0.007	-0.006	-0.006	-0.010*	-0.008
	(-1.28)	(-1.04)	(-1.34)	(-1.07)	(-1.67)	(-1.21)
Profit	-0.181***	-0.269***	-0.122***	-0.183***	-0.146***	-0.236***
	(-19.22)	(-21.50)	(-17.13)	(-19.55)	(-13.54)	(-17.79)
Size	0.019***	0.015***	0.012***	0.008***	0.018***	0.014***
	(17.90)	(12.51)	(15.16)	(9.38)	(19.67)	(14.36)
B/M	0.017***	0.023***	0.002**	0.003**	-0.018***	-0.024***
	(11.44)	(12.31)	(2.49)	(2.57)	(-17.70)	(-20.20)
Tangible	0.190***	0.187***	0.146***	0.147***	0.148***	0.147***
	(14.14)	(11.86)	(14.27)	(12.28)	(12.81)	(11.07)
IndustLev	0.344***	0.436***	0.244***	0.309***	0.241***	0.302***
	(29.47)	(32.85)	(28.79)	(32.10)	(25.06)	(28.00)
Constant	-0.052***	0.016	0.001	0.063***	0.027***	0.111***
	(-6.55)	(1.64)	(0.10)	(8.51)	(3.88)	(13.39)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	77,555	77,555	80,985	80,977	81,031	81,020
Adjusted R^2	0.330	0.337	0.302	0.309	0.261	0.248

Table B.2

Alternative Robust Standard Errors

This table presents regression results with standard errors clustered at industry and year level. Panel A shows the effects of inflexibility on leverage as in Table 2. The dependent variable is long-term debt scaled by market value of assets (*LDM*) in the first two columns and total debt scaled by market value of assets (*TDM*) in the last two columns. Columns (1) and (3) regress leverage on inflexibility (*Inflex*) together with control variables. Year and industry (four-digit SIC codes level) fixed effects are included. Columns (2) and (4) replace the continuous inflexibility measure with an indicator variable, *Inflex_Median*, which equals one if a firm's inflexibility is above the median in the sample in a certain year, and zero otherwise. Panel B displays the effects of inflexibility together with bank deregulation on leverage as in Table 6. The dependent variable is *LDM* in the first two columns and *TDM* in the last two columns. Columns (1) and (3) regress leverage on inflexibility together with industry and year fixed effects. Columns (2) and (4) add control variables. The sample period is from 1970 to 2017. *t*-statistics are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: Inflexibility and leverage

	LDM		TDM	
	(1)	(2)	(3)	(4)
Inflex	-0.442***		-0.542***	
	(-5.08)		(-5.01)	
Inflex_Median		-0.039***		-0.044***
		(-8.70)		(-8.52)
Controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Obs	80,979	80,979	80,979	80,979
Adjusted R^2	0.303	0.306	0.321	0.323

Panel B: Inflexibility, bank deregulation, and leverage

	LDM		TDM	
	(1)	(2)	(3)	(4)
Inflex×Dereg	0.558***	0.478***	0.563***	0.470***
	(5.37)	(5.63)	(4.63)	(4.65)
Inflex	-0.873***	-0.814***	-0.813***	-0.907***
	(-9.45)	(-7.15)	(-7.79)	(-6.79)
Dereg	-0.008	-0.007	-0.007	-0.006
	(-1.10)	(-1.03)	(-0.82)	(-0.77)
Controls	No	Yes	No	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Obs	81,354	80,979	81,354	80,979
Adjusted R^2	0.215	0.304	0.222	0.322

Table B.3

Time-invariant Inflexibility Measure

This table reports the results obtained using time-invariant inflexibility which is calculated as the time-series average of inflexibility over the sample period for each individual firm. Panel A presents the results from the following regression of leverage on inflexibility:

$$Leverage_{i,t} = \alpha + \beta Inflex_i + \gamma' X_{i,t-1} + \tau_t + \tau_j + \epsilon_{i,t},$$

where *Leverage* is either long-term debt scaled by market value of assets (*LDM* in Columns (1) to (2)) or total debt scaled by market value of assets (*TDM* in Columns (3) to (4)). *Inflex* is the time-invariant inflexibility measure. X represents the control variables including profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), assets tangibility (*Tangible*), and industry median leverage (*IndustLev*). *Inflex_Median* is an indicator which equals one if a firm's time-invariant inflexibility is above the median in the sample, and zero otherwise. The detailed variable definitions are provided in Appendix Table A.1. Columns (1) and (3) use the continuous time-invariant inflexibility measure. Columns (2) and (4) replace the inflexibility measure with the indicator variable. Both industry (four-digit SIC codes level) and year fixed effects are included. Panel B reports the results from the following regression:

$$Leverage_{i,t} = \alpha + \beta Inflex_i \times Dereg_{i,t} + \theta_1 Inflex_i + \theta_2 Dereg_{i,t} + \gamma' X_{i,t-1} + \tau_t + \tau_j + \epsilon_{i,t},$$

where *Dereg* is an indicator which equals one if firm i is headquartered in a state that had implemented the deregulation in or before year t, and zero otherwise. *Inflex×Dereg* is the interaction term between inflexibility and the deregulation dummy. Other variables are defined as above. Columns (1) and (3) regress leverage on inflexibility together with industry and year fixed effects. Columns (2) and (4) add control variables. The sample period is from 1970 to 2017. t-statistics based on standard errors clustered at firm level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: Inflexibility and leverage

	LDM		TDM	
	(1)	(2)	(3)	(4)
Inflex	-0.218***		-0.269***	
	(-5.98)		(-6.20)	
Inflex_Median		-0.042***		-0.044***
		(-9.03)		(-7.98)
Controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Obs	80,980	80,980	80,980	80,980
Adjusted R^2	0.301	0.306	0.320	0.322

Panel B: Inflexibility, bank deregulation, and leverage

	LDM		TDM	
	(1)	(2)	(3)	(4)
Inflex×Dereg	0.707***	0.478***	0.795***	0.470***
	(6.01)	(4.89)	(5.49)	(3.96)
Inflex	-1.283***	-0.814***	-1.392***	-0.907***
	(-12.08)	(-8.76)	(-10.39)	(-8.07)
Dereg	-0.072***	-0.007	-0.108***	-0.006
	(-15.60)	(-1.15)	(-20.14)	(-0.86)
Controls	No	Yes	No	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Obs	81,355	80,980	81,355	80,980
Adjusted R^2	0.033	0.304	0.046	0.322

Table B.4

Bank Deregulation: Regressions with Deregulation Index

This table reestimates the results in Table 6 with the deregulation dummy replaced by the continuous deregulation index. In Columns (1) and (2), the leverage ratio is long-term debt scaled by market value of assets (*LDM*), while the dependent variable in Columns (3) and (4) is total debt scaled by market value of assets (*TDM*). *Inflex* is the proxy for inflexibility. *DeregIndex* for a firm is the branching restrictiveness index in its headquarter state with lower value indicating more deregulation. *Inflex×DeregIndex* is the interaction term between inflexibility and the deregulation index. Control variables include profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), assets tangibility (*Tangible*), and industry median leverage (*IndustLev*). The detailed variable definitions are provided in Appendix Table A.1. Columns (1) and (3) regress leverage on inflexibility together with the industry (four-digit SIC codes level) and year fixed effects. Columns (2) and (4) add control variables in the regressions. The sample period is from 1970 to 2017. *t*-statistics based on standard errors clustered at firm level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	LDM		TDM	
	(1)	(2)	(3)	(4)
Inflex×DeregIndex	-0.116***	-0.102***	-0.123***	-0.104***
	(-3.70)	(-3.38)	(-3.30)	(-2.82)
Inflex	-0.152*	-0.191**	-0.068	-0.286***
	(-1.71)	(-2.20)	(-0.66)	(-2.68)
DeregIndex	-0.003	-0.001	-0.003	-0.001
	(-1.27)	(-0.52)	(-1.16)	(-0.59)
Profit		-0.204***		-0.306***
		(-19.34)		(-22.07)
Size		0.019***		0.015***
		(17.19)		(11.50)
B/M		0.030***		0.042***
		(16.00)		(18.05)
Tangible		0.163***		0.154***
		(10.98)		(8.97)
IndustLev		0.377***		0.471***
		(29.98)		(33.51)
Constant	0.219***	-0.046***	0.297***	0.031**
	(21.54)	(-4.04)	(24.81)	(2.31)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Obs	81,355	80,980	81,355	80,980
Adjusted R^2	0.215	0.303	0.222	0.321

Table B.5

Bank Deregulation: Eliminating Impacts of Other Deregulation Events

This table reports results from Equation (4) after eliminating the potential impacts of other banking deregulatory events. Columns (1) and (2) measure financial leverage with long-term debt scaled by market value of assets (*LDM*), while Columns (3) and (4) measure leverage with total debt scaled by market value of assets (*TDM*). In Columns (1) and (3), the sample excludes years before 1992 during which period the intrastate branching deregulation and the interstate banking deregulation were implemented. *Inflex* is the proxy for inflexibility. *Dereg* is an indicator which equals one if firm i is headquartered in a state that had implemented the interstate branching deregulation in or before year t, and zero otherwise. *Inflex*×*Dereg* is the interaction term between inflexibility and the deregulation dummy. Control variables include profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), assets tangibility (*Tangible*), and industry median leverage (*IndustLev*). The detailed variable definitions are provided in Appendix Table A.1. Columns (2) and (4) introduce two dummies into the regressions in Table 6: *Intra* is an indicator which equals one in years after the state implemented the intrastate branching deregulation, and zero otherwise; *Inter* is an indicator which equals one in years after the state implemented the interstate banking deregulation, and zero otherwise. The information on the dates of these two deregulations comes from Jayaratne and Strahan (1996) and Jiang, Levine, and Lin (2016), respectively. The sample period in Columns (2) and (4) is from 1970 to 2017. The industry (four-digit SIC codes level) and year fixed effects are included in the regressions. t-statistics based on standard errors clustered at firm level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	LDM		TDM	
	(1)	(2)	(3)	(4)
Inflex×Dereg	0.214**	0.478***	0.230**	0.469***
	(1.98)	(4.87)	(2.09)	(3.95)
Inflex	-0.428***	-0.812***	-0.482***	-0.904***
	(-4.19)	(-8.71)	(-4.71)	(-8.01)
Dereg	-0.001	-0.009	0.001	-0.008
	(-0.17)	(-1.33)	(0.15)	(-1.05)
Profit	-0.131***	-0.203***	-0.197***	-0.305***
	(-13.25)	(-19.42)	(-15.70)	(-22.19)
Size	0.021***	0.019***	0.017***	0.015***
	(17.50)	(17.26)	(12.04)	(11.51)
B/M	0.026***	0.030***	0.039***	0.042***
	(13.37)	(16.07)	(15.90)	(18.17)
Tangible	0.185***	0.163***	0.209***	0.153***
	(10.34)	(11.06)	(10.35)	(8.91)
IndustLev	0.372***	0.377***	0.455***	0.472***
	(23.30)	(29.99)	(25.70)	(33.60)
Intra		0.014***		0.018***
		(2.66)		(2.85)
Inter		-0.004		-0.004
		(-0.49)		(-0.46)
Constant	-0.075***	-0.051***	-0.042***	0.025**
	(-6.56)	(-5.75)	(-3.17)	(2.39)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Obs	49,705	80,980	49,705	80,980
Adjusted R^2	0.301	0.304	0.299	0.322

Table B.6

External Financing Dependence: Regression with Interaction Terms

This table shows the role of external financing dependence on the relation between leverage and inflexibility together with bank deregulation using interaction terms. The dependent variable is long-term debt scaled by market value of assets (*LDM*) in the first three columns and total debt scaled by market value of assets (*TDM*) in the last three columns. *V* represents three measures for external financing dependence. In Columns (1) and (4), *V* is cash holding (*Cash*). In Columns (2) and (5), *V* is high external financing needs (*EFN*) which equals one for firms in the highest quintile and zero for firms in the lowest quintile. In Columns (3) and (6), *V* is the financial constraint index proposed by Kaplan and Zingales (1997) (*KZ Index*). *Inflex* is the proxy for inflexibility. *Dereg* is an indicator which equals one if firm i is headquartered in a state that had implemented the deregulation in or before year t, and zero otherwise. *Inflex*×*Dereg* is the interaction term between inflexibility and the deregulation dummy. Control variables include profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), assets tangibility (*Tangible*), and industry median leverage (*IndustLev*). The detailed definitions are provided in Appendix Table A.1. Year and industry (four-digit SIC codes level) fixed effects are included. The sample period is from 1970 to 2017. t-statistics based on standard errors clustered at firm level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	LDM			TDM		
	(1)	(2)	(3)	(4)	(5)	(6)
V=	Cash	EFN	KZ Index	Cash	EFN	KZ Index
Inflex×Dereg×V	-1.124***	0.120***	0.010***	-1.432***	0.188***	0.010***
	(-3.65)	(4.39)	(4.44)	(-3.91)	(5.31)	(3.88)
Inflex×Dereg	0.695***	0.605***	0.481***	0.722***	0.614***	0.446***
	(4.93)	(5.38)	(4.69)	(4.58)	(4.73)	(3.56)
Inflex×V	1.726***	-0.150***	-0.015***	2.024***	-0.226***	-0.016***
	(6.41)	(-5.94)	(-6.83)	(6.31)	(-6.75)	(-7.02)
Dereg×V	0.022	-0.028***	-0.002***	0.106***	-0.039***	-0.002***
	(0.98)	(-8.68)	(-5.62)	(3.89)	(-9.56)	(-5.16)
Inflex	-1.100***	-0.835***	-0.853***	-1.154***	-0.890***	-0.933***
	(-9.16)	(-8.05)	(-9.06)	(-8.55)	(-7.43)	(-8.09)
Dereg	-0.007	-0.005	-0.013**	-0.014*	-0.003	-0.014*
	(-0.99)	(-0.80)	(-2.02)	(-1.75)	(-0.39)	(-1.79)
V	-0.283***	0.032***	0.002***	-0.501***	0.041***	0.003***
	(-13.55)	(10.51)	(8.53)	(-19.56)	(10.56)	(8.39)
Profit	-0.214***	-0.186***	-0.185***	-0.321***	-0.299***	-0.279***
	(-21.21)	(-17.51)	(-17.99)	(-25.18)	(-21.89)	(-20.67)
Size	0.017***	0.021***	0.018***	0.011***	0.016***	0.013***
	(15.15)	(18.32)	(16.45)	(8.58)	(12.59)	(10.57)
B/M	0.033***	0.032***	0.031***	0.047***	0.043***	0.042***
	(17.99)	(16.74)	(16.21)	(21.16)	(18.69)	(18.37)
Tangible	0.098***	0.167***	0.134***	0.041**	0.156***	0.106***
	(6.35)	(11.29)	(8.82)	(2.36)	(9.12)	(6.08)
IndustLev	0.354***	0.375***	0.368***	0.435***	0.468***	0.460***
	(28.68)	(29.93)	(29.03)	(31.96)	(33.54)	(32.76)
Constant	0.018*	-0.053***	-0.028***	0.137***	0.027**	0.058***
	(1.84)	(-5.96)	(-3.14)	(12.25)	(2.51)	(5.37)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	80,980	80,590	77,471	80,980	80,590	77,471
Adjusted R^2	0.323	0.310	0.313	0.361	0.330	0.334

Table B.7

Inflexibility and Default Risk

This table shows the relation between inflexibility and default risk. The default risk is measured with the modified Altman's Z-score proposed by Mackie-Mason (1990) in Panel A and the failure probability proposed by Campbell, Hilscher, and Szilagyi (2008) in Panel B. *Inflex* is the continuous measure of inflexibility. Higher Z-score indicates lower default risk, whereas higher failure probability is associated with higher default risk. *Inflex_Median* is an indicator which equals one if a firm's inflexibility is above the median in the sample in a certain year, and zero otherwise. In Panel A (Panel B), Columns (1) to (3) regress Z-score (failure probability) in year $t+1$, $t+2$, and $t+3$ on inflexibility in year t, respectively, and Columns (4) to (6) regress Z-score (failure probability) in year $t+1$, $t+2$, and $t+3$ on the inflexibility median dummy in year t, respectively. Year and industry (four-digit SIC codes level) fixed effects are included. The sample period is from 1970 to 2017. t-statistics based on standard errors clustered at firm level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: Inflexibility and Z-score

	Z_{t+1}	Z_{t+2}	Z_{t+3}	Z_{t+1}	Z_{t+2}	Z_{t+3}
	(1)	(2)	(3)	(4)	(5)	(6)
Inflex	-18.801***	-17.570***	-16.675***			
	(-12.95)	(-11.44)	(-10.17)			
Inflex_Median				-0.552***	-0.499***	-0.450***
				(-13.03)	(-11.65)	(-10.47)
Constant	2.183***	2.199***	2.218***	2.133***	2.153***	2.170***
	(75.62)	(74.39)	(72.90)	(82.50)	(81.62)	(81.11)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	72,789	66,635	61,010	72,789	66,635	61,010
Adjusted R^2	0.330	0.323	0.317	0.289	0.288	0.287

Panel B: Inflexibility and failure probability

	FP_{t+1}	FP_{t+2}	FP_{t+3}	FP_{t+1}	FP_{t+2}	FP_{t+3}
	(1)	(2)	(3)	(4)	(5)	(6)
Inflex	1.790***	1.404***	1.332***			
	(9.92)	(7.92)	(7.12)			
Inflex_Median				0.076***	0.052***	0.043***
				(10.94)	(7.55)	(6.24)
Constant	0.145***	0.144***	0.138***	0.139***	0.142***	0.139***
	(34.57)	(33.93)	(31.88)	(34.71)	(33.51)	(31.93)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	72,567	67,284	61,864	72,567	67,284	61,864
Adjusted R^2	0.055	0.053	0.052	0.051	0.050	0.049

Table 1

Summary Statistics

This table reports the summary statistics. Panel A displays the descriptive statistics for major variables in this paper, and Panel B presents the correlation coefficient among the variables. *Inflex* is the proxy for inflexibility. *LDM* is long-term debt scaled by market value of assets. *TDM* are total debt scaled by market value of assets. *Profit* is profitability. *Size* is firm size. *B/M* is book-to-market ratio. *Tangible* is assets tangibility. *IndustLev* is industry median leverage. The detailed variable definitions are provided in Appendix Table A.1. The sample period is from 1970 to 2017. The variables are winsorized at the 1st and 99th percentiles. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: Summary Statistics

	Mean	Std	Q1	Median	Q3	N
Inflex	0.017	0.032	0.006	0.010	0.016	81,759
LDM	0.221	0.229	0.021	0.155	0.347	81,355
TDM	0.286	0.267	0.057	0.217	0.448	81,355
Profit	0.109	0.149	0.071	0.127	0.181	81,556
Size	5.499	2.086	3.923	5.393	6.976	81,742
B/M	1.284	1.004	0.683	1.082	1.573	81,418
Tangible	0.294	0.210	0.131	0.249	0.409	81,659
IndustLev	0.233	0.183	0.081	0.203	0.347	81,758

Panel B: Correlation Matrix

	Inflex	LDM	TDM	Profit	Size	B/M	Tangible
LDM	-0.118***						
TDM	-0.113***	0.886***					
Profit	-0.323***	-0.016***	-0.072***				
Size	-0.152***	0.157***	0.062***	0.266***			
B/M	-0.071***	0.205***	0.260***	-0.151***	-0.139***		
Tangible	-0.039***	0.268***	0.213***	0.179***	0.154***	-0.044***	
IndustLev	-0.149***	0.462***	0.482***	0.093***	0.083***	0.225***	0.324***

Table 2
Baseline Regressions
This table reports the results from the following regression of leverage on inflexibility:

$$Leverage_{i,t} = \alpha + \beta Inflex_{i,t-1} + \gamma' X_{i,t-1} + \tau_t + \tau_j + \epsilon_{i,t},$$

where *Leverage* is either long-term debt scaled by market value of assets (*LDM* in Columns (1) to (5)) or total debt scaled by market value of assets (*TDM* in Columns (6) to (10)). *Inflex* is the proxy for inflexibility. *X* represents the control variables including profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), assets tangibility (*Tangible*), and industry median leverage (*IndustLev*). *Inflex_Median* is an indicator which equals one if a firm's inflexibility is above the median in the sample in a certain year, and zero otherwise. The detailed variable definitions are provided in Appendix Table A.1. Columns (1) and (6) regress leverage only on inflexibility. Columns (2) and (7) include industry (four-digit SIC codes level) and year fixed effects. Columns (3) and (8) add control variables to the univariate regressions. Columns (4) and (9) include both control variables and fixed effects. Columns (5) and (10) replace the continuous inflexibility measure with the dummy variable. The sample period is from 1970 to 2017. *t*-statistics based on standard errors clustered at firm level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	LDM					TDM				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Inflex	-0.843***	-0.439***	-0.455***	-0.442***		-0.942***	-0.375***	-0.624***	-0.542***	
	(-15.11)	(-9.12)	(-9.26)	(-8.81)		(-14.80)	(-6.74)	(-10.65)	(-9.06)	
Inflex_Median					-0.039***					-0.044***
					(-11.27)					(-10.75)
Profit			-0.181***	-0.205***	-0.194***			-0.262***	-0.307***	-0.292***
			(-17.91)	(-19.55)	(-18.61)			(-19.66)	(-22.28)	(-21.27)
Size			0.015***	0.020***	0.019***			0.008***	0.015***	0.015***
			(16.64)	(17.41)	(17.37)			(7.08)	(11.67)	(11.66)
B/M			0.028***	0.031***	0.031***			0.040***	0.042***	0.043***
			(15.03)	(16.08)	(16.29)			(17.41)	(18.19)	(18.40)
Tangible			0.161***	0.161***	0.168***			0.127***	0.150***	0.158***
			(15.32)	(10.90)	(11.37)			(10.88)	(8.77)	(9.22)
IndustLev			0.472***	0.377***	0.373***			0.603***	0.472***	0.468***
			(41.80)	(30.03)	(29.88)			(48.12)	(33.65)	(33.52)
Constant	0.236***	0.207***	-0.031***	-0.052***	-0.039***	0.302***	0.285***	0.053***	0.024**	0.037***
	(79.45)	(32.13)	(-5.19)	(-5.98)	(-4.44)	(86.75)	(35.98)	(7.19)	(2.31)	(3.53)
Industry FE	No	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes
Year FE	No	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes
Obs	81,355	81,355	80,980	80,980	80,980	81,355	81,355	80,980	80,980	80,980
Adjusted R^2	0.014	0.214	0.270	0.303	0.306	0.013	0.221	0.282	0.321	0.323

Table 3

Measurement Errors

The table shows the results of regressing leverage on inflexibility using the linear cumulant equations methodology of Erickson, Jiang, and Whited (2014). The dependent variables are long-term debt scaled by market value of assets (*LDM*) in the left panel and total debt scaled by market value of assets (*TDM*) in the right panel. In each panel, we report the results for the third, fourth, and fifth cumulants. For the sake of comparison, the first column of each panel presents the OLS results from Table 2. Measurement errors are assumed to be present in book-to-market ratio (*B/M*), assets tangibility (*Tangible*) and inflexibility (*Inflex*). The regressions also include profitability (*Profit*), firm size (*Size*), and industry median leverage (*IndustLev*). The detailed variable definitions are provided in Appendix Table A.1. The sample period is from 1970 to 2017. The variables are demeaned before the estimation to incorporate industry (four-digit SIC codes level) and year fixed effects. t-statistics are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	LDM				TDM			
	OLS	Third	Fourth	Fifth	OLS	Third	Fourth	Fifth
Inflex	-0.442***	-0.742***	-0.570***	-0.560***	-0.542***	-0.842***	-0.727***	-0.716***
	(-8.81)	(-5.03)	(-9.63)	(-9.09)	(-9.06)	(-8.17)	(-9.55)	(-9.17)
Profit	-0.205***	-0.513***	-0.258***	-0.272***	-0.307***	-0.496***	-0.390***	-0.401***
	(-19.55)	(-7.91)	(-17.49)	(-19.58)	(-22.28)	(-10.90)	(-20.68)	(-22.31)
Size	0.020***	0.003	0.016***	0.015***	0.015***	0.004	0.009***	0.009***
	(17.41)	(0.69)	(12.89)	(12.39)	(11.67)	(1.48)	(6.16)	(5.75)
B/M	0.031***	-0.038*	-0.018***	-0.009***	0.042***	-0.055***	-0.025***	-0.017***
	(16.08)	(-1.95)	(-4.82)	(-3.24)	(18.19)	(-5.15)	(-6.21)	(-5.10)
Tangible	0.161***	2.162***	0.223**	0.440***	0.150***	0.946***	0.368***	0.555***
	(10.90)	(3.74)	(2.59)	(7.80)	(8.77)	(2.69)	(3.64)	(7.81)
IndustLev	0.377***	0.321***	0.437***	0.413***	0.472***	0.537***	0.549***	0.528***
	(30.03)	(5.73)	(29.27)	(30.04)	(33.65)	(16.16)	(32.05)	(32.95)
Obs	80,980	80,980	80,980	80,980	80,980	80,980	80,980	80,980
Rho^2	0.303	0.211	0.096	0.115	0.321	0..109	0.101	0.115

Table 4

Instrumental Variables Estimation

This table reports the relation between inflexibility and leverage ratios using the instrumental variables estimation. The second-stage results for the two-stage-least-square regressions are presented. The instrumental variable for inflexibility is the 5-year lagged value of inflexibility in Columns (1) and (2), while the instrumental variable is the 2-year lagged industry-median value of inflexibility in Columns (3) and (4). The leverage ratio is the long-term debt scaled by market value of assets (*LDM*) in Columns (1) and (3) and the total debt scaled by market value of assets (*TDM*) in Columns (2) and (4). Control variables include profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), assets tangibility (*Tangible*), and industry median leverage (*IndustLev*). The detailed variable definitions are provided in Appendix Table A.1. The sample period is from 1970 to 2017. *t*-statistics based on standard errors clustered at firm level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	IV: Lagged Inflexibility		IV: Industry-median Inflexibility	
	(1) LDM	(2) TDM	(3) LDM	(4) TDM
Inflex	-0.405***	-0.509***	-1.129***	-1.251***
	(-5.22)	(-5.44)	(-2.85)	(-2.79)
Profit	-0.253***	-0.373***	-0.242***	-0.345***
	(-16.34)	(-18.36)	(-10.72)	(-12.96)
Size	0.019***	0.015***	0.018***	0.013***
	(14.14)	(10.09)	(12.79)	(8.44)
B/M	0.032***	0.042***	0.028***	0.040***
	(13.60)	(15.03)	(12.99)	(15.16)
Tangible	0.154***	0.142***	0.166***	0.156***
	(8.25)	(6.63)	(10.96)	(8.91)
IndustLev	0.345***	0.433***	0.369***	0.462***
	(22.71)	(25.78)	(28.53)	(31.94)
Constant	-0.041	-0.000	-0.050	0.000
	(-0.53)	(-0.00)	(-0.78)	(0.01)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Obs	53,466	53,466	76,607	76,607
Adjusted R^2	0.300	0.323	0.294	0.314

Table 5

Value Firms v.s. Growth Firms

This table reports heterogenous effects of inflexibility on financial leverage across value firms and growth firms. The dependent variables are long-term debt scaled by market value of assets (*LDM*) in Columns (1) to (3) and total debt scaled by market value of assets (*TDM*) in Columns (4) to (6). *Inflex* is the proxy for inflexibility. BM_2, BM_3, and BM_4 are indicator variables that equal to one if a firm's book-to-market ratio is in the second, third, and fourth quartile group in a given year, respectively, and zero otherwise. Control variables include profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), assets tangibility (*Tangible*), and industry median leverage (*IndustLev*). The detailed variable definitions are provided in Appendix Table A.1. Industry (four-digit SIC codes level) and year fixed effects are included in Columns (3) and (6). The sample period is from 1970 to 2017. *t*-statistics based on standard errors clustered at firm level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	LDM			TDM		
	(1)	(2)	(3)	(4)	(5)	(6)
Inflex×BM_2	-0.215**	-0.074	-0.042	-0.232**	0.021	0.067
	(-2.03)	(-0.93)	(-0.53)	(-2.10)	(0.24)	(0.74)
Inflex×BM_3	-0.608***	-0.345***	-0.356***	-0.607***	-0.176*	-0.186*
	(-5.36)	(-3.74)	(-3.88)	(-5.02)	(-1.69)	(-1.77)
Inflex×BM_4	-0.955***	-0.644***	-0.684***	-1.071***	-0.600***	-0.627***
	(-7.97)	(-5.47)	(-5.98)	(-7.72)	(-4.45)	(-4.86)
Inflex	-0.180***	-0.072**	-0.076**	-0.153***	-0.242***	-0.189***
	(-5.45)	(-2.17)	(-2.05)	(-3.57)	(-5.50)	(-3.90)
BM_2	0.108***	0.067***	0.075***	0.131***	0.084***	0.093***
	(32.88)	(21.20)	(22.43)	(35.13)	(23.54)	(24.22)
BM_3	0.208***	0.139***	0.155***	0.258***	0.173***	0.191***
	(51.64)	(32.16)	(34.50)	(56.25)	(35.29)	(37.25)
BM_4	0.219***	0.162***	0.188***	0.295***	0.212***	0.241***
	(41.15)	(29.01)	(32.46)	(49.04)	(33.23)	(36.63)
Profit		-0.132***	-0.156***		-0.200***	-0.247***
		(-15.45)	(-17.37)		(-18.16)	(-21.25)
Size		0.014***	0.019***		0.006***	0.014***
		(15.62)	(17.77)		(5.42)	(11.66)
B/M		-0.004*	-0.008***		-0.004	-0.010***
		(-1.65)	(-3.79)		(-1.36)	(-3.66)
Tangible		0.154***	0.144***		0.117***	0.128***
		(15.35)	(10.52)		(10.59)	(8.18)
IndustLev		0.434***	0.323***		0.556***	0.404***
		(39.63)	(26.43)		(46.25)	(29.80)
Constant	0.085***	-0.078***	-0.090***	0.109***	-0.005	-0.020**
	(38.67)	(-14.04)	(-11.06)	(42.23)	(-0.68)	(-2.04)
Industry FE	No	No	Yes	No	No	Yes
Year FE	No	No	Yes	No	No	Yes
Obs	813,55	80,980	80,980	81,355	80,980	80,980
Adjusted R^2	0.129	0.307	0.344	0.162	0.328	0.371

Table 6
Bank Deregulation
This table shows the results from the following regression:

$$Leverage_{i,t} = \alpha + \beta Inflex_{i,t-1} \times Dereg_{i,t} + \theta_1 Inflex_{i,t-1} + \theta_2 Dereg_{i,t} + \gamma' X_{i,t-1} + \tau_t + \tau_j + \epsilon_{i,t},$$

where *Leverage* is either long-term debt scaled by market value of assets (*LDM* in Columns (1) to (4)) or total debt scaled by market value of assets (*TDM* in Columns (5) to (8)). *Inflex* is the proxy for inflexibility. *Dereg* is an indicator which equals one if firm i is headquartered in a state that had implemented the deregulation in or before year t, and zero otherwise. *Inflex*×*Dereg* is the interaction term between inflexibility and the deregulation dummy. X represents the control variables including profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), assets tangibility (*Tangible*), and industry median leverage (*IndustLev*). The detailed variable definitions are provided in Appendix Table A.1. Columns (1) and (5) regress leverage only on inflexibility. Columns (2) and (6) include industry (four-digit SIC codes level) and year fixed effects. Columns (3) and (7) add control variables to the univariate regressions. Columns (4) and (8) include both control variables and fixed effects. The sample period is from 1970 to 2017. t-statistics based on standard errors clustered at firm level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	LDM				TDM			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Inflex×Dereg	0.707***	0.558***	0.550***	0.478***	0.795***	0.563***	0.519***	0.470***
	(6.01)	(5.49)	(5.66)	(4.89)	(5.49)	(4.59)	(4.46)	(3.96)
Inflex	-1.283***	-0.873***	-0.866***	-0.814***	-1.392***	-0.813***	-0.995***	-0.907***
	(-12.08)	(-9.23)	(-9.32)	(-8.76)	(-10.39)	(-7.08)	(-9.02)	(-8.07)
Dereg	-0.072***	-0.008	-0.023***	-0.007	-0.108***	-0.007	-0.041***	-0.006
	(-15.60)	(-1.17)	(-5.44)	(-1.15)	(-20.14)	(-0.88)	(-8.73)	(-0.86)
Profit			-0.187***	-0.204***			-0.279***	-0.306***
			(-18.33)	(-19.43)			(-20.59)	(-22.19)
Size			0.016***	0.019***			0.010***	0.015***
			(16.58)	(17.28)			(8.78)	(11.54)
B/M			0.028***	0.030***			0.039***	0.042***
			(14.88)	(16.09)			(17.12)	(18.19)
Tangible			0.159***	0.163***			0.117***	0.152***
			(14.70)	(11.02)			(9.78)	(8.87)
IndustLev			0.460***	0.377***			0.580***	0.472***
			(39.53)	(30.05)			(45.46)	(33.68)
Constant	0.271***	0.211***	-0.019***	-0.048***	0.355***	0.289***	0.072***	0.028***
	(69.84)	(32.51)	(-3.04)	(-5.52)	(76.30)	(36.17)	(9.41)	(2.67)
Industry FE	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	No	Yes	No	Yes	No	Yes	No	Yes
Obs	81,355	81,355	80,980	80,980	81,355	81,355	80,980	80,980
Adjusted R^2	0.033	0.215	0.272	0.304	0.046	0.222	0.286	0.322

Table 7

Bank Deregulation: Dynamic Effect Estimation

This table estimates the dynamic effect of bank deregulation. The dependent variable is long-term debt scaled by market value of assets (*LDM*) in the first column and total debt scaled by market value of assets (*TDM*) in the second column. *Before2* and *Before1* are respectively indicators for two years and one year before the deregulation. *Current0* is an indicator for the deregulation year. *After1* is an indicator for one year after the deregulation. *After2* is an indicator which equals one in two years or more post-deregulation, and zero otherwise. *Inflex* is the proxy for inflexibility. The control variables include profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), assets tangibility (*Tangible*), and industry median leverage (*IndustLev*). The detailed variable definitions are provided in Appendix Table A.1. Year and firm fixed effects are included. The sample period is from 1970 to 2017. *t*-statistics based on standard errors clustered at firm level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	LDM	TDM
Before2×Inflex	0.165	0.148
	(1.60)	(1.22)
Before1×Inflex	0.147	0.180
	(1.32)	(1.38)
Current0×Inflex	0.308***	0.255*
	(2.58)	(1.93)
After1×Inflex	0.274**	0.305**
	(2.27)	(2.18)
After2×Inflex	0.244**	0.313**
	(2.18)	(2.53)
Before2	-0.004	-0.001
	(-0.63)	(-0.17)
Before1	-0.006	-0.002
	(-0.69)	(-0.22)
Current0	-0.006	0.001
	(-0.47)	(0.06)
After1	-0.011	-0.006
	(-0.75)	(-0.35)
After2	-0.006	-0.001
	(-0.31)	(-0.04)
Inflex	-0.355***	-0.371***
	(-2.91)	(-2.69)
Profit	-0.191***	-0.296***
	(-17.92)	(-22.31)
Size	0.043***	0.051***
	(14.81)	(15.69)
B/M	0.011***	0.014***
	(8.29)	(9.60)
Tangible	0.115***	0.122***
	(6.91)	(6.48)
IndustLev	0.293***	0.357***
	(24.24)	(26.61)
Constant	-0.097***	-0.065***
	(-6.93)	(-4.14)
Firm FE	Yes	Yes
Year FE	Yes	Yes
Obs	80,980	80,980
Adjusted R^2	0.603	0.634

Table 8

Bank Deregulation: Placebo Test

This table presents results for a placebo test using samples with randomized bank deregulation. For each simulation, we randomly assign a deregulation year to each state in the sample while maintaining the distribution of deregulation years, and then estimate Equation (4) with the randomized sample. Based on 100 simulations, this table reports the summary statistics of the coefficients and the corresponding t-statistics for the interaction term between inflexibility and the deregulation dummy. The t-statistics are calculated based on standard errors clustered at firm level. The dependent variable is the long-term debt scaled by market value of assets (*LDM*) in models (1) and (2) and the total debt scaled by market value of assets (*TDM*) in models (3) and (4). In models (1) and (3), leverage is regressed on inflexibility together with industry (four-digit SIC codes level) and year fixed effects. Models (2) and (4) add control variables in the regressions. The sample period is from 1970 to 2017.

	LDM				TDM			
	(1)		(2)		(3)		(4)	
	Coefficients	t-stat	Coefficients	t-stat	Coefficients	t-stat	Coefficients	t-stat
Mean	0.129	0.740	0.116	0.665	0.156	0.962	0.071	0.814
Std	0.157	1.178	0.158	0.919	0.153	0.840	0.156	1.085
Min	-0.104	-1.120	-0.095	-1.010	-0.096	-0.570	-0.180	-1.530
Q1	-0.006	-0.569	-0.030	0.000	0.041	0.430	0.056	0.339
Median	0.156	0.775	0.180	0.945	0.140	1.080	0.082	1.055
Q3	0.236	1.220	0.232	1.425	0.247	1.498	0.154	1.218
Max	0.362	1.660	0.347	1.700	0.437	1.850	0.333	1.770
Controls	No		Yes		No		Yes	
Industry FE	Yes		Yes		Yes		Yes	
Year FE	Yes		Yes		Yes		Yes	

Table 9
Bank Debt
This table reports the results of regressing bank debt on inflexibility. The dependent variable is the ratio of total bank debt from Capital IQ to market value of assets. *Inflex* is the proxy for inflexibility. *Dereg* is an indicator which equals one if firm i is headquartered in a state that had implemented the deregulation in or before year t, and zero otherwise. *Inflex*×*Dereg* is the interaction term between inflexibility and the deregulation dummy. The control variables include profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), assets tangibility (*Tangible*), and industry median leverage (*IndustLev*). The detailed variable definitions are provided in Appendix Table A.1. In Column (1), leverage is regressed on inflexibility and control variables. Column (2) adds year and industry (four-digit SIC code level) fixed effects. Column (3) use Fama-French 48 industries instead of the four-digit SIC codes for industry fixed effects. Column (4) includes industry by year fixed effects. The sample period is from 1976 to 2017 due the availability of data from Capital IQ. t-statistics based on standard errors clustered at firm and year level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)
Inflex×Dereg	0.115***	0.069***	0.125***	0.094**
	(3.46)	(2.78)	(3.61)	(2.40)
Inflex	-0.126***	-0.080***	-0.136***	-0.105**
	(-3.75)	(-3.19)	(-3.96)	(-2.69)
Dereg	0.017	0.016	0.015	0.020
	(1.25)	(1.18)	(1.09)	(1.22)
Profit	-0.114***	-0.121***	-0.108**	-0.097*
	(-3.03)	(-3.20)	(-2.65)	(-2.03)
Size	-0.026***	-0.023***	-0.028***	-0.024***
	(-11.33)	(-10.17)	(-12.14)	(-10.20)
B/M	0.031***	0.033***	0.033***	0.039***
	(4.54)	(4.95)	(4.66)	(4.30)
Tangible	0.010	0.046*	0.023	0.032
	(0.56)	(1.87)	(1.03)	(1.05)
IndustLev	0.302***	0.260***	0.294***	
	(13.13)	(8.51)	(11.87)	
Constant	0.263***	0.242***	0.272***	0.301***
	(10.97)	(10.79)	(12.43)	(12.28)
SIC4 FE	No	Yes	No	No
FF48 FE	No	No	Yes	No
Year FE	No	Yes	Yes	No
SIC4-Year FE	No	No	No	Yes
Obs	7,522	7,522	7,522	7,522
Adjusted R^2	0.175	0.287	0.231	0.242

Table 10

External Financing Dependence

This table shows the effects of inflexibility together with bank deregulation on leverage for subsamples classified by proxies for external financing dependence. The dependent variable is long-term debt scaled by market value of assets (*LDM*) in Panel A and total debt scaled by market value of assets (*TDM*) in Panel B. The measures for external financing dependence are cash holding (*Cash*), external financing needs (*EFN*), and financial constraint index proposed by Kaplan and Zingales (1997) (*KZ Index*). Each year, we sort firms in our sample into quintiles based on these three measures. In each panel, Columns (1), (3), and (5) report results for firms in the lowest quintile, and Columns (2), (4), and (6) present results for firms in the highest quintile. The regressors are defined as before and the detailed definitions are provided in Appendix Table A.1. Year and industry (four-digit SIC codes level) fixed effects are included. The sample period is from 1970 to 2017. *t*-statistics based on standard errors clustered at firm level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: LDM

	Cash		EFN		KZ Index	
	(1) Low	(2) High	(3) Low	(4) High	(5) Low	(6) High
Inflex×Dereg	0.481*	0.229*	0.286	0.367***	0.226*	0.531***
	(1.74)	(1.94)	(1.37)	(3.14)	(1.66)	(3.31)
Inflex	-1.020***	-0.337***	-0.755***	-0.534***	-0.346***	-0.616***
	(-4.15)	(-2.99)	(-3.89)	(-5.08)	(-2.68)	(-4.38)
Dereg	0.002	-0.021*	-0.004	-0.011	-0.015	0.017
	(0.15)	(-1.66)	(-0.58)	(-0.75)	(-1.50)	(1.24)
Profit	-0.215***	-0.127***	-0.286***	-0.032***	-0.129***	0.053***
	(-8.40)	(-10.52)	(-16.80)	(-3.00)	(-8.86)	(3.31)
Size	0.018***	0.020***	0.013***	0.045***	0.019***	0.037***
	(9.82)	(9.66)	(11.10)	(19.15)	(11.12)	(15.80)
B/M	0.076***	0.018***	0.020***	0.012***	0.017***	0.061***
	(11.70)	(8.59)	(8.13)	(4.26)	(6.88)	(9.77)
Tangible	0.076***	0.110***	0.135***	0.189***	-0.111***	0.135***
	(3.62)	(2.88)	(8.52)	(8.59)	(-3.86)	(6.33)
IndustLev	0.319***	0.230***	0.229***	0.344***	0.202***	0.234***
	(14.04)	(7.36)	(15.04)	(10.79)	(8.66)	(9.82)
Constant	-0.023	-0.055***	-0.018	-0.095***	-0.011	-0.029
	(-1.21)	(-2.89)	(-1.52)	(-3.76)	(-0.91)	(-1.27)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	15,361	12,113	23,858	10,411	12,802	13,507
Adjusted R^2	0.276	0.277	0.270	0.432	0.278	0.379

Panel B: TDM

	Cash		EFN		KZ Index	
	(1) Low	(2) High	(3) Low	(4) High	(5) Low	(6) High
Inflex×Dereg	0.694**	0.239	0.327	0.575***	0.322*	0.613***
	(2.29)	(1.59)	(1.28)	(3.90)	(1.95)	(3.59)
Inflex	-1.142***	-0.346**	-0.854***	-0.744***	-0.473***	-0.729***
	(-4.07)	(-2.39)	(-3.93)	(-5.58)	(-3.04)	(-5.05)
Dereg	0.005	-0.020	-0.004	-0.034**	-0.020	0.011
	(0.37)	(-1.39)	(-0.51)	(-2.06)	(-1.59)	(0.77)
Profit	-0.393***	-0.163***	-0.420***	-0.055***	-0.201***	0.052***
	(-13.00)	(-11.13)	(-19.06)	(-4.05)	(-10.48)	(2.75)
Size	0.005***	0.020***	0.012***	0.040***	0.019***	0.022***
	(2.78)	(8.58)	(8.46)	(14.82)	(9.62)	(9.35)
B/M	0.113***	0.026***	0.028***	0.021***	0.023***	0.102***
	(15.32)	(9.67)	(8.89)	(6.05)	(7.45)	(13.57)
Tangible	0.021	0.082*	0.155***	0.181***	-0.177***	0.068***
	(0.90)	(1.85)	(8.25)	(7.11)	(-5.09)	(2.88)
IndustLev	0.397***	0.283***	0.281***	0.464***	0.266***	0.299***
	(16.84)	(7.62)	(15.23)	(13.12)	(9.57)	(12.48)
Constant	0.107***	-0.021	0.024	-0.032	0.031*	0.109***
	(4.93)	(-0.90)	(1.57)	(-1.07)	(1.96)	(4.52)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	15,361	12,113	23,858	10,411	12,802	13,507
Adjusted R^2	0.334	0.279	0.295	0.438	0.313	0.396

Table 11

Robustness: Alternative Fixed-effects Specifications

This table reports the results after controlling alternative fixed effects. Panel A shows the effects of inflexibility on leverage as in Table 2 and Panel B displays the effects of inflexibility together with bank deregulation on leverage as in Table 6. In each panel, Columns (1) and (4) include industry by year fixed effects. Columns (2) and (5) include industry fixed effects, year fixed effects and headquarter state fixed effects. Columns (3) and (6) use Fama-French 48 industries instead of the four-digit SIC codes as the industry definition. The dependent variable is long-term debt scaled by market value of assets (*LDM*) in Columns (1) to (3) and total debt scaled by market value of assets (*TDM*) in Columns (4) to (6). The regressors are defined as before and detailed definitions are provided in Appendix Table A.1. The sample period is from 1970 to 2017. *t*-statistics are reported in parentheses. Standard errors are clustered at firm level except for Columns (2) and (5) where standard errors are clustered at state level. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: Inflexibility and leverage

	LDM			TDM		
	(1)	(2)	(3)	(4)	(5)	(6)
Inflex	-0.439***	-0.434***	-0.411***	-0.534***	-0.534***	-0.515***
	(-7.95)	(-5.09)	(-8.12)	(-8.16)	(-5.55)	(-8.56)
Profit	-0.209***	-0.204***	-0.203***	-0.309***	-0.304***	-0.301***
	(-17.40)	(-7.85)	(-19.07)	(-19.43)	(-8.23)	(-21.66)
Size	0.020***	0.019***	0.018***	0.016***	0.015***	0.013***
	(15.70)	(13.68)	(16.95)	(10.51)	(10.48)	(10.73)
B/M	0.034***	0.030***	0.029***	0.047***	0.042***	0.041***
	(15.60)	(14.56)	(15.00)	(17.72)	(17.55)	(17.24)
Tangible	0.177***	0.163***	0.153***	0.161***	0.156***	0.124***
	(9.92)	(11.25)	(11.51)	(7.79)	(10.84)	(8.26)
IndustLev		0.377***	0.438***		0.472***	0.552***
		(31.37)	(32.81)		(37.49)	(37.37)
Constant	0.045***	-0.078***	-0.058***	0.134***	-0.028*	0.019*
	(5.24)	(-6.19)	(-6.88)	(13.00)	(-1.92)	(1.88)
SIC4 FE	No	Yes	No	No	Yes	No
FF48 FE	No	No	Yes	No	No	Yes
Year FE	No	Yes	Yes	No	Yes	Yes
SIC4-Year FE	Yes	No	No	Yes	No	No
State FE	No	Yes	No	No	Yes	No
Obs	80,980	80,980	79,756	80,980	80,980	79,756
Adjusted R^2	0.277	0.308	0.290	0.290	0.327	0.312

Panel B: Inflexibility, bank deregulation, and leverage

	LDM			TDM		
	(1)	(2)	(3)	(4)	(5)	(6)
Inflex×Dereg	0.476***	0.494***	0.465***	0.434***	0.502***	0.430***
	(4.18)	(3.82)	(4.78)	(3.23)	(3.21)	(3.70)
Inflex	-0.809***	-0.821***	-0.772***	-0.872***	-0.927***	-0.849***
	(-7.60)	(-5.24)	(-8.38)	(-6.98)	(-4.80)	(-7.75)
Dereg	-0.007	-0.006	-0.006	-0.004	-0.004	-0.007
	(-0.95)	(-0.62)	(-1.00)	(-0.50)	(-0.31)	(-0.94)
Profit	-0.209***	-0.202***	-0.202***	-0.308***	-0.303***	-0.300***
	(-17.31)	(-7.77)	(-18.93)	(-19.38)	(-8.18)	(-21.57)
Size	0.020***	0.019***	0.018***	0.015***	0.015***	0.013***
	(15.59)	(13.69)	(16.80)	(10.41)	(10.37)	(10.60)
B/M	0.034***	0.030***	0.029***	0.047***	0.041***	0.041***
	(15.60)	(14.62)	(15.01)	(17.72)	(17.63)	(17.25)
Tangible	0.179***	0.164***	0.155***	0.162***	0.157***	0.125***
	(10.00)	(11.32)	(11.60)	(7.85)	(10.79)	(8.33)
IndustLev		0.377***	0.438***		0.473***	0.552***
		(31.32)	(32.76)		(37.57)	(37.33)
Constant	0.050***	-0.071***	-0.054***	0.138***	-0.020	0.023**
	(5.39)	(-5.39)	(-6.41)	(12.34)	(-1.33)	(2.24)
SIC4 FE	No	Yes	No	No	Yes	No
FF48 FE	No	No	Yes	No	No	Yes
Year FE	No	Yes	Yes	No	Yes	Yes
SIC4-Year FE	Yes	No	No	Yes	No	No
State FE	No	Yes	No	No	Yes	No
Obs	80,980	80,980	79,756	80,980	80,980	79,756
Adjusted R^2	0.278	0.309	0.291	0.290	0.328	0.312

Table 12

Robustness: Additional Controls

This table reports the results after incorporating additional control variables. Panel A shows the effects of inflexibility on leverage as in Table 2 and Panel B displays the effects of inflexibility together with bank deregulation on leverage as in Table 6. The dependent variable is long-term debt scaled by market value of assets (*LDM*) in Columns (1) to (3) and total debt scaled by market value of assets (*TDM*) in Columns (4) to (6). In each panel, Columns (1) and (4) report our baseline results from Table 2 (for Panel A) and Table 6 (for Panel B). Columns (2) and (5) include stock return volatility (*Vol*), firm age (*log(Age)*), operating leverage (*OL*), price-to-cost margin (*Price-Cost Margin*), and Compustat-based Herfindahl index (*HHI*). Columns (3) and (6) add Hoberg and Phillips (2010)'s Herfindahl index (*HP HHI*). The detailed definitions are provided in Appendix Table A.1. The sample period is from 1970 to 2017, except for Columns (3) and (6) where the sample is restricted to 1975 to 2005 due to the availability of the Hoberg-Phillips data. Year and industry (four-digit SIC codes level) fixed effects are included. *t*-statistics based on standard errors clustered at firm level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: Inflexibility and leverage

	LDM			TDM		
	(1)	(2)	(3)	(4)	(5)	(6)
Inflex	-0.442***	-0.478***	-0.707***	-0.542***	-0.583***	-0.920***
	(-8.81)	(-8.30)	(-8.25)	(-9.06)	(-8.75)	(-9.26)
Vol		2.185***	1.804***		3.491***	3.079***
		(18.40)	(13.00)		(25.59)	(19.02)
log(Age)		-0.003	0.001		0.002	0.009
		(-0.55)	(0.16)		(0.38)	(1.12)
OL		-0.019***	-0.015***		-0.017***	-0.014***
		(-5.07)	(-3.37)		(-3.90)	(-2.72)
Price-Cost Margin		-0.010*	-0.032***		-0.020***	-0.048***
		(-1.84)	(-3.30)		(-3.02)	(-4.19)
HHI		-0.018**	-0.012		-0.018**	-0.012
		(-2.42)	(-1.55)		(-2.15)	(-1.36)
HP HHI			-0.269			-0.146
			(-1.39)			(-0.67)
Constant	-0.052***	-0.104***	-0.056**	0.024**	-0.090***	-0.080**
	(-5.98)	(-7.10)	(-2.04)	(2.31)	(-5.42)	(-2.57)
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	80,980	64,484	40,867	80,980	64,484	40,867
Adjusted R^2	0.303	0.310	0.294	0.321	0.343	0.329

Panel B: Inflexibility, bank deregulation, and leverage

	LDM			TDM		
	(1)	(2)	(3)	(4)	(5)	(6)
Inflex×Dereg	0.478***	0.578***	0.478***	0.470***	0.619***	0.432***
	(4.89)	(4.86)	(3.50)	(3.96)	(4.59)	(2.75)
Inflex	-0.814***	-0.936***	-1.005***	-0.907***	-1.074***	-1.190***
	(-8.76)	(-8.27)	(-7.54)	(-8.07)	(-8.45)	(-7.78)
Dereg	-0.007	-0.012*	-0.008	-0.006	-0.012*	-0.007
	(-1.15)	(-1.76)	(-1.26)	(-0.86)	(-1.66)	(-0.94)
Vol		2.203***	1.813***		3.510***	3.088***
		(18.62)	(13.09)		(25.80)	(19.10)
log(Age)		-0.002	0.002		0.003	0.009
		(-0.41)	(0.21)		(0.52)	(1.16)
OL		-0.020***	-0.016***		-0.018***	-0.015***
		(-5.31)	(-3.52)		(-4.11)	(-2.84)
Price-Cost Margin		-0.010*	-0.033***		-0.021***	-0.049***
		(-1.90)	(-3.36)		(-3.02)	(-4.24)
HHI		-0.017**	-0.012		-0.017**	-0.012
		(-2.35)	(-1.49)		(-2.09)	(-1.31)
HP HHI			-0.245			-0.125
			(-1.27)			(-0.57)
Constant	-0.048***	-0.098***	-0.052*	0.028***	-0.084***	-0.077**
	(-5.52)	(-6.70)	(-1.90)	(2.67)	(-5.04)	(-2.46)
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	80,980	64,484	40,867	80,980	64,484	40,867
Adjusted R^2	0.304	0.311	0.295	0.322	0.344	0.329

Table 13

Introduction of CDS

This table reports the effect of CDS introduction on the relation between inflexibility and leverage ratios. The leverage ratio is the long-term debt scaled by market value of assets (*LDM*) in Columns (1) to (4) and the total debt scaled by market value of assets (*TDM*) in Columns (5) to (8). *Inflex* is the proxy for inflexibility. *Inflex_Median* is an indicator which equals one if a firm's inflexibility is above the median in the sample in a certain year, and zero otherwise. *CDS* is an indicator which equals one if a firm has CDS traded on its debt in a given year and zero otherwise. Control variables include profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), assets tangibility (*Tangible*), and industry median leverage (*IndustLev*). The detailed variable definitions are provided in Appendix Table A.1. The sample period is from 1970 to 2017. *t*-statistics based on standard errors clustered at firm level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	LDM				TDM			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Inflex×CDS	2.001***	1.368**			2.491***	1.710**		
	(3.22)	(2.18)			(3.61)	(2.47)		
Inflex	-1.820***	-1.852***			-2.417***	-2.289***		
	(-11.80)	(-11.62)			(-13.15)	(-12.01)		
Inflex_Median×CDS			0.027**	0.019*			0.033***	0.023**
			(2.49)	(1.84)			(2.73)	(2.03)
Inflex_Median			-0.035***	-0.037***			-0.041***	-0.043***
			(-10.84)	(-11.59)			(-10.76)	(-11.10)
CDS	-0.001	0.018**	0.009	0.027***	-0.006	0.028***	0.007	0.040***
	(-0.14)	(1.97)	(1.22)	(3.54)	(-0.64)	(2.75)	(0.90)	(4.72)
Profit	-0.238***	-0.262***	-0.208***	-0.242***	-0.361***	-0.407***	-0.317***	-0.380***
	(-20.44)	(-21.88)	(-18.77)	(-20.54)	(-24.68)	(-26.75)	(-22.55)	(-25.31)
Size	0.016***	0.020***	0.016***	0.020***	0.008***	0.014***	0.008***	0.015***
	(16.62)	(17.86)	(16.95)	(18.67)	(6.97)	(11.20)	(7.47)	(12.07)
B/M	0.055***	0.060***	0.057***	0.061***	0.077***	0.083***	0.081***	0.085***
	(22.19)	(24.13)	(23.25)	(24.81)	(25.78)	(27.56)	(27.04)	(28.33)
Tangible	0.178***	0.177***	0.177***	0.179***	0.151***	0.175***	0.148***	0.177***
	(17.87)	(13.17)	(17.80)	(13.35)	(13.29)	(10.98)	(13.07)	(11.11)
IndustLev	0.417***	0.330***	0.421***	0.328***	0.544***	0.423***	0.551***	0.420***
	(37.47)	(27.46)	(38.04)	(27.22)	(41.99)	(30.27)	(42.70)	(30.02)
Constant	-0.034***	-0.054***	-0.050***	-0.063***	0.047***	0.022**	0.022***	0.008
	(-5.22)	(-6.22)	(-8.47)	(-7.60)	(5.81)	(2.10)	(3.03)	(0.76)
Industry FE	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	No	Yes	No	Yes	No	Yes	No	Yes
Obs	80,980	80,980	80,980	80,980	80,980	80,980	80,980	80,980
Adjusted R^2	0.304	0.339	0.303	0.339	0.320	0.362	0.317	0.361