Inflexibility and Leverage*

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Abstract

Firms' inflexibility to adjust their scale persistently explains capital structure variations in a comprehensive sample and randomly-selected subsamples. Higher inflexibility leads to lower financial leverage, potentially due to higher default risk and lower value of tax shields. Contraction inflexibility determines leverage more than expansion inflexibility. Moreover, inflexibility explains financial leverage on top of operating leverage variability and cash flow variability. Interestingly, the substitution effect between financial and operating leverage is much weaker among flexible firms. In addition, inflexible firms increase leverage more than flexible firms following a positive credit supply shock, which supports our main findings.

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Keywords: Inflexibility, Capital Structure, Distress Risk, Tax Shields, Bank Credit.

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1 Introduction

A fundamental question in financial economics is how operating inflexibility affects corporate financial policies.[1] Empirical evidence on this topic is limited, potentially due to the lack of a general inflexibility measure. Existing studies have examined the impacts of firm-level inflexibility to adjust output volume (Reinartz and Schmid, 2016) and product price (D'Acunto, Liu, Pflueger, and Weber, 2018). Another important aspect of operating flexibility is investment flexibility, which captures firms' ability to adjust the scale of physical and human capital. Prior research documents substantial variations across firms in the purchase and resale prices of physical capital as well as the replacement cost of human capital, which are shown to affect firms' risk and return profiles. These variations could also have important implications for corporate capital structure decisions.[2] In this paper, we study the relation between a firm's financial leverage and its investment inflexibility through the lens of a novel proxy of firm-level inflexibility, which is derived from a neoclassical model of a firm with assets-in-place and options to contract and expand.

In the model, firms incur adjustment costs when they expand or contract their productive scale in response to productivity shocks. Productive scale refers to a bundle of productive factors that generate quasi-fixed operating costs, such as physical capital, labor, raw materials and other commitments. The adjustment friction leads to an inaction region where firms do not adjust their scale. Inflexible firms with higher adjustment costs tend to wait longer than flexible firms before making adjustments. Therefore, a firm's inflexibility corresponds to the width of the inaction region that is closely related to an observed range of its cost-to-sales ratio (or inverse profitability) while not adjusting its scale. This suggests that the historical range of a firm's operating costs-to-sales ratio, scaled by the volatility of productivity shocks, measures the firm's inflexibility.[3]

Inflexible firms are less likely to contract in recessions or expand during economic booms, which has largely two effects. First, the inflexibility to downsize (reduce quasi-fixed operating costs) in bad times raises the expected cost of financial distress by increasing default risk and lowers the value of

[1] The capital structure literature documents that corporate financing decisions are influenced by numerous factors, including profitability (Graham, 2000), firm size (Korteweg, 2010; Öztekin, 2015), ownership structure (Grennan, Michaely, and Vincent, 2017), information asymmetry (Chang, Dasgupta, and Hilary, 2006), geographical diversification of operations (Erel, Jang, and Weisbach, 2020), relationship with stakeholders (Banerjee, Dasgupta, and Kim, 2008), stock market conditions (Baker and Wurgler, 2002; Alti, 2006), and macroeconomic conditions (Erel, Julio, Kim, and Weisbach, 2012).

[2] Simintzi, Vig, and Volpin (2015) and Serfling (2016) link labor protection with financial leverage by employing changes in country-level and state-level employment laws, respectively. However, neither of them constructs a direct measure of firm-level labor flexibility.

[3] The idea of measuring ranges or inaction regions relates to dynamic capital structure models (Strebulaev, 2007).

tax shields. Second, the inflexibility to scale up (produce more when profit margins are high) in good times limits firms' taxable income and thereby reduces tax benefits of debt financing. Both effects suggest that inflexibility decreases firms' incentives to maintain a high level of financial leverage ratio. Hence, all else equal, we expect inflexible firms to adopt lower financial leverage than flexible firms.[4]

With a large sample of U.S. public firms from 1970 to 2017, we estimate the effect of inflexibility on financial leverage. Consistent with our expectation, financial leverage decreases substantially with inflexibility. In ordinary least squares (OLS) regressions, a one-standard-deviation increase in inflexibility is associated with a 1.4% (1.7%) decrease in the long-term (total) leverage ratio, which corresponds to 6.7% (6.4%) of the average long-term (total) leverage ratio.[5] Moreover, with randomly-selected subsamples, we show that inflexibility is a powerful factor that persistently explains variations in financial leverage. Its performance is comparable to several important leverage determinants established in the literature (e.g., Frank and Goyal, 2009) such as profitability, firm size, book-to-market ratio, and asset tangibility.

Distress risk and tax-shield benefits are potential mechanisms underlying the negative relation between inflexibility and financial leverage. To test the distress risk channel, we first exploit the enactment of anti-recharacterization laws that offer creditors greater access to the collateral when the borrowing firm goes bankrupt. In support of the distress risk channel, we show that the impact of inflexibility on financial leverage becomes weaker when creditors are better protected against firms' default risk. Also, we find that our baseline results are more pronounced among firms in industries that likely face higher default risk, that is, industries with higher cash flow volatility and higher R&D intensity. To evaluate the role of tax-shield benefits, we exploit variations in corporate tax rates. Consistent with the tax shield channel, we document that higher corporate tax rates amplify the effect of inflexibility on financial leverage, especially among more profitable firms.

Intuitively, the inflexibility on both expansions and contractions could induce firms to adopt low leverage ratios. However, the degree of impacts from both sides may not be the same. In fact, we show that contraction inflexibility plays a more critical role in determining financial leverage than expansion inflexibility. To disentangle these effects, we exploit the variation in the relative importance of contraction and expansion options in different subsamples. First, we compare value

[4] 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.

[5] Figure 1 reveals that the average long-term (total) leverage ratio declines monotonically from 26% (33%) in the most flexible group to 17% (23%) in the most inflexible group. The effect of inflexibility cannot be subsumed by other determinants of leverage. Indeed, the unexpected leverage ratios (i.e., leverage residuals) after adjusting for previously documented relevant factors also exhibit a remarkably decreasing pattern (Figure 1).

firms with growth firms. Growth firms usually face many valuable investment opportunities and thus are likely far away from the contraction boundary. By contrast, value firms are likely far away from the expansion boundary since they are usually equipped with much unproductive capital that can be utilized when receiving positive productivity shocks. Therefore, for value (growth) firms, the variation in contraction (expansion) inflexibility would contribute much to the variation in our inflexibility measure. Our results reveal that the negative inflexibility-leverage relation is more pronounced among value firms, suggesting a larger role of contraction inflexibility in determining financial leverage. Second, we compare periods of economic recessions and booms. We find that the relation between inflexibility and financial leverage is stronger during recession periods, further confirming our view that contraction inflexibility is more important in driving capital structure decisions.

We further show that inflexibility helps explain financial leverage on top of operating leverage, operating leverage variability, and cash flow variability. Although operating leverage can be influenced by inflexibility, these two concepts are different. In particular, operating leverage captures the cost structure in a firm, whereas inflexibility reflects a firm's inability to adjust its scale in response to productivity shocks. A firm with high operating leverage can be flexible, and an inflexible firm can have low operating leverage. Interestingly, flexibility weakens the well-known substitution effect between operating and financial leverage. The negative relation between operating and financial leverage disappears among the most flexible firms. This evidence is consistent with the intuition that the flexibility to adjust the productive scale allows firms with high operating leverage to reduce their distress risk when receiving negative productivity shocks.

One might think that our inflexibility measure is a proxy for the variability of operating leverage which captures how much a firm's operating leverage varies over time. Yet, this is not the case. Operating leverage variability mainly reflects variations in operating leverage within the inaction region where the firm does not adjust its scale, while inflexibility directly captures more extreme situations where the firm's productivity hits its adjustment boundaries. Intuitively, the variation captured by our inflexibility measure matters more for creditors who are concerned about firms' distress risk. Thus, we expect that inflexibility could explain financial leverage on top of operating leverage variability, and our test results are consistent with this view.

Existing literature suggests that firms with higher cash flow risk are associated with lower financial leverage. Although the inflexibility to adjust productive scale may lead to more volatile cash flows, we show that the effect of inflexibility on leverage differs from that of cash flow risk. Similar to operating leverage variability, cash flow variability primarily captures variations in cash flows within firms' inaction region rather than situations where firms actually adjust their productive scale. Thus, we expect and find that inflexibility could explain financial leverage on top of cash flow variability.

We then follow D'Acunto, Liu, Pflueger, and Weber (2018) to analyze differential leverage responses to a positive credit supply shock, which motivates banks to lend more to riskier firms and even actively search for borrowers with low leverage ratios. The increased credit supply makes it easier for riskier firms to get funded. Therefore, a positive credit supply shock is likely to lower firms' borrowing costs. Given that inflexible firms tend to be underleveraged and face higher pre-shock credit constraints, reduced funding costs increase debt taking, but even more so for inflexible firms. Indeed, inflexible firms experience more significant increases in leverage ratios compared to flexible firms after an increase in credit supply induced by the interstate bank branching deregulation. This finding supports our main result that inflexible firms tend to adopt lower leverage ratios than flexible firms. In addition, firms' inflexibility level does not change significantly around the shock. Hence, the negative inflexibility-leverage relation is not driven by the possibility that low-leverage firms facing financial constraints fail to scale up in response to positive productivity shocks and thereby appear inflexible.

One may be concerned that the agency costs of free cash flows could explain the negative relation between financial leverage and inflexibility. Specifically, high-leverage firms may have a low level of inflexibility because they have low free cash flows, which might prevent corporate managers from allowing their firm to deviate much from its optimal size. In contrast to this view, however, we find that firms' inflexibility level does not change significantly around the passage of antitakeover laws, which increases agency costs by reducing the threat of hostile takeovers. The evidence alleviates the concern that our main results are driven by agency problems.

Our main results are also supported by a battle of robustness tests. Despite theoretical foundations on the relation between inflexibility and financial leverage, inflexibility may not be exogenous to capital structure decisions. To perfectly identify the effects of inflexibility on financial leverage, one needs exogenous shocks to inflexibility. However, such shocks are not readily available since inflexibility tends to be a persistent firm characteristic. To mitigate concerns about omitted variables, we consider the effects of various factors such as market power (price-cost margin and Herfindahl index), stock return volatility, and firm age. We also include firm fixed effects to account for the effects of time-invariant firm-level characteristics. As another attempt to alleviate potential concerns, we employ the instrumental variables approach. Our instrumental variable relies on the fact that labor adjustment inflexibility is an important component of inflexibility and exploits variations in labor adjustment costs created by the adoption of labor protection laws against wrongful termination.

The wrongful discharge law that prevents employers from firing workers without just cause increases firms' labor adjustment costs. Thus, we use firms' exposure to costs associated with wrongful discharge laws as the instrument for inflexibility. Our main results remain robust in all the additional tests. Moreover, our results become stronger after taking into account potential measurement error.

This paper adds to a growing literature on the role of operating flexibility in financial economics. Existing work on risk management suggests that production flexibility significantly affects firms' hedging behavior and liquidity management (Hirshleifer, 1991; Lin, Schmid, and Weisbach, 2020). Asset pricing research (Gu, Hackbarth, and Johnson, 2018) shows theoretically and empirically that flexibility is an essential determinant of firms' risk and return profiles. More closely related to our paper, a few studies investigate the impacts of flexibility on corporate financing decisions. Reinartz and Schmid (2016) document a positive relation between volume flexibility and financial leverage using a volume flexibility measure that is specific to energy utility firms.[6] Simintzi, Vig, and Volpin (2015) and Serfling (2016) find that firms reduce financial leverage after reforms enhancing employment protection. Furthermore, the recent work by D'Acunto, Liu, Pflueger, and Weber (2018) shows that firms' flexibility to adjust product prices helps explain variations in capital structure, where higher price stickiness is associated with lower financial leverage.

Our paper contributes to the above strand of research in several aspects. First, we show that investment inflexibility decreases financial leverage, which is consistent with the tradeoff theory. Second, our inflexibility measure is theory-grounded, easy to construct, and applicable to all firms with publicly available accounting data. The use of the whole universe of public firms allows us to provide more general and reliable evidence. Third, with this inflexibility measure, we are able to document several additional novel findings. For example, we find that contraction inflexibility plays a more significant role in determining financial leverage than expansion inflexibility. We show that flexibility weakens the well-known substitution effect between operating and financial leverage. We also document that inflexibility helps explain financial leverage on top of operating leverage variability and cash flow risk. Taken together, our paper represents a very comprehensive empirical investigation of the relation between inflexibility and corporate capital structure.

This paper also extends the capital structure literature. Financial policy is a key topic for economists, managers and investors, because it can influence not only the rate of return a company

[6] Based on census data for firms in selected industries (3,416 firm-year observations), MacKay (2003) shows that volume flexibility increases financial leverage, whereas investment flexibility decreases financial leverage (Table 3 in MacKay's paper). Limitations on MacKay's data sample and estimation methods may explain why his results are different from our findings that are obtained from a comprehensive sample based on a general inflexibility measure.

earns for its shareholders but also whether or not a firm can survive economic downturns. As a result, researchers have put considerable effort into understanding capital structure decisions. Notwithstanding an extensive list of characteristics to explain the observed variations in financial leverage, empirical models' ability to capture most variations remains unresolved (Harris and Raviv, 1991; Graham and Leary, 2011). In this paper, we focus on inflexibility as an important and heretofore underexplored capital structure determinant. We document the significant role of firms' inflexibility in explaining cross-sectional variations in capital structure choices. Notably, the explanatory power of inflexibility is comparable to several important leverage determinants selected by Frank and Goyal (2009).

Finally, our results also relate 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. For inflexible firms, a high level of financial leverage could result in severe distress and even bankruptcy during recessions. Thus, adopting a relatively low leverage ratio is relatively more beneficial for less flexible firms because this low-leverage policy provides them with protection against unfavorable situations.

The paper proceeds as follows. Section 2 develops our hypothesis on the relation between inflexibility and financial leverage. Section 3 describes the data and variable constructions. Section 4 presents our empirical evidence. Finally, Section 5 concludes.

2 Hypothesis Development

The idea that inflexibility affects financial leverage has been formalized in theoretical studies. An early model on production flexibility and financial leverage is proposed by Mauer and Triantis (1994), which shows that volume inflexibility increases default risk, lowers tax benefits of debt, and thus decreases debt capacity. In their dynamic framework, a firm produces an output with stochastic price. In response to price fluctuations, the firm can adjust its production capacity by shutting down or restarting production facility with fixed costs. The firm can also alter its capital structure by issuing debt and equity, which incurs recapitalization costs. Consistent with the tradeoff theory (Robichek and Myers, 1966; Kraus and Litzenberger, 1973), the optimal capital structure decision in this setting is characterized by a tradeoff between tax benefits and bankruptcy costs of debt financing. In their model, high inflexibility to shut down operations in difficult times prevents the firm from avoiding operating losses, which results in lower benefits of tax shields and higher expected cost of financial distress due to higher default risk.[7] On the other hand, in good times, inflexible firms cannot quickly resume operations to capture the increased operating profits, which lowers their taxable income and limits the tax benefits of debt financing. Thus, both the inflexibility to shut down and resume operations incentivize firms to adopt a low level of financial leverage.

The inflexibility we analyze refers to a firm's inability to adjust its productive scale, which is a firm's productive factors that generate quasi-fixed operating costs, such as physical capital, labor, raw materials and other commitments. Although concept-wise, our definition of inflexibility is different from volume inflexibility discussed in the above model, the channels through which both dimensions of inflexibility affect financial leverage are similar: when receiving negative productivity shocks, firms with high contraction inflexibility cannot scale down easily to reduce quasi-fixed operating costs, which raises their default risk and lowers the value of tax shields; when receiving positive productivity shocks, firms with high expansion inflexibility cannot scale up easily to produce more, which limits their taxable income and tax benefits of debt financing. Thus, we hypothesize that inflexibility decreases financial leverage.

In a setting that is the basis for our inflexibility measure, Appendix B of Hackbarth and Johnson (2015) shows that more flexible firms enjoy larger debt capacity. In their framework, inflexibility on the contraction side increases the risk associated with fixed costs so that fixed interest payments are less desirable for a firm following the trade-off theory. In other words, a more flexible firm, on the margin, has a higher optimal leverage ratio.

Despite theoretical foundations, empirical evidence on the relation between inflexibility and financial leverage is limited, and existing studies have mainly focused on a selected set of firms. In this paper, we employ a theory-grounded firm-level inflexibility measure which is available for the whole universe of public firms. As a result, we are able to test theoretical implications in a broad context.

3 Data and Measures

3.1 Data Sources

Our sample includes U.S. public firms from 1970 to 2017. We obtain financial data from the Compustat database and the stock return data from the Center for Research in Security Prices

[7] Consistent with this implication, we find that higher inflexibility is associated with higher future default risk (Table IA.4 in the Internet Appendix). In particular, higher inflexibility predicts lower Z-score (Mackie-Mason, 1990) and higher failure probability (Campbell, Hilscher, and Szilagyi, 2008). Moreover, we find that banks charge higher spreads on term loans and credit lines borrowed by inflexible firms than those borrowed by flexible firms (Figure IA.1 in the Internet Appendix).

(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. Table A.1 in the Appendix provides a detailed description of variable definitions.

3.2 Inflexibility Measure

We adopt a firm-level inflexibility measure based on a continuous-time, partial-equilibrium model (see Hackbarth and Johnson (2015) for details). The model assumes that a firm has repeated options to expand or contract its composite scale A for certain adjustment costs in response to permanent productivity shocks θ. In this setting, the firm's cash flow per unit time is $\Pi_t = \theta_t^{1-\gamma} A_t^{\gamma} - mA_t$, where $\gamma \in (0, 1)$ governs returns to scale, and $m > 0$ denotes the operating cost per unit of A. The firm faces quasi-fixed and variable adjustment costs for both expansion and contraction. 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.

The model produces an (upper) contraction boundary (denoted by U) and a (lower) expansion boundary (denoted by L) for re-scaled productivity $Z_t \equiv A_t/\theta_t$. It suggests that the firm lives in Z space on the interval $[L,\ U]$, the width of which captures the firm's flexibility. Flexible firms (with lower adjustment costs) will adjust scale more often and bring Z closer to its interior optimum. In comparison, inflexible firms (with higher adjustment costs) will adjust scale less often. Thus, inflexibility corresponds to the inaction region between U and L, $\log(U/L)$. This range should be scaled by the volatility of productivity shocks, σ, because firms in more volatile businesses will optimally wait longer to exercise their adjustment options but this effect is unrelated to firms' inflexibility.

Empirically, we follow Gu, Hackbarth, and Johnson (2018) to construct the inflexibility measure. The width of the firm's inaction region is measured by the range of its operating costs over sales. 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, this range is scaled by the volatility of the growth rate 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:

$$Inflex_{i,t} = \frac{\max_{i,t_0,t}\left(\frac{OPC}{Sales}\right) - \min_{i,t_0,t}\left(\frac{OPC}{Sales}\right)}{\text{std}_{i,t_0,t}\left(\Delta \log\left(\frac{Sales}{Assets}\right)\right)}, \tag{1}$$

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 the firm's operating costs over sales during the period from year t_0 to year t, and $\text{std}_{i,t_0,t}\left(\Delta \log\left(\frac{Sales}{Assets}\right)\right)$ is the standard deviation of the annual growth rate of sales over assets 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. In our calculation, we use a 20-year estimation window. To avoid potential noise, we require that at least 10 observations are available for a firm to calculate the inflexibility measure.[8]

This inflexibility measure significantly correlates with 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.[9] 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 flexibility explains the cross-sectional variations in capital structure decisions.

3.3 Leverage Measures

In this paper, we mainly focus on two measures of financial leverage. One is the ratio of long-term debt to the market value of assets (*LD*), and the other is the ratio of total debt to the market value of assets (*TD*). *LD* is the ratio of long-term debt to market value of assets, where the market value of assets is calculated as the sum of long-term debt and debt in current liabilities plus the market value of equity. Similarly, *TD* is computed as the ratio of book value of total debt to the market value of assets.

For robustness checks, we also consider several alternative measures of financial leverage. Specifically, we define *LD1* (*TD1*) as the long-term debt (total debt) scaled by the sum of market value of equity, book value of total debt, and total preferred stock minus deferred taxes and investment tax credit. In addition, we calculate *LD2* (*TD2*) as the long-term debt (total debt) divided by the sum of market value of equity and the difference between total assets and total common equity. 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

[8] Our results still hold if we define the inflexibility of a firm in year t as the average of its original inflexibility specified in Equation (1) from the beginning of our sample period to year t (Table IA.3 in the Internet Appendix).

[9] 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 *redeployability index* in Kim and Kung (2017), and the firm-level *capital reallocation rate* defined in Eisfeldt and Rampini (2006). It also shows that the measure is significantly positively related to the industry-level *inflexible employment* measure in Syverson (2004) and the industry-level *unionization rate*. In untabulated results, we 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.

in the Internet Appendix.

3.4 Control Variables

Existing studies establish that firms' capital structure decisions could be affected by a number of factors. After investigating the relation between financial leverage and more than twenty previously documented factors, Frank and Goyal (2009) conclude that the most reliable explanatory variables are industry-level leverage, market-to-book assets ratio, asset tangibility, profits, firm size, expected inflation, and the dividend-paying status.[10] In particular, they show that larger firms, less profitable firms, firms with more tangible assets, and firms with higher book-to-market ratios have higher financial leverage. Moreover, a firm's leverage ratio is positively associated with leverage ratios of the firm's industry peers. They also find that firms are likely to maintain a high level of leverage when inflation is expected to be high. In addition, they show that dividend-paying firms tend to adopt lower financial leverage compared to non-dividend-paying firms. Based on their study, we include the following control variables in our analysis: profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), asset tangibility (*Tangible*), industry-level leverage (*IndustLev*), and the dividend payer dummy (*Payer*). Specifically, *Profit* is the ratio of operating income before depreciation to book value of total assets; *Size* is the logarithm of book value of total assets;[11] *B/M* is book value of total assets divided by the sum of market value of equity and the difference between total assets and total common equity; *Tangible* is the ratio of net property, plant, and equipment to book value of total assets; *IndustLev* is the median value of total leverage ratio (*TD*) in a particular industry and a given year; *Payer* is an indicator variable that equals one if a firm pays common dividends during a fiscal year, and zero otherwise.

3.5 Summary Statistics

Table 1 presents the summary statistics. To avoid impacts of outliers, we winsorize continuous variables at the 1st and 99th percentiles. Panel A shows the descriptive statistics. The mean of our inflexibility measure is 0.015.[12] The average long-term (total) leverage ratio is around 21% (27%). The mean of total assets is approximately $241 million, with the average return on assets equal to 11.8%. The mean of the book-to-market ratio is 0.81. On average, around one-third of the assets are tangible.

[10] With an international sample, Öztekin (2015) confirms that firm size, tangibility, industry leverage, profits, and inflation are reliable determinants of financial leverage.

[11] Our results are similar if we deflate total assets with the Consumer Price Index (CPI).

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

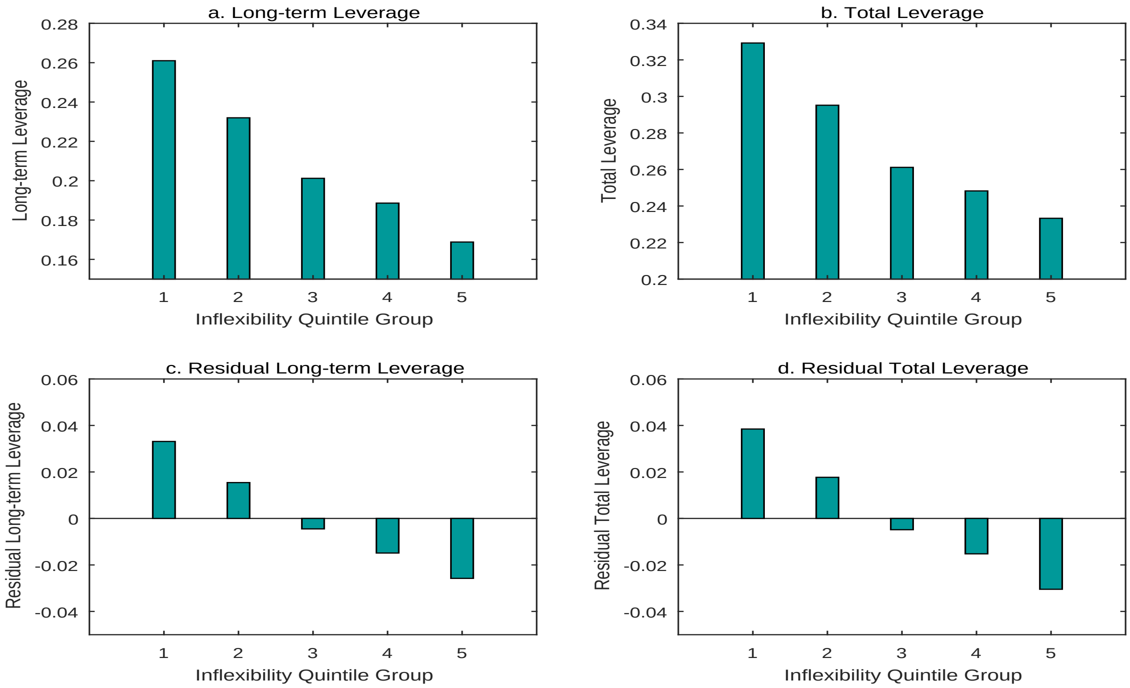

Figure 1
Inflexibility and Leverage Ratios
This figure illustrates the relation between inflexibility and leverage ratios. Firms are divided into quintile groups each year based on their inflexibility level. The subfigure a (b) plots the average long-term (total) leverage ratio in each group. The subfigure c (d) plots the average residual long-term (total) leverage in each group. The residual leverage is the residuals from the regression of financial leverage on profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), asset tangibility (*Tangible*), dividend payer dummy (*Payer*), and industry median leverage (*IndustLev*). The sample period is from 1970 to 2017.

[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. Compared with flexible firms, inflexible firms are smaller and less profitable. The less flexible firms also tend to have lower book-to-market ratios and less tangible assets.

Figure 1 illustrates the relation between inflexibility and leverage ratios. Firms are divided into quintile groups each year based on their inflexibility level. Subfigure a (b) demonstrates the average long-term (total) leverage ratio for firms in each group. The pattern is fairly striking: moving from the most flexible firms (Group 1) to the most inflexible firms (Group 5), the long-term leverage ratio decreases dramatically from around 26% to nearly 17%. The total leverage ratio exhibits a similar pattern.

One concern with the results above is that the variation in leverage ratios across inflexibility-sorted groups might capture cross-sectional differences in other factors associated with financial leverage, such as profitability and firm size. An analysis of unexpected leverage ratios helps adjust for previously-identified determinants of capital structure choices. To that end, we examine the relation between inflexibility and residual leverage, where the residual leverage is residuals from the regression of financial leverage on control variables specified in Section 3.4. Subfigure c (d) in Figure 1 illustrates the average value of residual long-term (total) leverage ratio for firms in each group. We find that the average residual leverage ratios decrease monotonically and strongly with inflexibility. For example, the average residual total leverage ratio declines from about 3.8% in the most flexible group to -3.0% in the most inflexible group. This decreasing pattern indicates that firms with higher inflexibility tend to have lower financial leverage ratios, even after controlling for other firm characteristics.

4 Inflexibility and Leverage

4.1 Baseline Analysis

To study the inflexibility-leverage relation, we first run the following OLS regression:

$$Leverage_{i,t} = \alpha + \beta Inflex_{i,t-1} + \gamma' X_{i,t-1} + \tau_{j,t} + \epsilon_{i,t}, \tag{2}$$

where $Leverage_{i,t}$ is the leverage ratio of 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, firm size, book-to-market ratio, asset tangibility, dividend payer dummy, and industry median leverage. $\tau_{j,t}$ denotes industry-by-year fixed effects, with industries defined at the three-digit SIC codes level.

[Insert Table 2 Here]

Table 2 presents the results. Columns (1) to (4) use the long-term leverage ratio (LD) as the dependent variable, while Columns (5) to (8) report results for the total leverage ratio (TD). Columns (1) and (5) show the results from the univariate regression of leverage on inflexibility. We find that the coefficients on inflexibility are negative (-1.350 and -1.557) and significant at the 1% level.[13] The coefficients on inflexibility remain significant after introducing control variables to the regressions (Columns (2) and (6)).

[13] The robust standard errors are clustered at the firm level. Our results are robust to clustering standard errors at the industry level or the industry and year level (Table IA.2 in the Internet Appendix).

Columns (3) and (7) report results from regressions incorporating both control variables and fixed effects. For both leverage ratios, the coefficients on inflexibility are negative (-0.668 and -0.823) and statistically significant ($t =$ -9.20 and -9.95). These coefficients indicate that a one-standard-deviation increase in inflexibility leads to a 1.4% (1.7%) decrease in LD (TD), which corresponds to 6.7% (6.4%) of the average long-term (total) leverage ratio. Finally, we replace the continuous inflexibility measure with an indicator that equals one if a firm's inflexibility is above the sample median in a given year, and zero otherwise. This specification accounts for the possible nonlinear relation between inflexibility and leverage. As shown in Columns (4) and (8), the coefficients on these dummies are also significantly negative. In summary, the results from our baseline regressions show that inflexible firms tend to adopt lower financial leverage, which supports our hypothesis. We also find that these results are robust to alternative definitions of financial leverage (Table IA.1 in the Internet Appendix).

4.2 Performance Persistence

When evaluating the performance of various factors in explaining the variation in capital structure, Frank and Goyal (2009) show that six selected factors are the most reliable ones since the relation between financial leverage and these variables is strong and consistent in random subsamples. In this subsection, we examine whether inflexibility can persistently explain the variation in financial leverage by conducting the analysis with randomly-selected subsamples.

First, we split the whole sample into 10 equally-sized random groups. With each subsample, we rerun our baseline regression in Equation (2). For each explanatory variable, Panel A in Table 3 presents the average coefficient estimate, the average t-statistics, the percentage of regressions for which the coefficient estimate on a factor is positive and statistically significant at the 1% level, and the percentage of regressions for which the coefficient estimate on a factor is negative and statistically significant at the 1% level. Notably, the coefficient on inflexibility is consistently negative and significant in all random groups. The evidence suggests that our inflexibility measure is a powerful leverage determinant which performs as persistently as other reliably important drivers of financial leverage.

[Insert Table 3 Here]

In the second test, we estimate our baseline regression with five-year (not necessarily successive) subsamples randomly drawn from the whole sample. The exercise is repeated 50 times. Panel B in Table 3 shows that coefficients on inflexibility in all random subsamples are statistically significant with the expected negative sign. Moreover, the magnitude of the average coefficient estimates (-0.719 and -0.875) is comparable to that of the estimated coefficient on inflexibility obtained from the full sample (-0.668 and -0.823). The results again highlight the persistence and importance of our inflexibility measure in determining corporate capital structure.

4.3 Mechanisms

Theoretical models (e.g., Mauer and Triantis, 1994; Aivazian and Berkowitz, 1998) suggest that inflexible firms adopt lower leverage ratios than flexible firms because inflexible firms face higher distress risk and enjoy smaller tax-shield benefits. We now test these two channels separately.

4.3.1 Distress Risk

If high distress risk induces inflexible firms to maintain relatively low leverage ratios, we anticipate that the impact of inflexibility on financial leverage is less pronounced when lenders are better protected against borrowing firms' financial distress. We exploit the variation in creditor rights associated with the enactment of anti-recharacterization laws to test our expectation. These laws are relevant for firms that borrow through a special purpose vehicle (SPV). As a commonly-used way to conduct secured borrowing, the SPV is designed to protect collaterals from automatic stay if the borrowing firm goes bankrupt.[14] However, before anti-recharacterization laws, creditors' right to seize collaterals in the SPV is not guaranteed because bankruptcy courts may recharacterize these collaterals and make them subject to automatic stay. Anti-recharacterization laws deny judges' discretion in this regard and thereby strengthen the rights of secured creditors in bankruptcy. Thus, we expect that the negative relation between inflexibility and leverage becomes weaker following the enactment of these laws.

To conduct our test, we define a dummy variable, ARL, that equals one if the incorporation state of a firm had introduced anti-recharacterization laws in or before a given year, and zero otherwise.[15] We regress financial leverage on inflexibility, ARL, the interaction between the two variables, and control variables. In addition to our baseline control variables, we include an indicator variable, CDS, that equals one if a firm has introduced credit default swaps (CDS) contracts for its debt in a given year, and zero otherwise.[16] This variable is incorporated to account for the fact that CDS

[14] By analyzing a large sample between 1994 and 2004, Feng, Gramlich, and Gupta (2009) show that more than 40% firms utilize SPVs.

[15] Anti-recharacterization laws were introduced in Texas and Louisiana in 1997, Alabama in 2001, Delaware in 2002, South Dakota in 2003, Virginia in 2004, and Nevada in 2005.

[16] CDS inception dates are from the Markit database, which provides CDS pricing data since 2001. We merge

contracts, which allows the buyer (usually creditors) to ask for reimbursement from the seller in the case of borrower default, offer lenders protection against borrowers' default risk. These regressions include incorporation state-by-year fixed effects, industry-by-year fixed effects, and firm fixed effects. Columns (1) and (2) in Table 4 report the results. For both leverage ratios, the coefficient on the interaction term of inflexibility and ARL is positive and statistically significant. The evidence suggests that stronger creditor rights weaken the negative relation between inflexibility and financial leverage, which is consistent with the distress risk channel.

[Insert Table 4 Here]

The second heterogeneity we employ is the variation in cash flow volatility across industries. Firms in industries with more volatile cash flows are likely to face higher distress risk. Hence, we expect that inflexibility exerts larger influence on financial leverage among firms in industries with higher cash flow volatility. Columns (3) and (4) in Table 4 report results from regressions incorporating the interaction between inflexibility and industry-level cash flow volatility ($CF\ Vol_{Ind}$), which is average cash flow volatility in a given industry and year. The cash flow volatility is calculated as the standard deviation of the ratio of operating income before depreciation to total assets over the past forty quarters where the calculation requires at least eight quarterly observations. As expected, coefficients on the interaction term are negative and statistically significant at the 1% level.

Our third test is based on the evidence that higher research and development (R&D) intensity is associated with higher distress risk (Opler and Titman, 1994; Zhang, 2015). If the distress risk channel holds, we expect that financial leverage decreases with inflexibility more dramatically among firms in industries with higher R&D intensity. Industry-level R&D intensity ($R\&D_{Ind}$) is computed as the average R&D capital stock-to-equity ratio of firms in the industry in a given year. Following Chan, Lakonishok, and Sougiannis (2001), R&D capital stock is calculated as the five-year cumulative R&D expenditures calculated with an annual depreciation rate of 20%. Consistent with our expectation, Columns (5) and (6) in Table 4 show that higher R&D intensity amplifies the negative impact of inflexibility on financial leverage.

In summary, we show that the effect of inflexibility on leverage is weaker when creditor rights are better protected. We also find that our baseline results are more pronounced among firms in industries that likely face higher default risk, that is, industries with higher cash flow volatility and

CDS trading information with our primary dataset by manually checking the name and ticker of companies. In our sample, around 600 unique firms are matched with CDS data.

higher R&D intensity. These findings support our view that higher distress risk associated with inflexibility could explain the negative relation between inflexibility and financial leverage.

4.3.2 Tax Shields

Benefits of tax shields are the second potential mechanism to explain the negative relation between inflexibility and financial leverage. Specifically, the inflexibility to scale down in economic downturns lowers the value of tax shields, and the inflexibility to increase operating scale when profit margins are high decreases taxable income and thus limits tax benefits of debt financing. Hence, inflexibility reduces firms' incentives to adopt a high leverage ratio. If the tax shield channel holds, we expect the impact of inflexibility on financial leverage to be stronger among firms in regions with higher corporate tax rates.

To test the tax shield channel, we regress leverage ratios on inflexibility together with the interaction term between inflexibility and the average effective tax rate in a given state and year. The tax rate is calculated as total income tax expense divided by pre-tax book income less special items. Table 5 reports the results. As shown in Columns (1) and (2), coefficients on the interaction term are negative and statistically significant in regressions of both leverage ratios. The results confirm our expectation that high corporate tax rates strengthen the effects of inflexibility on financial leverage.

[Insert Table 5 Here]

We also expect that the tax shield channel is more important for more profitable firms. Thus, the sample is split into two subsamples based on the median value of firms' profitability in a given year. We then separately run regressions using the subsamples. Consistent with our expectation, Columns (3) to (6) in Table 5 show that the impact of inflexibility on financial leverage increases with tax rates in the subsample of more profitable firms. For less profitable firms, the interaction of inflexibility and tax rate is negative but statistically insignificant. Overall, the results in Table 5 are consistent with the tax shield channel.

4.4 Contraction Inflexibility v.s. Expansion Inflexibility

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 relative importance of expansion options and contraction options differs.

We first focus on the differential impacts of our inflexibility measure on financial leverage among value and growth firms. Since growth firms usually face many valuable investment opportunities, they are likely to be far from the contraction boundary. Therefore, it is relatively rare for growth firms to exercise contraction options. 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. The unproductive capital might be difficult to get rid of during economic downturns but can undoubtedly 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 examine whether expansion inflexibility 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, firms are sorted into tercile groups each year based on their book-to-market ratio. We then define two dummy variables, BM_2 and BM_3, to be equal to one if a firm is in the middle and top tercile, respectively, and zero otherwise. These dummies and their interactions with the inflexibility measure are introduced into the regression of financial leverage on inflexibility. The coefficients on interaction terms are of interest.

[Insert Table 6 Here]

Columns (1) and (2) in Table 6 present results from regressions of the long-term leverage ratio. Regardless of whether to include control variables and fixed effects, the coefficients on the interaction terms are consistently negative and significant. More importantly, the magnitude of these coefficients becomes larger as the book-to-market ratio increases. For example, after controlling for other determinants of leverage, year fixed effects, and firm fixed effects, the coefficients on *Inflex* $\times$ BM_2 and *Inflex* $\times$ BM_3 are -0.290 (t = -3.61) and -0.576 (t = -4.85), respectively. The evidence indicates that compared with growth firms where expansion options tend to dominate, the impact of inflexibility on leverage is much more pronounced among value firms for which contraction options are likely to be more important. The stronger effects in value firms also hold for total leverage ratio.

In addition, we investigate the differential effects of inflexibility on financial leverage over business cycles. In economic downturns, firms are likely to be far away from their expansion boundary, and contraction inflexibility should be more important in determining financial leverage. By contrast, in economic booms, firms are closer to their expansion boundary, and expansion inflexibility should play a bigger role. To exploit the heterogeneity over business cycles, we classify our sample into recession and expansion periods based on the National Bureau of Economic Research (NBER) business cycle reference dates. Specifically, the dummy variable, *Recession*, is set to one if a given year is in the NBER recession periods, and zero otherwise. Table 6 shows that the coefficients on *Inflex*×*Recession* are negative and statistically significant, suggesting that the negative relation between inflexibility and leverage is more pronounced in recessions when contraction inflexibility is more important.

Overall, with the comparison between value firms and growth firms as well as the comparison between recession periods and boom periods, Table 6 shows that contraction inflexibility plays a larger role than expansion inflexibility in determining financial leverage.

4.5 Inflexibility, Operating Leverage, Cash Flow Risk, and Financial Leverage

4.5.1 Operating Leverage, Operating Leverage Variability, and Cash Flow Variability

One may be concerned that inflexibility is simply a proxy for operating leverage, the variability of operating leverage, or cash flow risk. In this subsection, we distinguish inflexibility from these firm characteristics. We also demonstrate that inflexibility exerts incremental effects on financial leverage beyond the effects of operating leverage, operating leverage variability, and cash flow variability.

Prior studies have documented that firms with high operating leverage tend to adopt low financial leverage. It is possible that firms with high operating leverage also tend to be inflexible. However, we would note that although inflexibility and operating leverage are related in the sense that inflexibility could influence operating leverage, the two characteristics are conceptually different. Operating leverage captures the cost structure in a firm, whereas inflexibility refers to a firm's inability to adjust its productive scale in response to productivity shocks. To distinguish the effects of inflexibility and operating leverage, we include operating leverage (OL) in our regressions. As in Gu, Hackbarth, and Johnson (2018), we measure operating leverage with the ratio of quasi-fixed costs to sales. The quasi-fixed costs are estimated from 5-year rolling-window regressions of quarterly operating costs on one-quarter lagged costs, contemporaneous sales, and one-quarter lagged sales.[17]

[17] To avoid impacts of outliers and potential data errors, we require that at least eight observations are available in

In addition to the level of operating leverage, inflexibility is distinct from the variability of operating leverage measured by operating leverage volatility. A firm is likely to be riskier and associated with higher expected distress costs if its operating leverage is more volatile. Hence, we expect a negative relation between financial leverage and operating leverage variability. Although the variability of operating leverage captures how much a firm's operating leverage varies over time, it mainly represents the variation within the inaction region where the firm does not adjust its operating scale. By contrast, our inflexibility measure directly captures more extreme situations where the firm's productivity hits adjustment boundaries. Intuitively, the variation captured by our inflexibility measure matters more for creditors who are concerned about firms' distress risk. Thus, we expect that inflexibility could explain financial leverage on top of operating leverage variability. To test this conjecture, we incorporate operating leverage variability in our regressions. To measure operating leverage variability, we compute the standard deviation of operating leverage over the past ten years where we require at least three observations in the calculation.

Finally, inflexibility differs from cash flow risk, although the inflexibility to adjust productive scale may lead to more volatile cash flows. Survey evidence suggests that cash flow volatility is among the top things CFOs consider when choosing financial policies (Graham and Harvey, 2002). Prior research shows that higher cash flow risk is associated with lower financial leverage. However, similar to the variability of operating leverage, cash flow variability is supposed to primarily capture variations in cash flows within firms' inaction region rather than situations where firms adjust their productive scale. Thus, we expect that inflexibility has additional explanatory power for financial leverage over and above cash flow risk. In our analysis, cash flow risk is measured by the standard deviation of the ratio of operating income before depreciation to total assets over the past forty quarters where we require at least eight observations in the calculation.

Table 7 presents results from regressions of financial leverage on inflexibility, operating leverage, operating leverage variability, and cash flow risk. As expected, the results show that in the absence of inflexibility, financial leverage is negatively associated with operating leverage, operating leverage variability, and cash flow volatility. More importantly, when the three variables are added into our baseline regressions of financial leverage on inflexibility, coefficients on inflexibility remain negative and statistically significant at the 1% level (Columns (5) and (10)). We also find that coefficients on operating leverage variability and cash flow volatility become insignificant or even switch sign in the

each rolling window and that firms' quarterly asset growth rate, cost growth rate, and sales growth rate are between -0.75 and 0.75.

presence of inflexibility. The results indicate that our inflexibility measure could explain variations in financial leverage beyond the effects of operating leverage, operating leverage variability, and cash flow variability and that inflexibility is a more reliable leverage determinant compared to operating leverage variability and cash flow risk.

[Insert Table 7 Here]

4.5.2 Substitution Effect Between Operating and Financial Leverage

We have documented that the impact of inflexibility on financial leverage is distinct from that of operating leverage. We now further distinguish these two concepts by examining the well-known substitution effect between financial and operating leverage conditional on inflexibility. Intuitively, the flexibility to adjust productive scale enables firms with high operating leverage to lower their distress risk in economic downturns. Thus, we expect that the substitution effect between financial and operating leverage is less pronounced among flexible firms.

To test this conjecture, we sort firms in our sample into quintile groups each year based on their inflexibility measure. Independently, firms are divided into quintile groups each year based on their operating leverage. Figure 2 plots the average long-term and total leverage ratios in each of the twenty-five groups. It shows that for all levels of operating leverage, the average leverage ratios decrease as inflexibility increases, suggesting that the negative impact of inflexibility on financial leverage is separate from that of operating leverage. More importantly, we find that the negative relation between operating and financial leverage becomes weaker, moving from the most inflexible group to the most flexible group. Surprisingly, the negative relation disappears among the most flexible firms. This striking pattern is consistent with our conjecture that flexibility weakens the substitution effect between operating and financial leverage.

[Insert Table 8 Here]

We then investigate the relation among inflexibility, operating leverage, and financial leverage in a regression framework to control for the impacts of other leverage determinants. Specifically, financial leverage is regressed on indictors for firms in the middle and top inflexibility terciles ($Inflex_2$ and $Inflex_3$), an indicator for firms with the above-median operating leverage (OL_1), and the interaction terms between these variables. The regressions also include control variables specified

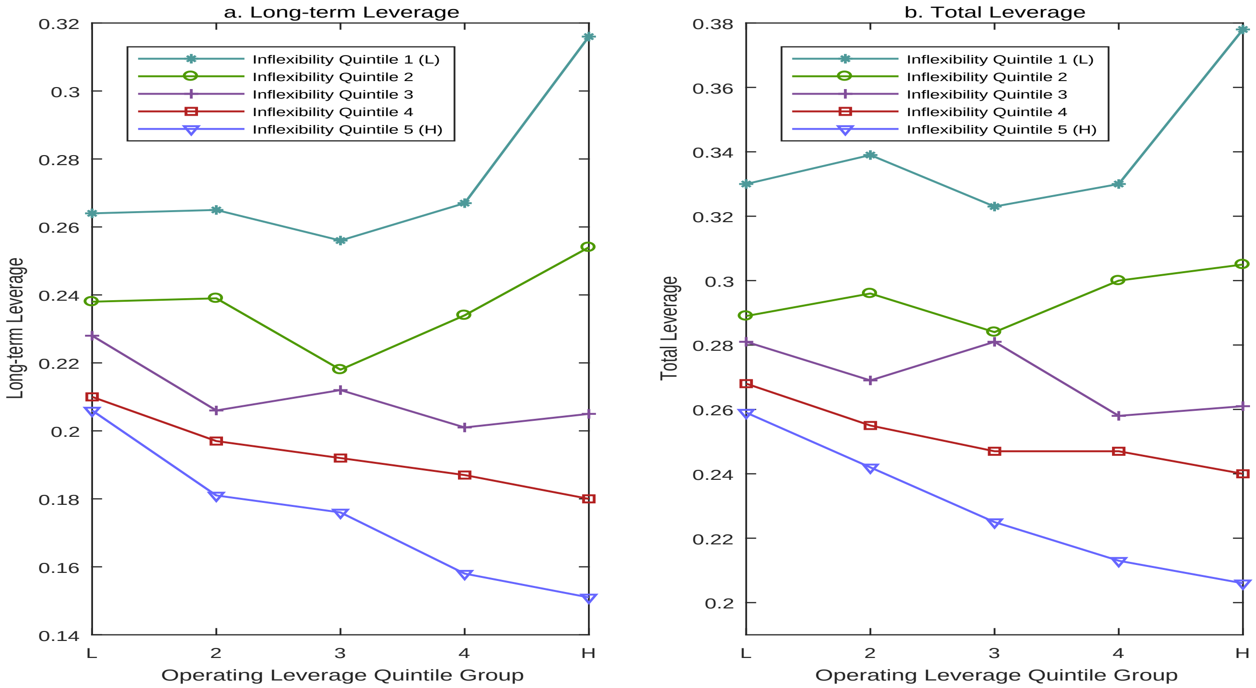

Figure 2

Leverage Ratios Across Inflexibility and Operating Leverage Groups

This figure demonstrates the relation between inflexibility, operating leverage, and financial leverage. Each year, firms are divided into quintile groups based on their inflexibility measure. Independently, firms are divided into quintile groups based on their operating leverage. The subfigure a (b) plots the average long-term (total) leverage in each group sorted on inflexibility and operating leverage. The sample period is from 1970 to 2017.

in our baseline regressions, year fixed effects, and firm fixed effects. Table 8 shows that coefficients on the interaction terms are negative and statistically significant. Consistent with our double-sorting results, the magnitude of coefficients on $OL_1 \times Inflex_2$ is smaller than that of coefficients on $OL_1 \times Inflex_3$. The evidence suggests that the substitution effect between operating and financial leverage is less pronounced among flexible firms. Our results also show that the negative relation between inflexibility and financial leverage is stronger among firms with high operating leverage. In other words, there exists a positive interaction effect between inflexibility and operating leverage.

4.6 Inflexibility, Credit Supply Shock, and Financial Leverage

To further investigate the role of inflexibility in corporate capital structure decisions, we examine how flexible and inflexible firms adjust leverage ratios in response to a positive credit supply shock, namely, the staggered state-level bank deregulation in the United States.[18] Prior to the 1990s,

[18] Bank debt is an important source of financing for many firms (e.g., Chakraborty, Goldstein, and MacKinlay, 2018). It is well-established in the literature that the bank deregulation represents a positive credit supply shock

banks in the U.S. were prohibited from opening branches across state boundaries. The restrictions were relaxed with the passage of the Riegle-Neal Interstate Banking and Branching Efficiency Act (IBBEA) in 1994.[19] The deregulation increases competition among banks. Under competitive pressure, banks might be willing to lend more to riskier firms and even actively search for borrowers with low leverage ratios.[20] In addition, the deregulation makes it easier for inflexible firms to get access to bank loans even when they are close to default. Hence, a positive credit supply shock likely lowers borrowing costs for firms. Given that inflexible firms tend to be underleveraged and face higher pre-event credit constraints, larger benefits of debt, on the margin, increase debt taking, but even more so for inflexible firms, because this way inflexible firms can ameliorate more their under-leverage problem to fund their business activities such as valuable investment opportunities.[21] By contrast, flexible firms already are, on average, at or closer to their leverage targets and hence respond less to a positive credit supply shock. Taken together, we expect that inflexible firms increase their financial leverage more than flexible firms following the bank branching deregulation.

While the IBBEA initiated the nationwide deregulation regarding interstate branching, it left the state authority with substantial freedom to implement the new law. States are allowed to set interstate branching regulations regarding four crucial provisions.[22] Based on the four aspects, Rice and Strahan (2010) construct a time-varying index of interstate branching restrictiveness for each state from 1994 to 2005. This index, ranging from zero to four, represents the number of restrictions the state implements and enables us to measure the variation associated with the deregulation. In our analysis, one state is considered implementing the deregulation if it removed at least one of the four restrictions.

Before comparing how financial leverage of flexible and inflexible firms responds to the credit supply shock, we validate our empirical framework. First, we verify that leverage ratios of flexible

for both private and public firms (e.g., Rice and Strahan, 2010; Amore, Schneider, and Žaldokas, 2013).

[19] The first wave of interstate bank deregulation started in 1978 when Maine passed a law permitting bank holding companies in other states to enter. This action was followed by other states and all states but Hawaii had passed similar laws by 1992. During this period, only the purchase of existing whole banks was allowed, but the entry through branching was still prohibited. Our findings remain unchanged after controlling for the potential impacts of earlier bank deregulatory events (Table IA.6 in the Internet Appendix).

[20] The opening of bank branches in firms' headquarter state may also promote loan financing by facilitating communications between banks and borrowers and thereby reducing information asymmetries. This suggests that the deregulation could improve credit access more significantly for riskier firms for which information asymmetry matters more. Consistent with larger benefits of reduced information frictions for riskier firms, Neuhann and Saidi (2018) show that the reduction in information asymmetry arising from the removal of certain firewalls in extant universal banks enables these banks to finance riskier firms.

[21] With the data on credit lines collected by Sufi (2009), we find that the average credit line usage rate for inflexible firms (33.00%) is higher than that for flexible firms (22.35%), where the difference is significantly different from zero ($t =$ -3.23). In addition, the distribution of credit line usage rate for inflexible firms lies to the right of that for flexible firms (Figure IA.2 in the Internet Appendix). The results suggest that inflexible firms are relatively more credit constrained.

[22] The four provisions include 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.

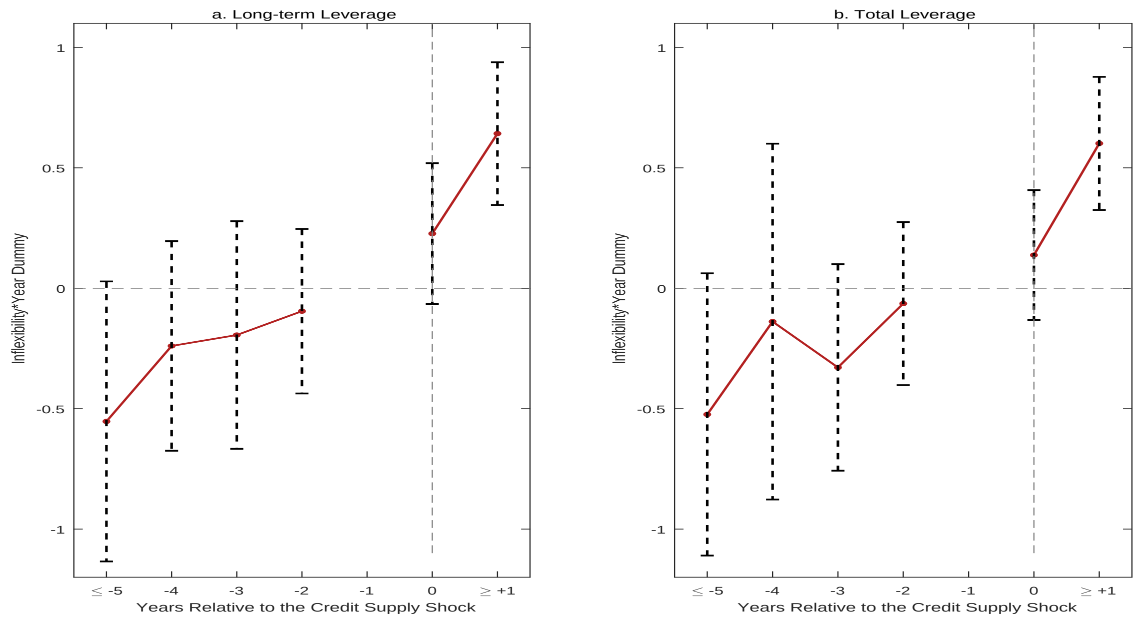

Figure 3
Credit Supply Shock: Parallel Trend

This figure illustrates leverage responses in firms with different levels of inflexibility around the credit supply shock. It plots estimated coefficients on the interaction terms ($\hat{\beta}$s) and the corresponding 95% confidence intervals from the following regression:

$$
\begin{aligned}
Leverage_{i,t} \quad = \quad & \alpha + \beta_1 Inflex_{i,t-1} \times Dereg^{-5}_{s,t} + \cdots + \beta_4 Inflex_{i,t-1} \times Dereg^{-2}_{s,t} + \beta_5 Inflex_{i,t-1} \times Dereg^{0}_{s,t} \\
+ \quad & \beta_6 Inflex_{i,t-1} \times Dereg^{+1}_{s,t} + \theta_1 Inflex_{i,t-1} + \tau_{s,t} + \tau_{j,t} + \epsilon_{i,t},
\end{aligned}
$$

where $Leverage_{i,t}$ is either the long-term leverage ratio (subfigure a) or the total leverage ratio (subfigure b). $Inflex_{i,t-1}$ is the proxy for inflexibility. $Dereg^{-5}_{s,t}$ is equal to one for years at least five years prior to the shock; $Dereg^{-k}_{s,t}$ is equal to one for the year k years prior to the shock, with $k = 2,\ 3,\ 4$; $Dereg^{0}_{s,t}$ is equal to one for the year when the shock occurs; $Dereg^{+1}_{s,t}$ is equal to one for years after the shock; $\tau_{s,t}$ and $\tau_{j,t}$ denote headquarter state-by-year fixed effects and industry-by-year fixed effects, respectively. The sample period is from 1970 to 2017.

and inflexible firms follow similar pre-event trends. To do so, we regress financial leverage on the interaction between inflexibility and indicators for years relative to the credit supply shock. Figure 3 plots coefficient estimates on these interaction terms together with the confidence interval. The coefficients on the interaction between inflexibility and pre-event year dummies are not statistically different from zero, indicating that the parallel trend assumption is satisfied.

Second, we verify that firms' inflexibility level is not affected by the shock of credit supply. Notably, inflexibility is a highly persistent firm characteristic that is not likely to change around the shock. In our sample, the auto-correlation coefficient of the inflexibility measure is 0.97. We also test whether firms' inflexibility level changes following the credit supply shock, using firms that have not experienced the shock as a control group. In particular, we regress our inflexibility measure on an indicator variable that equals one if a firm's headquarter state had implemented the bank deregulation in or before a given year, together with industry-by-year fixed effects and firm fixed effects. The coefficient on the indicator is 0.00 ($t = 1.54$). This evidence confirms that firms' inflexibility does not change significantly around the credit supply shock.

To explore differential responses of flexible and inflexible firms' financial leverage to the credit supply shock, we estimate the following regression model:

$$Leverage_{i,t} = \alpha + \beta Inflex_{i,t-1} \times Dereg_{s,t} + \theta Inflex_{i,t-1} + \gamma' X_{i,t-1} + \tau_{s,t} + \tau_{j,t} + \tau_i + \epsilon_{i,t}, \quad (3)$$

where $Dereg_{s,t}$ is an indicator for bank deregulation which equals one if the headquarter state of firm i had implemented the deregulation in or before year t, and zero otherwise. $\tau_{s,t}$ denotes headquarter state-by-year fixed effects. τ_i denotes firm fixed effects. Other variables are defined in the same way as in Equation (2). We expect the coefficient of the interaction term, $Inflex_{i,t-1} \times Dereg_{s,t}$, to be positive, because more inflexible firms experience a more considerable increase in funds available after the shock and thus a more substantial increase in financial leverage.

Consistent with our expectation, Table 9 shows that coefficients on the interaction term are positive and statistically significant in all specifications. For example, after control variables and fixed effects are added (Columns (3) and (6)), the coefficient β in the regression of long-term leverage ratio and total leverage ratio is estimated to be 0.315 ($t = 2.81$) and 0.332 ($t = 2.02$), respectively. The evidence that inflexible firms respond more to credit supply shocks indicates that they are likely in a greater need for funds to finance their business activities, lending additional support to our conclusion that inflexible firms adopt lower leverage ratios than flexible firms.

[Insert Table 9 Here]

Since bank deregulation is a shock to bank credit, we investigate changes in financial leverage associated with bank debt. In particular, we define bank-debt-related leverage ratio as total outstanding term loans scaled by the market value of assets. Consistent with responses in long-term and total leverage ratios, results in Table IA.5 in the Internet Appendix reveal that inflexible firms experience a more substantial increase in their bank debt compared with flexible firms when facing more credit supply from banks.

In summary, we show that inflexible firms increase financial leverage more than flexible firms following a positive credit supply shock. This finding supports our main result that inflexible firms adopt lower financial leverage. Our results are also consistent with existing evidence that the impact of the credit supply shock on various corporate outcomes is more pronounced among credit-constrained firms (e.g., Krishnan, Nandy, and Puri, 2015). More importantly, firms' inflexibility level does not change significantly around the shock that potentially relaxes firms' financial constraints. This evidence helps mitigate the concern that the negative relation between inflexibility and leverage is driven by reverse causality related to financial constraints. Specifically, firms that have difficulty borrowing might be financially constrained and not be able to scale up when positive productivity shocks arrive, which possibly increases these firms' inflexibility level.

Another potential concern is reverse causality related to agency costs of free cash flows. In particular, high-leverage firms tend to have lower free cash flows, which could prevent corporate managers from driving their firm far away from its optimal size (Jensen, 1986) and thus might lower the firm's inflexibility measure. To mitigate this concern, we examine whether an exogenous shock to agency costs significantly affects our inflexibility measure. Specifically, we focus on the staggered adoption of state-level business combination laws, which creates hurdles for hostile takeovers. Given that the takeover threat is an effective corporate governance mechanism to discipline managers (Bertrand and Mullainathan, 2003), the passage of antitakeover laws is supposed to increase agency costs. To conduct the test, we regress our inflexibility measure on an indicator variable that equals one if a firm's incorporation state had adopted the business combination law in or before a given year, together with industry-by-year fixed effects and firm fixed effects. The coefficient on the indicator is 0.00 and statistically insignificant (t = -0.32), indicating that firms' inflexibility does not change significantly around the shock to agency costs.[23] The evidence suggests that our main result is not likely to be driven by agency cost-related reverse causality.[24]

4.7 Robustness

We then conduct a battle of robustness tests to support our main finding. We first address potential concerns on measurement error using linear cumulant equations. To mitigate concerns on omitted variables, we control for additional variables that affect capital structure decisions and may be correlated with firms' inflexibility, such as industry competition, stock return volatility, and firm age. We also include firm fixed effects to account for unobservable firm-specific factors. Finally, we present results from an instrumental variables estimation.

[23] Our conclusion remains the same if we take into account the effects of other antitakeover laws and relevant court decisions.

[24] We do not find a significant change in firms' inflexibility level after bank deregulation and the adoption of business combination laws if we construct the inflexibility measure separately in the pre- and post-event periods.

4.7.1 Measurement Error

Erickson, Jiang, and Whited (2014) suggest that measurement error could be a concern in studies on capital structure determinants. 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 their work, we assume that there is measurement error in the book-to-market ratio and asset tangibility. We also assume that the inflexibility measure is mismeasured. Panel A in Table 10 reports the results. After taking into account potential measurement error, coefficients on inflexibility are still negative and significant at the 1% level. More importantly, compared with the benchmark from OLS regressions, the magnitude of the coefficients from linear cumulant equations is larger, indicating that measurement error significantly biases our baseline results downward.

[Insert Table 10 Here]

4.7.2 Industry Competition, Stock Return Volatility and Firm Age

Product market competition could influence firms' financing decisions (e.g., Sullivan, 1974; Miao, 2005). If product market competition also correlates with inflexibility, our baseline estimates may be biased. To alleviate this concern, we incorporate price-to-cost margin (*Price-Cost Margin*) that captures firm-level market power. It is calculated as one minus the ratio of cost of goods sold to net sales. As an alternative measure for industry competition, we consider the Herfindahl index (*HHI*) based on sales data from Compustat. Although the Compustat-based HHI is widely used as a measure for industry competition in the literature, Ali, Klasa, and Yeung (2009) raise concerns about this practice. They suggest that this proxy ignores private firms in the economy and may not be able to capture the actual competition in the product market. To mitigate this concern, we also include the Herfindahl index constructed by Hoberg and Phillips (2010) that is calculated based on both public and private firms.

Several studies treat stock return volatility as one determinant of financial leverage. At the same time, it is possible that stock return volatility of inflexible firms is higher than that of flexible firms. To show that our results are not driven by the omission of volatility, we include return volatility

(*Ret Vol*) as an additional control variable. This variable is the annualized stock return volatility calculated as the standard deviation of daily stock returns in the previous fiscal year, where we require that at least 60 daily observations are available.

Firm age is another factor we consider. Old firms may have better access to capital and thus adopt different financial policies compared with younger ones. Firm age may also be correlated with inflexibility, given that older firms tend to react more slowly to technological changes (Jovanovic and Rousseau, 2014). Thus, we control for the logarithm of firm age (*log(Age)*), where firm age is the number of years since a firm's first appearance in Compustat.

Panel B in Table 10 presents the results from regressions incorporating these additional control variables. Columns (1) and (4) show that our conclusions remain unchanged after taking into account the effects of industry competition. As shown in Columns (2) and (5), the inclusion of stock return volatility and firm age does not change the negative relation between inflexibility and financial leverage. Our conclusions also hold after we control for effects of time-invariant firm-level characteristics by including firm fixed effects (Columns (3) and (6)). These findings alleviate potential concerns on omitted variable biases.

4.7.3 Instrumental Variables Estimation

Although the idea that inflexibility affects financial leverage has been formalized in theoretical studies, inflexibility might not be exogenous to capital structure decisions. Ideally, we need exogenous shocks to inflexibility to identify the effect of inflexibility on financial policies. Unfortunately, inflexibility is generally persistent so that desirable shocks are not readily available. To mitigate endogeneity concerns, we have shown that our results are not driven by financial constraints, agency problems, or the omission of important firm characteristics. As an additional attempt to address endogeneity issues, we employ the instrumental variables (IV) approach.

Our instrumental variable relies on the fact that labor adjustment inflexibility is an important component of inflexibility and exploits the variation in labor adjustment costs created by the adoption of labor protection laws against wrongful termination. In the United States, employment-at-will is a long-existing legal doctrine, which means that workers and employers may terminate their employment relationships without notification, financial penalty, or the provision of good cause.[25]. Since the

[25] The employment-at-will doctrine was first recognized by the Tennessee Supreme Court in 1884. By the mid-1930s, almost all U.S. state courts adopted this doctrine (Morriss, 1994).

1970s, U.S. state courts started to adopt common-law exceptions to the employment-at-will doctrine, among which the most far-reaching exception is the good-faith exception (Kugler and Saint-Paul, 2004). The good-faith exception prohibits employers from discharging workers without just cause.

The adoption of wrongful discharge laws (WDL) increases firms' firing costs since WDL-related lawsuits could lead to significant monetary loss for firms.[26] Therefore, we expect that the adoption of wrongful discharge laws, and the good-faith exception in particular, is positively related to firms' inflexibility. Importantly, the adoption of wrongful discharge laws is arguably exogenous to firms' financial leverage for at least two reasons. First, the recognition of these laws is based on judicial decisions rather than legislative decisions and thus is less likely to be affected by lobbying activities. Second, commonly-used rationales by judges for adopting these laws range from assuring consistency in law trends to promoting fairness in employment relationships (Walsh and Schwarz, 1996), which are unlikely to be correlated with factors driving corporate capital structure decisions.

Although wrongful discharge laws likely increase firms' labor adjustment costs, firms may have different exposure to the effects of WDL-related lawsuits. Intuitively, the more employees a firm hires, the larger the expected costs of wrongful discharge laws are. Moreover, the same amount of firing costs is supposed to exert less significant impacts on large firms than small firms. Thus, our instrumental variable, *WDL Exposure*, is constructed as an indicator for the adoption of wrongful discharge laws, multiplied by firms' total number of employees and scaled by sales. This variable captures firms' exposure to impacts of wrongful discharge laws.

In our analysis, we focus on industries with high employee separation rates since the effects of wrongful discharge laws are expected to be more pronounced among industries that discharge workers more frequently (Serfling, 2016). To identify these industries, we calculate the separation rate as the fraction of workers discharged from their jobs as part of a mass layoff in each industry, state, and year. The data on the total number of employee separations are collected from the Bureau of Labor Statistics (BLS)'s Mass Layoff Statistics program, and the data on the total number of employees are obtained from the Bureau of Economic Analysis (BEA).[27] We use the time-series median value of separation rates as a constant characteristic for each industry in each state and apply it to the entire period of our sample. Our analysis utilizes firms in industries with the above-median separation rate.[28]

[26] By analyzing more than one hundred WDL trials in California between 1980 and 1986, Dertouzos, Holland, and Ebener (1988) show that plaintiffs win in around 70% of the cases and that the average jury award for winning plaintiffs is $650,000.

[27] The annual separation rate is calculated over the period from 1998 to 2013. In 2013, BLS terminated the Mass Layoff Statistics program.

[28] The separation rate is converted from the North American Industry Classification System (NAICS) to the

[Insert Table 11 Here]

Table 11 reports results from 2SLS regressions. The first-stage regression suggests that there exists a strong relation between the instrumental variable and our inflexibility measure. The coefficient on the instrument is positive and statistically significant at the 1% level. The F-statistic also indicates that the instrument is not weak. The second-stage regressions show that both leverage ratios decrease with inflexibility, confirming our baseline findings. We acknowledge that our instrumental variable may have some limitations given that it is impossible to prove an instrument is perfectly exogenous.

5 Conclusion

This paper examines how a firm's inflexibility (i.e., inability to adjust its scale in response to productivity shocks) shapes its financial policy. Using a firm-level inflexibility measure constructed based on real option theories, we find that inflexible firms adopt lower financial leverage relative to flexible firms. Higher default risk and lower value of tax benefits associated with inflexibility are two potential channels. Notably, firms' inflexibility to contract or expand affects their financing decisions asymmetrically. In particular, our evidence suggests that contraction inflexibility exerts a larger impact on financial leverage compared to expansion inflexibility. Further analysis reveals that inflexibility helps explain financial leverage on top of operating leverage, operating leverage variability, and cash flow variability. Interestingly, we find that flexibility weakens the well-known substitution effect between operating and financial leverage. The negative relation between operating leverage and financial leverage even disappears among flexible firms. In addition, we show that inflexible firms increase financial leverage more than flexible firms following a positive credit supply shock, which is consistent with our main finding that inflexible firms tend to adopt lower financial leverage and thus are more credit constrained.

Our results highlight the importance of inflexibility in explaining cross-sectional variations in corporate capital structure. Although previous studies have documented that inflexibility affects a firm's risk management and its stock returns, the evidence on the relation between inflexibility and financial leverage is limited. By examining a large sample of U.S. public firms over almost 50 years with a theory-grounded inflexibility measure, we provide new evidence on the relation and many other useful insights on this topic.

Standard Industrial Classification (SIC) system.

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.

Alti, Aydoğan, 2006, How persistent is the impact of market timing on capital structure?, *Journal of Finance* 61, 1681–1710.

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.

Banerjee, Shantanu, Sudipto Dasgupta, and Yungsan Kim, 2008, Buyer–supplier relationships and the stakeholder theory of capital structure, *Journal of Finance* 63, 2507–2552.

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

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

Chakraborty, Indraneel, Itay Goldstein, and Andrew MacKinlay, 2018, Housing price booms and crowding-out effects in bank lending, *Review of Financial Studies* 31, 2806–2853.

Chan, Louis KC, Josef Lakonishok, and Theodore Sougiannis, 2001, The stock market valuation of research and development expenditures, *Journal of Finance* 56, 2431–2456.

Chang, Xin, Sudipto Dasgupta, and Gilles Hilary, 2006, Analyst coverage and financing decisions, *Journal of Finance* 61, 3009–3048.

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

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.

Dertouzos, James N, Elaine Holland, and Patricia A Ebener, 1988, The legal and economic consequences of wrongful termination, Rand Corporation.

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

Erel, Isil, Yeejin Jang, and Michael S Weisbach, 2020, The corporate finance of multinational firms, Working paper, National Bureau of Economic Research.

Erel, Isil, Brandon Julio, Woojin Kim, and Michael S Weisbach, 2012, Macroeconomic conditions and capital raising, *Review of Financial Studies* 25, 341–376.

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.

Feng, Mei, Jeffrey D Gramlich, and Sanjay Gupta, 2009, Special purpose vehicles: Empirical evidence on determinants and earnings management, *Accounting Review* 84, 1833–1876.

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

Graham, John, and Campbell Harvey, 2002, How do CFOs make capital budgeting and capital structure decisions?, *Journal of Applied Corporate Finance* 15, 8–23.

Graham, John R, 2000, How big are the tax benefits of debt?, *Journal of Finance* 55, 1901–1941.

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.

Grennan, Jillian, Roni Michaely, and Christopher J Vincent, 2017, The deleveraging of US firms and institutional investors' role, Working paper, Duke University.

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

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.

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

Jensen, Michael C, 1986, Agency costs of free cash flow, corporate finance, and takeovers, *American Economic Review* 76, 323–329.

Jovanovic, Boyan, and Peter L Rousseau, 2014, Extensive and intensive investment over the business cycle, *Journal of Political Economy* 122, 863–908.

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

Korteweg, Arthur, 2010, The net benefits to leverage, *Journal of Finance* 65, 2137–2170.

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

Krishnan, Karthik, Debarshi K Nandy, and Manju Puri, 2015, Does financing spur small business productivity? Evidence from a natural experiment, *Review of Financial Studies* 28, 1768–1809.

Kugler, Adriana D, and Gilles Saint-Paul, 2004, How do firing costs affect worker flows in a world with adverse selection?, *Journal of Labor Economics* 22, 553–584.

Lin, Chen, Thomas Schmid, and Michael S Weisbach, 2020, Product price risk and liquidity management: Evidence from the electricity industry, *Management Science* forthcoming.

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

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

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.

Morriss, Andrew P, 1994, Exploding myths: An empirical and economic reassessment of the rise of employment at-will, *Missouri Law Review* 59, 679.

Neuhann, Daniel, and Farzad Saidi, 2018, Do universal banks finance riskier but more productive firms?, *Journal of Financial Economics* 128, 66–85.

Opler, Tim C, and Sheridan Titman, 1994, Financial distress and corporate performance, *Journal of Finance* 49, 1015–1040.

Öztekin, Özde, 2015, Capital structure decisions around the world: Which factors are reliably important?, *Journal of Financial and Quantitative Analysis* 50, 301–323.

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.

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.

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.

Walsh, David J, and Joshua L Schwarz, 1996, State common law wrongful discharge doctrines: Up-date, refinement, and rationales, *American Business Law Journal* 33, 645.

Zhang, Wei, 2015, R&D investment and distress risk, *Journal of Empirical Finance* 32, 94–114.

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 these variables. *Inflex* is the proxy for inflexibility. *LD* is the long-term leverage ratio. *TD* is the total leverage ratio. *Profit* is profitability. *Size* is firm size. *B/M* is the book-to-market ratio. *Tangible* is asset tangibility. *Payer* is an indicator for dividend-paying firms. *IndustLev* is the industry median leverage ratio. Detailed variable definitions are provided in Appendix Table A.1. The sample period is from 1970 to 2017. The continuous variables are winsorized at the 1^{st} and 99^{th} percentiles. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: Summary Statistics

	Mean	Std	Q1	Median	Q3	N
Inflex	0.015	0.021	0.006	0.010	0.016	79,993
LD	0.206	0.203	0.027	0.153	0.326	79,316
TD	0.267	0.237	0.062	0.211	0.420	79,316
Profit	0.118	0.131	0.077	0.130	0.183	79,329
Size	5.483	2.049	3.954	5.378	6.921	79,481
B/M	0.806	0.330	0.565	0.798	1.024	79,071
Tangible	0.298	0.205	0.142	0.256	0.409	79,429
Payer	0.536	0.499	0.000	1.000	1.000	79,506
IndustLev	0.220	0.161	0.087	0.201	0.324	79,506

Panel B: Correlation Matrix

	Inflex	LD	TD	Profit	Size	B/M	Tangible	Payer
LD	-0.138***							
TD	-0.136***	0.884***						
Profit	-0.294***	-0.048***	-0.110***					
Size	-0.152***	0.138***	0.039***	0.244***				
B/M	-0.144***	0.366***	0.438***	-0.169***	-0.210***			
Tangible	-0.011***	0.285***	0.228***	0.164***	0.148***	0.103***		
Payer	-0.216***	-0.007*	-0.058***	0.327***	0.313***	0.009**	0.168***	
IndustLev	-0.162***	0.442***	0.464***	0.078***	0.033***	0.419***	0.327***	0.202***

Table 2
Baseline Regressions
This table reports results from the following regression:

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

where $Leverage_{i,t}$ is either the long-term leverage ratio (*LD* in Columns (1) to (4)) or the total leverage ratio (*TD* in Columns (5) to (8)) of firm i in year t. $Inflex_{i,t-1}$ is the proxy for inflexibility. $X_{i,t-1}$ represents control variables, including profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), asset tangibility (*Tangible*), dividend payer dummy (*Payer*), and industry median leverage (*IndustLev*). Detailed variable definitions are provided in Appendix Table A.1. Columns (1) and (5) regress leverage only on inflexibility. Columns (2) and (6) add control variables to the univariate regressions. Columns (3) and (7) include both control variables and industry-by-year fixed effects. Columns (4) and (8) replace the continuous inflexibility measure with $Inflex_{High}$, an indicator that equals one if the inflexibility measure of firm i is above the sample median in year $t-1$, and zero otherwise. Constants are not reported. The sample period is from 1970 to 2017. t-statistics based on standard errors clustered at the firm level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	LD				TD			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Inflex	-1.350***	-0.752***	-0.668***		-1.557***	-1.002***	-0.823***	
	(-16.83)	(-10.67)	(-9.20)		(-16.95)	(-12.56)	(-9.95)	
$Inflex_{High}$				-0.042***				-0.047***
				(-13.21)				(-12.87)
Profit		-0.127***	-0.156***	-0.145***		-0.198***	-0.241***	-0.226***
		(-13.48)	(-15.52)	(-14.72)		(-16.94)	(-18.94)	(-17.70)
Size		0.021***	0.026***	0.026***		0.016***	0.025***	0.025***
		(24.69)	(24.89)	(24.98)		(16.82)	(21.43)	(21.59)
B/M		0.148***	0.163***	0.164***		0.206***	0.223***	0.226***
		(28.79)	(27.78)	(28.51)		(34.29)	(33.25)	(34.01)
Tangible		0.166***	0.168***	0.174***		0.133***	0.151***	0.159***
		(17.91)	(12.39)	(12.93)		(13.17)	(9.71)	(10.21)
Payer		-0.062***	-0.078***	-0.078***		-0.082***	-0.106***	-0.106***
		(-18.72)	(-20.63)	(-21.04)		(-21.94)	(-24.56)	(-24.93)
IndustLev		0.383***				0.487***		
		(32.35)				(36.30)		
Industry-year FE	No	No	Yes	Yes	No	No	Yes	Yes
Obs	79,316	78,551	78,551	78,551	79,316	78,551	78,551	78,551
Adjusted R^2	0.019	0.315	0.351	0.356	0.018	0.344	0.387	0.391

Table 3
Performance Persistence
This table reports results from the performance persistence test of leverage determinants. In Panel A, the whole sample is split into 10 equally-sized random subsamples. With each subsample, we regress financial leverage on inflexibility (*Inflex*), profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), asset tangibility (*Tangible*), and dividend payer dummy (*Payer*) as well as industry-by-year fixed effects. The dependent variables are the long-term leverage ratio (*LD*) in Columns (1) to (4) and the total leverage ratio (*TD*) in Columns (5) to (8). For each leverage determinant, this panel reports the average coefficient estimate, the average *t*-statistics based on standard errors clustered at the firm level, the percentage of subsample regressions for which the coefficient estimate on a leverage determinant is positive and statistically significant at the 1% level, and the percentage of subsample regressions for which the coefficient estimate on a leverage determinant is negative and statistically significant at the 1% level. In Panel B, we run the same regression as in Panel A with a subsample consisting of data in five years (not necessarily successive) randomly drawn from the whole sample. The trial is rerun 50 times. For each leverage determinant, this panel reports the same statistics as in Panel A. Detailed variable definitions are provided in Appendix Table A.1. The sample period is from 1970 to 2017.

Panel A: Equally-sized Random Subsamples

	LD				TD			
	(1) Coefficient	(2) *t*-stat	(3) Sig. Positive	(4) Sig. Negative	(5) Coefficient	(6) *t*-stat	(7) Sig. Positive	(8) Sig. Negative
Inflex	-0.547	-4.02	0%	100%	-0.682	-4.25	0%	100%
Profit	-0.127	-5.56	0%	100%	-0.200	-7.10	0%	100%
Size	0.023	12.83	100%	0%	0.023	10.89	100%	0%
B/M	0.149	13.00	100%	0%	0.208	15.28	100%	0%
Tangible	0.176	6.85	100%	0%	0.161	5.48	100%	0%
Payer	-0.072	-9.47	0%	100%	-0.096	-11.18	0%	100%

Panel B: Randomly-drawn Five-year Subsamples

	LD				TD			
	(1) Coefficient	(2) *t*-stat	(3) Sig. Positive	(4) Sig. Negative	(5) Coefficient	(6) *t*-stat	(7) Sig. Positive	(8) Sig. Negative
Inflex	-0.719	-5.72	0%	100%	-0.875	-5.93	0%	100%
Profit	-0.170	-8.38	0%	100%	-0.260	-10.43	0%	100%
Size	0.026	18.48	100%	0%	0.025	15.71	100%	0%
B/M	0.162	17.52	100%	0%	0.221	20.55	100%	0%
Tangible	0.174	8.86	100%	0%	0.157	7.12	100%	0%
Payer	-0.077	-13.24	0%	100%	-0.105	-16.01	0%	100%

Table 4
Mechanisms: Distress Risk
This table reports results from the following regression:

$$Leverage_{i,t} = \alpha + \beta Inflex_{i,t-1} \times M + \theta_1 Inflex_{i,t-1} + \theta_2 M + \gamma' X_{i,t-1} + \tau_{s,t} + \tau_{j,t} + \tau_i + \epsilon_{i,t},$$

where $Leverage_{i,t}$ is either the long-term leverage ratio (*LD* in Columns (1), (3) and (5)) or the total leverage ratio (*TD* in Columns (2), (4) and (6)) of firm i in year t. $Inflex_{i,t-1}$ is the proxy for inflexibility. M represents $ARL_{s,t}$ (in Columns (1) and (2)), *CF Vol*$_{Ind}$ (in Columns (3) and (4)), or *R&D*$_{Ind}$ (in Columns (5) and (6)). $ARL_{s,t}$ is an indictor that equals one if the incorporation state of firm i had introduced anti-recharacterization laws in or before year t, and zero otherwise. *CF Vol*$_{Ind}$ is the average cash flow volatility of firms in the same industry as firm i and is measured in year $t-1$. The cash flow volatility is calculated as the standard deviation of the ratio of operating income before depreciation to total assets over the past forty quarters where the calculation requires at least eight quarterly observations. *R&D*$_{Ind}$ is the average research and development (R&D) intensity of firms in the same industry as firm i and is measured in year $t-1$. The R&D intensity is calculated as the ratio of R&D capital stock to market value of equity, where R&D capital stock is the five-year cumulative R&D expenditures, assuming an annual depreciation rate of 20%. $X_{i,t-1}$ represents control variables, including profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), asset tangibility (*Tangible*), dividend payer dummy (*Payer*), and CDS inception dummy (*CDS*). Detailed variable definitions are provided in Appendix Table A.1. Industry-by-year fixed effects, and firm fixed effects are included in the regressions. Columns (1) and (2) additionally include incorporation state-by-year fixed effects. Constants are not reported. The sample period is from 1985 to 2017. t-statistics based on standard errors clustered at the incorporation state level (Columns (1) and (2)) or the firm level (Columns (3) to (6)) are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	LD	TD	LD	TD	LD	TD
Inflex×ARL	0.183**	0.198**				
	(2.22)	(1.99)				
Inflex×CF Vol$_{Ind}$			-0.083***	-0.133***		
			(-2.59)	(-3.44)		
Inflex×R&D$_{Ind}$					-0.302**	-0.602***
					(-2.21)	(-3.66)
Inflex	-0.366***	-0.252**	-0.316***	-0.182	-0.271**	-0.078
	(-3.68)	(-2.02)	(-2.67)	(-1.28)	(-2.16)	(-0.53)
Profit	-0.102***	-0.172***	-0.104***	-0.175***	-0.101***	-0.171***
	(-10.86)	(-10.84)	(-10.81)	(-14.68)	(-10.47)	(-14.32)
Size	0.043***	0.051***	0.042***	0.050***	0.042***	0.050***
	(22.35)	(16.22)	(15.13)	(15.69)	(14.79)	(15.45)
B/M	0.080***	0.109***	0.081***	0.111***	0.080***	0.109***
	(18.05)	(20.75)	(15.23)	(17.29)	(14.77)	(16.77)
Tangible	0.123***	0.152***	0.114***	0.147***	0.114***	0.145***
	(11.93)	(13.03)	(7.19)	(7.95)	(6.98)	(7.63)
Payer	-0.027***	-0.032***	-0.027***	-0.031***	-0.026***	-0.031***
	(-12.84)	(-11.09)	(-6.74)	(-7.34)	(-6.29)	(-7.03)
CDS	0.010	0.010	0.011	0.011	0.012	0.011
	(1.50)	(1.50)	(1.33)	(1.26)	(1.44)	(1.25)
State-year FE	Yes	Yes	No	No	No	No
Industry-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	56,956	56,956	57,365	57,365	53,338	53,338
Adjusted R^2	0.662	0.704	0.662	0.704	0.656	0.699

Table 5
Mechanisms: Tax Shields
This table reports results from the following regression:

$$Leverage_{i,t} = \alpha + \beta Inflex_{i,t-1} \times Tax\ Rate_{s,t-1} + \theta_1 Inflex_{i,t-1} + \theta_2 Tax\ Rate_{s,t-1} + \gamma' X_{i,t-1} + \tau_t + \tau_i + \epsilon_{i,t},$$

where $Leverage_{i,t}$ is either the long-term leverage ratio (*LD* in Columns (1), (3) and (5)) or the total leverage ratio (*TD* in Columns (2), (4) and (6)) of firm i in year t. $Inflex_{i,t-1}$ is the proxy for inflexibility. $Tax\ Rate_{s,t-1}$ is the average effective tax rate of firms in state s in year $t-1$. $X_{i,t-1}$ represents control variables, including profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), asset tangibility (*Tangible*), and dividend payer dummy (*Payer*). Detailed variable definitions are provided in Appendix Table A.1. Columns (1) and (2) report results from regressions using the full sample. The full sample is also split into two subsamples based on the median value of firms' profitability in a given year. Columns (3) to (6) report results from regressions using these subsamples. Year fixed effects and firm fixed effects are included in the regressions. Constants are not reported. The sample period is from 1970 to 2017. t-statistics based on standard errors clustered at the firm level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	Full Sample		Low Profitability		High Profitability	
	(1)	(2)	(3)	(4)	(5)	(6)
	LD	TD	LD	TD	LD	TD
Inflex×Tax Rate	-2.692**	-2.863**	-1.956	-2.061	-3.173**	-3.653**
	(-2.51)	(-2.28)	(-1.46)	(-1.23)	(-2.47)	(-2.56)
Inflex	0.173	0.285	0.248	0.268	0.205	0.426
	(0.63)	(0.88)	(0.70)	(0.62)	(0.61)	(1.17)
Tax Rate	-0.022	-0.021	-0.005	0.016	-0.011	-0.006
	(-0.67)	(-0.58)	(-0.12)	(0.30)	(-0.30)	(-0.15)
Profit	-0.141***	-0.230***	-0.066***	-0.139***	-0.236***	-0.310***
	(-15.19)	(-19.74)	(-5.14)	(-9.16)	(-11.97)	(-13.92)
Size	0.043***	0.050***	0.046***	0.056***	0.030***	0.033***
	(16.74)	(17.08)	(12.05)	(12.94)	(11.26)	(11.05)
B/M	0.095***	0.130***	0.032***	0.058***	0.131***	0.166***
	(19.70)	(22.86)	(5.34)	(7.95)	(20.41)	(22.95)
Tangible	0.130***	0.142***	0.187***	0.204***	0.088***	0.093***
	(8.79)	(8.41)	(10.01)	(9.46)	(4.58)	(4.50)
Payer	-0.036***	-0.043***	-0.028***	-0.035***	-0.030***	-0.034***
	(-9.93)	(-10.80)	(-5.96)	(-6.98)	(-6.73)	(-7.02)
IndustLev	0.220***	0.279***	0.207***	0.289***	0.180***	0.210***
	(17.48)	(19.54)	(11.29)	(14.32)	(12.98)	(13.20)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	78,551	78,551	33,537	33,537	45,014	45,014
Adjusted R^2	0.650	0.692	0.663	0.703	0.667	0.689

Table 6

Contraction Inflexibility v.s. Expansion Inflexibility

This table reports heterogeneous effects of contraction inflexibility and expansion inflexibility on financial leverage. Columns (1) to (4) report results from the following regression:

$$Leverage_{i,t} = \alpha + \beta_1 Inflex_{i,t-1} \times BM_2 + \beta_2 Inflex_{i,t-1} \times BM_3 + \theta_1 Inflex_{i,t-1} + \theta_2 BM_2 + \theta_3 BM_3 + \gamma' X_{i,t-1} + \tau_t + \tau_i + \epsilon_{i,t},$$

and Columns (5) to (8) report results from the following regression:

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

where $Leverage_{i,t}$ is either the long-term leverage ratio (LD) or the total leverage ratio (TD) of firm i in year t. $Inflex_{i,t-1}$ is the proxy for inflexibility. BM_2 and BM_3 are indicator variables that equal to one if firm i is in the middle and top tercile of book-to-market ratio in year $t-1$, respectively, and zero otherwise. $Recession_t$ is an indicator variable that equals one if the economy is in recession in year t, and zero otherwise. $X_{i,t-1}$ represents control variables, including profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), asset tangibility (*Tangible*), and dividend payer dummy (*Payer*). Detailed variable definitions are provided in Appendix Table A.1. Year fixed effects and firm fixed effects are included in Columns (2), (4), (6), and (8). Constants are not reported. The sample period is from 1970 to 2017. t-statistics based on standard errors clustered at the firm level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	Value v.s. Growth				Recession v.s. Boom			
	LD		TD		LD		TD	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Inflex×BM_2	-0.569***	-0.290***	-0.570***	-0.209**				
	(-4.77)	(-3.61)	(-4.42)	(-2.16)				
Inflex×BM_3	-1.049***	-0.576***	-1.194***	-0.390***				
	(-6.26)	(-4.85)	(-6.50)	(-2.67)				
BM_2	0.117***	0.042***	0.144***	0.050***				
	(36.39)	(17.20)	(38.60)	(17.57)				
BM_3	0.192***	0.083***	0.255***	0.099***				
	(41.94)	(23.42)	(49.52)	(24.47)				
Inflex×Recession					-0.705***	-0.207***	-0.759***	-0.220**
					(-6.62)	(-2.68)	(-5.98)	(-2.36)
Recession					0.062***		0.086***	
					(25.26)		(30.32)	
Inflex	-0.494***	-0.179	-0.532***	-0.194	-1.252***	-0.444***	-1.441***	-0.372***
	(-9.98)	(-1.55)	(-8.75)	(-1.45)	(-15.80)	(-3.57)	(-16.04)	(-2.63)
Profit		-0.145***		-0.241***		-0.142***		-0.231***
		(-15.54)		(-20.51)		(-15.26)		(-19.81)
Size		0.042***		0.049***		0.043***		0.049***
		(16.67)		(17.14)		(16.64)		(16.99)
B/M						0.095***		0.130***
						(19.64)		(22.81)
Tangible		0.130***		0.144***		0.128***		0.140***
		(8.95)		(8.65)		(8.68)		(8.29)
Payer		-0.036***		-0.043***		-0.036***		-0.042***
		(-10.05)		(-10.98)		(-9.90)		(-10.77)
IndustLev		0.221***		0.284***		0.219***		0.278***
		(17.58)		(19.89)		(17.35)		(19.41)
Year FE	No	Yes	No	Yes	No	Yes	No	Yes
Firm FE	No	Yes	No	Yes	No	Yes	No	Yes
Obs	78,725	78,551	78,725	78,551	79,316	78,551	79,316	78,551
Adjusted R^2	0.130	0.651	0.166	0.692	0.028	0.650	0.031	0.692

Table 7

Inflexibility, Operating Leverage Variability, and Cash Flow Risk

This table reports results from regressions of financial leverage on inflexibility, operating leverage, operating leverage volatility, and cash flow volatility. The regression specification is similar to that in Table 2. The dependent variable is the long-term leverage ratio (*LD*) in Columns (1) to (5) and the total leverage ratio (*TD*) in Columns (6) to (10). *Inflex* is the proxy for inflexibility. *OL* is operating leverage. *OL Vol* is operating leverage volatility. *CF Vol* is cash flow volatility. Control variables include profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), asset tangibility (*Tangible*), and dividend payer dummy (*Payer*). Detailed variable definitions are provided in Appendix Table A.1. Industry-by-year fixed effects are included in the regressions. Constants are not reported. The sample period is from 1970 to 2017. *t*-statistics based on standard errors clustered at the firm level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	LD					TD				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Inflex	-0.668***				-0.444***	-0.823***				-0.480***
	(-9.20)				(-5.43)	(-9.95)				(-5.29)
Profit	-0.156***	-0.108***	-0.088***	-0.066***	-0.134***	-0.241***	-0.184***	-0.155***	-0.095***	-0.216***
	(-15.52)	(-16.37)	(-11.05)	(-14.27)	(-12.33)	(-18.94)	(-22.16)	(-15.71)	(-16.75)	(-15.77)
Size	0.026***	0.027***	0.027***	0.029***	0.025***	0.025***	0.024***	0.024***	0.026***	0.023***
	(24.89)	(29.29)	(26.82)	(33.22)	(21.43)	(21.43)	(23.19)	(22.05)	(26.66)	(17.66)
B/M	0.163***	0.151***	0.158***	0.146***	0.152***	0.223***	0.221***	0.225***	0.221***	0.209***
	(27.78)	(33.73)	(30.18)	(36.55)	(23.45)	(33.25)	(42.15)	(37.04)	(46.32)	(27.83)
Tangible	0.168***	0.167***	0.166***	0.164***	0.165***	0.151***	0.167***	0.169***	0.166***	0.169***
	(12.39)	(14.46)	(12.43)	(16.92)	(10.48)	(9.71)	(12.57)	(11.11)	(14.69)	(9.54)
Payer	-0.078***	-0.069***	-0.069***	-0.073***	-0.071***	-0.106***	-0.093***	-0.092***	-0.097***	-0.093***
	(-20.63)	(-20.07)	(-18.35)	(-21.87)	(-16.70)	(-24.56)	(-23.89)	(-21.80)	(-25.79)	(-19.48)
OL		-0.031***			-0.043***		-0.052***			-0.063***
		(-9.69)			(-7.08)		(-13.69)			(-8.71)
OL Vol			-0.026***		0.024**			-0.047***		0.016
			(-3.76)		(2.26)			(-5.82)		(1.32)
CF Vol				-0.045***	-0.011				-0.058***	0.043
				(-3.60)	(-0.21)				(-3.73)	(0.67)
Industry-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	78,551	97,309	78,592	112,495	56,152	78,551	97,309	78,592	112,495	56,152
Adjusted R^2	0.351	0.346	0.337	0.362	0.346	0.387	0.376	0.367	0.382	0.371

Table 8
Inflexibility, Operating Leverage, and Financial Leverage
This table reports results from the following regression:

$$Leverage_{i,t} = \alpha + \beta_1 OL_1 \times Inflex_2 + \beta_2 OL_1 \times Inflex_3 + \theta_1 OL_1 + \theta_2 Inflex_2 + \theta_3 Inflex_3 + \gamma' X_{i,t-1} + \tau_t + \tau_i + \epsilon_{i,t},$$

where $Leverage_{i,t}$ is either the long-term leverage ratio (*LD* in Columns (1) to (3)) or the total leverage ratio (*TD* in Columns (4) to (6)) of firm i in year t. *Inflex2* and *Inflex3* are indicator variables that equal to one if firm i is in the middle and top inflexibility tercile in year $t-1$, respectively, and zero otherwise. *OL1* is an indicator that equals one if the operating leverage of firm i is above the sample median in year $t-1$, and zero otherwise. $X_{i,t-1}$ represents control variables, including profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), asset tangibility (*Tangible*), dividend payer dummy (*Payer*), and industry median leverage (*IndustLev*). Detailed variable definitions are provided in Appendix Table A.1. Year fixed effects and firm fixed effects are included in Columns (3) and (6). Constants are not reported. The sample period is from 1970 to 2017. t-statistics based on standard errors clustered at the firm level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	LD			TD		
	(1)	(2)	(3)	(4)	(5)	(6)
$OL_1 \times Inflex_2$	-0.030***	-0.025***	-0.009*	-0.030***	-0.027***	-0.009*
	(-3.98)	(-4.15)	(-1.88)	(-3.53)	(-4.13)	(-1.73)
$OL_1 \times Inflex_3$	-0.044***	-0.032***	-0.012**	-0.050***	-0.041***	-0.014***
	(-5.43)	(-5.05)	(-2.46)	(-5.25)	(-5.72)	(-2.60)
OL_1	0.006	0.004	0.003	0.008	0.001	0.005
	(0.95)	(0.88)	(0.79)	(1.15)	(0.09)	(1.22)
$Inflex_2$	-0.036***	-0.020***	-0.009**	-0.042***	-0.023***	-0.009**
	(-6.56)	(-4.61)	(-2.29)	(-6.52)	(-4.76)	(-2.24)
$Inflex_3$	-0.055***	-0.034***	-0.012**	-0.059***	-0.035***	-0.010*
	(-8.45)	(-6.64)	(-2.30)	(-7.65)	(-5.93)	(-1.78)
Profit		-0.107***	-0.122***		-0.164***	-0.199***
		(-11.29)	(-12.89)		(-14.11)	(-16.92)
Size		0.020***	0.042***		0.015***	0.048***
		(21.63)	(15.45)		(14.03)	(15.87)
B/M		0.147***	0.094***		0.209***	0.129***
		(27.42)	(18.25)		(33.08)	(21.19)
Tangible		0.169***	0.121***		0.142***	0.137***
		(16.93)	(7.88)		(13.17)	(7.90)
Payer		-0.061***	-0.027***		-0.078***	-0.032***
		(-17.28)	(-7.23)		(-19.87)	(-7.86)
IndustLev		0.373***	0.228***		0.474***	0.285***
		(28.05)	(16.79)		(31.87)	(18.87)
Year FE	No	No	Yes	No	No	Yes
Firm FE	No	No	Yes	No	No	Yes
Obs	65,196	64,961	64,961	65,196	64,961	64,961
Adjusted R^2	0.032	0.318	0.647	0.028	0.343	0.688

Table 9
Credit Supply Shock
This table reports results from the following regression:

$$Leverage_{i,t} = \alpha + \beta Inflex_{i,t-1} \times Dereg_{s,t} + \theta Inflex_{i,t-1} + \gamma' X_{i,t-1} + \tau_{s,t} + \tau_{j,t} + \tau_i + \epsilon_{i,t},$$

where $Leverage_{i,t}$ is either the long-term leverage ratio (*LD* in Columns (1) to (3)) or the total leverage ratio (*TD* in Columns (4) to (6)) of firm i in year t. $Inflex_{i,t-1}$ is the proxy for inflexibility. $Dereg_{s,t}$ is an indicator that equals one if the headquarter state of firm i had implemented the interstate bank branching deregulation in or before year t, and zero otherwise. $Inflex_{i,t-1} \times Dereg_{s,t}$ is the interaction term between inflexibility and the deregulation dummy. $X_{i,t-1}$ represents control variables, including profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), asset tangibility (*Tangible*), dividend payer dummy (*Payer*), and industry median leverage (*IndustLev*). Detailed variable definitions are provided in Appendix Table A.1. Headquarter state-by-year fixed effects, industry-by-year fixed effects and firm fixed effects are included in Columns (3) and (6). Constants are not reported. The sample period is from 1970 to 2017. t-statistics based on standard errors clustered at the headquarter state level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	LD			TD		
	(1)	(2)	(3)	(4)	(5)	(6)
Inflex×Dereg	1.034***	0.919***	0.315***	1.129***	0.858***	0.332**
	(4.06)	(4.95)	(2.81)	(4.12)	(3.62)	(2.02)
Inflex	-1.912***	-1.398***	-0.571***	-2.086***	-1.581***	-0.513**
	(-6.23)	(-6.65)	(-4.21)	(-5.79)	(-5.61)	(-2.48)
Dereg	-0.078***	-0.042***		-0.112***	-0.063***	
	(-6.66)	(-6.23)		(-7.60)	(-7.07)	
Profit		-0.135***	-0.140***		-0.213***	-0.229***
		(-7.93)	(-12.26)		(-7.99)	(-13.55)
Size		0.023***	0.044***		0.020***	0.050***
		(27.00)	(15.56)		(17.89)	(17.65)
B/M		0.143***	0.089***		0.197***	0.120***
		(19.36)	(11.43)		(27.96)	(14.82)
Tangible		0.159***	0.138***		0.122***	0.149***
		(14.41)	(11.27)		(13.32)	(9.28)
Payer		-0.071***	-0.035***		-0.096***	-0.042***
		(-13.79)	(-10.75)		(-15.74)	(-8.23)
IndustLev		0.360***			0.448***	
		(19.40)			(23.09)	
State-year FE	No	No	Yes	No	No	Yes
Industry-year FE	No	No	Yes	No	No	Yes
Firm FE	No	No	Yes	No	No	Yes
Obs	78,015	77,268	77,268	78,015	77,268	77,268
Adjusted R^2	0.045	0.319	0.669	0.060	0.352	0.710

Table 10
Robustness Tests
This table reports results from robustness tests. Panel A presents results from regressions of the long-term leverage ratio (*LD*) and the total leverage ratio (*TD*) on inflexibility using the linear cumulant equations. For each leverage ratio, we report the results with the fourth and fifth cumulants. Columns (1) and (4) shows the OLS results from Table 2. We assume book-to-market ratio (*B/M*), asset tangibility (*Tangible*), and inflexibility (*Inflex*) are measured with error. Panel B reports results from OLS regressions of leverage ratios on inflexibility with additional control variables. Columns (1) and (4) add price-to-cost margin (*Price-Cost Margin*), Compustat-based Herfindahl index (*HHI*), and the Hoberg-Phillips Herfindahl index (*HP HHI*) to our baseline controls specified in Table 2. Industry fixed effects and year fixed effects are included in the regressions. Columns (2) and (5) add stock return volatility (*Ret Vol*) and firm age (*log(Age)*). Industry-by-year fixed effects are included in the regressions. Columns (3) and (6) include year fixed effects and firm fixed effects. Detailed variable definitions are provided in Appendix Table A.1. The sample period is from 1970 to 2017 except for Columns (1) and (4) in Panel B, where the sample is restricted from 1975 to 2005 due to the availability of the Hoberg-Phillips data. Constants are not reported. *t*-statistics based on standard errors clustered at the firm level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: Measurement Error

	LD			TD		
	(1) OLS	(2) Fourth	(3) Fifth	(4) OLS	(5) Fourth	(6) Fifth
Inflex	-0.752***	-1.166***	-1.012***	-1.002***	-1.693***	-1.418***
	(-10.67)	(-7.85)	(-11.56)	(-12.56)	(-8.42)	(-12.93)
Profit	-0.127***	-0.281***	-0.222***	-0.198***	-0.436***	-0.356***
	(-13.48)	(-12.87)	(-15.30)	(-16.94)	(-14.92)	(-17.76)
Size	0.021***	0.010***	0.014***	0.016***	0.000	0.005***
	(24.69)	(7.61)	(13.33)	(16.82)	(-0.20)	(4.02)
B/M	0.148***	-0.202***	-0.078***	0.206***	-0.296***	-0.130***
	(28.79)	(-9.75)	(-6.27)	(34.29)	(-11.89)	(-8.74)
Tangible	0.166***	0.109***	0.098***	0.133***	0.137***	0.141***
	(17.91)	(3.59)	(5.21)	(13.17)	(3.38)	(5.84)
Payer	-0.062***	-0.055***	-0.057***	-0.082***	-0.073***	-0.076***
	(-18.72)	(-13.69)	(-15.60)	(-21.94)	(-15.00)	(-17.77)
IndustLev	0.383***	0.708***	0.606***	0.487***	0.919***	0.775***
	(32.35)	(30.17)	(37.26)	(36.30)	(30.26)	(38.80)
Obs	78,551	78,551	78,551	78,551	78,551	78,551
Rho^2	0.315	0.199	0.236	0.344	0.191	0.242

Panel B: Additional Control Variables

	LD			TD		
	(1)	(2)	(3)	(4)	(5)	(6)
Inflex	-1.019***	-0.699***	-0.381***	-1.258***	-0.884***	-0.359***
	(-9.69)	(-9.53)	(-3.12)	(-10.39)	(-10.50)	(-2.67)
HHI	-0.005			-0.005		
	(-0.21)			(-0.20)		
HP HHI	-0.121			-0.080		
	(-0.83)			(-0.49)		
Price-Cost Margin	-0.009**	-0.000	0.004**	-0.011*	-0.001	0.006**
	(-2.16)	(-0.01)	(2.02)	(-1.95)	(-0.23)	(2.51)
Ret Vol		0.104***	0.054***		0.167***	0.084***
		(15.34)	(10.52)		(20.67)	(14.15)
log(Age)		-0.008*	-0.063***		-0.003	-0.068***
		(-1.78)	(-5.37)		(-0.65)	(-5.22)
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	No	No	Yes	No	No
Year FE	Yes	No	Yes	Yes	No	Yes
Industry-year FE	No	Yes	No	No	Yes	No
Firm FE	No	No	Yes	No	No	Yes
Obs	47,973	76,013	77,152	47,973	76,013	77,152
Adjusted R^2	0.344	0.363	0.655	0.379	0.408	0.698

Table 11

Instrumental Variables Estimation

This table reports results from the instrumental variables estimation. The inflexibility is instrumented with *WDL Exposure*, which captures firms' exposure to variations in labor adjustment costs associated with the adoption of state-level wrongful discharge laws. It is constructed as an indicator variable for the adoption of wrongful discharge laws, multiplied by firms' total number of employees and scaled by sales. Column (1) reports results from the first-stage regression, where the inflexibility measure is the dependent variable. Columns (2) and (3) report results from second-stage regressions where the long-term leverage ratio (*LD*) and the total leverage ratio (*TD*) is the dependent variable, respectively. Control variables include profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), asset tangibility (*Tangible*), dividend payer dummy (*Payer*), and the logarithm of the total number of employees (*log(Emp)*). Detailed variable definitions are provided in Appendix Table A.1. Headquarter state-by-year fixed effects, industry-by-year fixed effects, and firm fixed effects are included in the regressions. The sample includes firms in industries with the above-median separation rate, where the separation rate refers to the fraction of employees separated from work as part of a mass layoff. Constants are not reported. The sample period is from 1970 to 2017. t-statistics based on standard errors clustered at the headquarter state level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

		LD	TD
	(1)	(2)	(3)
Inflex		-2.489***	-4.058***
		(-4.62)	(-6.10)
WDL Exposure	0.318***		
	(6.50)		
Profit	-0.008***	-0.159***	-0.265***
	(-3.67)	(-13.28)	(-13.43)
Size	0.001	0.041***	0.046***
	(1.16)	(7.09)	(6.00)
B/M	-0.001*	0.085***	0.115***
	(-1.80)	(6.99)	(9.53)
Tangible	0.006***	0.131***	0.152***
	(4.15)	(8.29)	(7.18)
Payer	-0.001***	-0.033***	-0.040***
	(-3.10)	(-7.56)	(-6.64)
log(EMP)	-0.002**	-0.005	0.000
	(-2.18)	(-1.13)	(0.07)
State-year FE	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Obs	40,734	40,734	40,734
F-stat	42.22		

Appendix

Table A.1

Variable Definition

Variable	Definition
Leverage Measures	
LD	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 DLTT + DLC) plus the market value of equity (Compustat item CSHO × PRCC_F)
TD	Total debt (Compustat item DLTT + DLC) divided by market value of assets (defined as in LD)
LD1	Long-term debt divided by the sum of market value of equity, book value of total debt, and total preferred stock (Compustat item PSTKL) minus deferred taxes and investment tax credit (Compustat item TXDITC)
TD1	Total debt divided by market value of assets (defined as in LD1)
LD2	Long-term debt divided by the sum of market value of equity and the difference between total assets (Compustat item AT) and total common equity (Compustat item CEQ)
TD2	Total debt divided by market value of assets (defined as in LD2)
LDA	Long-term debt divided by book value of total assets
TDA	Total debt divided by book value of total assets
Inflexibility Measures	
Inflex	Inflexibility measure, calculated as the range of firms' operating costs (Compustat item XSGA + COGS) over sales (Compustat item SALE) divided by the standard deviation of the annual growth rate of sales over assets
$\text{Inflex}_{\text{High}}$	Dummy variable which equals one if a firm's inflexibility is above the sample median in a given year, and zero otherwise
Other Variables	
ARL	Dummy variable that equals one if the incorporation state of firm i had introduced anti-recharacterization laws in or before year t, and zero otherwise
B/M	Book value of total assets divided by the sum of market value of equity and the difference between total assets and total common equity
CDS	Dummy variable which equals one if firm i has introduced CDS contracts for its debt in year t, and zero otherwise
CF Vol	Cash flow volatility, calculated as the standard deviation of the ratio of operating income before depreciation (Compustat item OIBDPQ) to total assets (Compustat item ATQ) over the past forty quarters where the calculation requires at least eight quarterly observations
Dereg	Dummy variable which equals one if the headquarter state of firm i had implemented the interstate bank branching deregulation in or before year t, and zero otherwise
HHI	Herfindahl index based on sales from Compustat
HP HHI	Fitted Herfindahl index from Hoberg and Phillips (2010)
IndustLev	The median value of total market leverage (TD) in a particular industry and a given year
log(Age)	Logarithm of firm age, where age is the number of years since a firm's first appearance in Compustat
log(Emp)	Logarithm of total number of employees (Compustat item EMP)
OL	Operating leverage, calculated as the ratio of quasi-fixed costs to sales
OL Vol	Operating leverage volatility, calculated as the standard deviation of operating leverage over the past ten years where the calculation requires at least three annual observations
Payer	Dummy variable which equals one if a firm pays common dividends (Compustat item DVC) during a fiscal year, and zero otherwise
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 to total assets
$\text{R\&D}_{\text{Ind}}$	Average research and development (R&D) intensity of firms in a given industry and year. The R&D intensity is calculated as the ratio of R&D capital stock to market value of equity, where R&D capital stock is the five-year cumulative R&D expenditures, assuming an annual depreciation rate of 20%

Continued on the next page

Variable	Definition
Recession	Dummy variable which equals one if a given year is in the NBER recession periods, and zero otherwise
Ret Vol	Annualized stock return volatility calculated from daily data over the previous fiscal year where the calculation requires at least 60 daily observations
Size	The logarithm of book value of total assets
Tangible	The ratio of net property, plant, and equipment (Compustat item PPENT) to total assets
Tax Rate	Average effective tax rate in a state and year, where effective tax rate is calculated as total income tax expense (Compustat item TXT) divided by pre-tax book income (Compustat item PI) less special items (Compustat item SPI); and the tax rate is winsorized at [0, 1]
WDL Exposure	An indicator for the adoption of state-level wrongful discharge laws, multiplied by firms' total number of employees and scaled by sales

Internet Appendix:
Inflexibility and Leverage

Olivia Lifeng Gu, Dirk Hackbarth, and Tong Li

Not for Publication

This Internet Appendix reports additional results on the relation between inflexibility and financial leverage. Figure IA.1 illustrates the relation between inflexibility and bank loan spreads. Figure IA.2 compares the credit line usage rates of flexible and inflexible firms. In Table IA.1, we replicate our main results using alternative leverage measures. Table IA.2 reports results from baseline regressions with standard errors clustered at the industry and year level. Table IA.3 reports results from regressions of financial leverage on an alternative inflexibility measure. The alternative inflexibility measure of a firm in a given year is calculated as the average of its original inflexibility from the beginning of our sample period to that year. Table IA.4 presents the relation between inflexibility and default risk. Table IA.5 reports results from regressions of the bank-debt-related leverage ratio on inflexibility. Table IA.6 reports results after eliminating potential impacts from other bank deregulatory events.

Internet Appendix

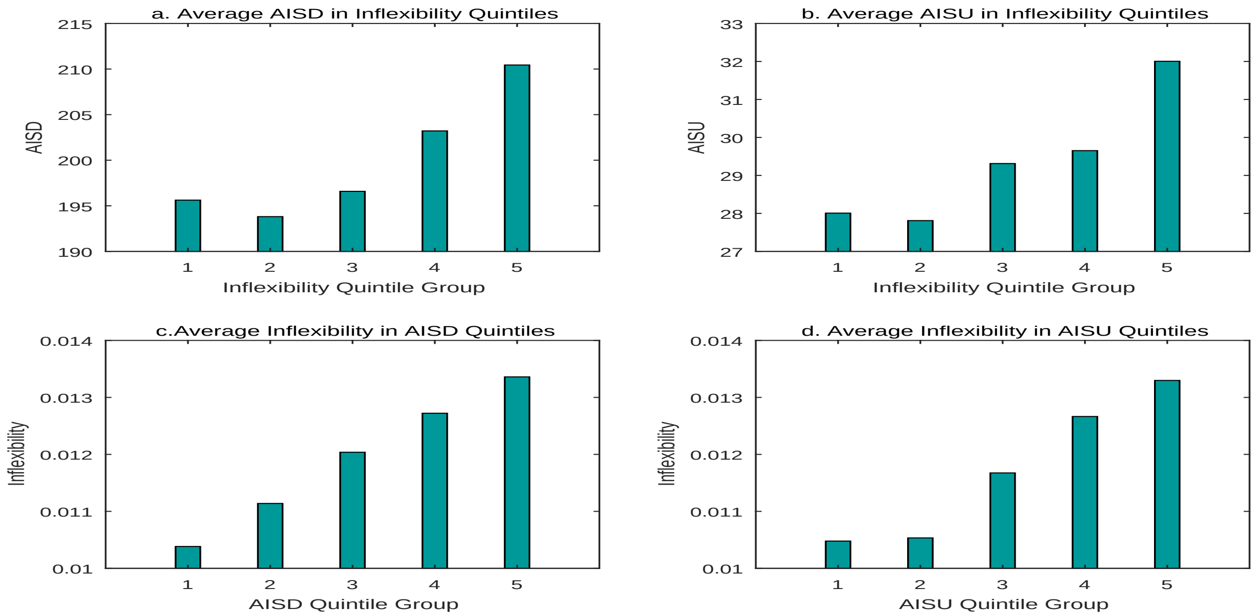

Figure IA.1
Inflexibility and Loan Spreads

This figure demonstrates the relation between inflexibility and bank loan spreads. The bank loan sample is from DealScan and consists of term loans and lines of credit. Loan facilities are sorted into quintile groups based on the one-year lagged inflexibility level of borrowing firms. Subfigure a and Subfigure b plot the average all-in-drawn spread (AISD) and all-in-undrawn spread (AISU) of loan facilities in each inflexibility quintile, respectively. The differences in the average AISD and AISU between the top and bottom inflexibility quintiles are statistically significant at the 1% level (t = 7.27 and 5.95). Loan facilities are then sorted into quintile groups based on their all-in-drawn spread (AISD) and all-in-undrawn spread (AISU). Subfigure c and Subfigure d plot the average one-year lagged inflexibility of borrowing firms associated with loan facilities in each AISD and AISU quintile, respectively. The difference in the average inflexibility between the top and bottom AISD (AISU) quintiles is statistically significant at the 1% level (t = 10.35 and 8.09). The sample period is from 1981 to 2017, due to the availability of loan spread data.

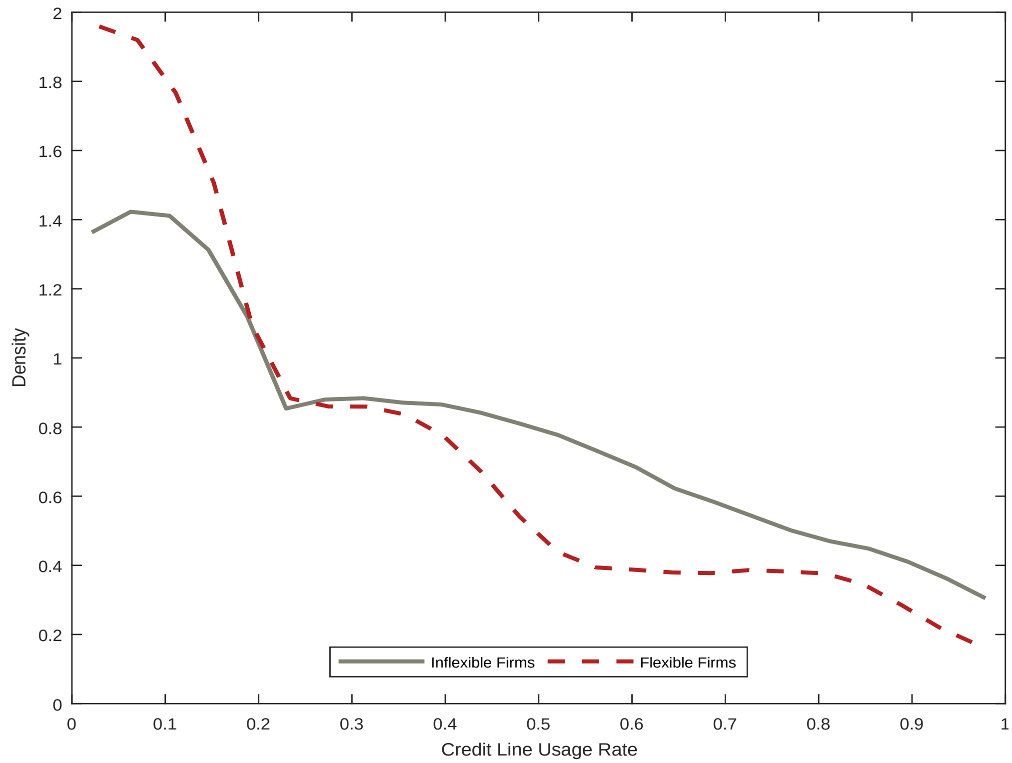

Figure IA.2
Credit Line Usage Rate: Flexible Firms v.s. Inflexible Firms
This figure demonstrates the density of credit line usage rates for flexible firms (bottom quintile) and inflexible firms (top quintile). The sample period is from 1996 to 2003, due to the availability of Sufi (2009)'s credit line data.

Table IA.1
Alternative Leverage Definitions
This table reports results from the following regression:

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

where $Leverage_{i,t}$ is the leverage ratio of firm i in year t. $Inflex_{i,t-1}$ is the proxy for inflexibility. $X_{i,t-1}$ represents control variables, including profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), asset tangibility (*Tangible*), and dividend payer dummy (*Payer*). Results for six alternative leverage ratios are presented. *LD1* (*TD1*) is the long-term (total) debt scaled by the sum of market value of equity, book value of total debt, and total preferred stock minus deferred taxes and investment tax credit. *LD2* (*TD2*) is the long-term (total) debt scaled by the sum of market value of equity and the difference between total assets and total common equity. *LDA* (*TDA*) is the long-term (total) debt scaled by book value of total assets. Detailed variable definitions are provided in Appendix Table A.1. Industry-by-year fixed effects are included in the regressions. Constants are not reported. The sample period is from 1970 to 2017. t-statistics based on standard errors clustered at the firm level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	LD1	TD1	LD2	TD2	LDA	TDA
	(1)	(2)	(3)	(4)	(5)	(6)
Inflex	-0.690***	-0.843***	-0.484***	-0.587***	-0.585***	-0.702***
	(-9.18)	(-9.96)	(-8.79)	(-9.30)	(-7.70)	(-7.86)
Profit	-0.150***	-0.229***	-0.090***	-0.143***	-0.129***	-0.223***
	(-15.07)	(-18.38)	(-12.15)	(-15.61)	(-10.65)	(-14.39)
Size	0.026***	0.025***	0.017***	0.016***	0.022***	0.021***
	(24.24)	(21.26)	(21.90)	(18.33)	(22.89)	(19.43)
B/M	0.170***	0.233***	0.102***	0.140***	-0.002	-0.005
	(28.15)	(33.92)	(23.83)	(28.80)	(-0.47)	(-0.91)
Tangible	0.188***	0.174***	0.148***	0.141***	0.169***	0.168***
	(13.30)	(10.76)	(13.71)	(11.37)	(13.28)	(11.48)
Payer	-0.072***	-0.100***	-0.054***	-0.072***	-0.064***	-0.084***
	(-18.77)	(-22.72)	(-18.81)	(-22.13)	(-18.11)	(-20.96)
Industry-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	75,282	75,282	78,584	78,548	78,654	78,616
Adjusted R^2	0.363	0.395	0.324	0.351	0.236	0.223

Table IA.2
Alternative Robust Standard Errors
This table reports results from the following regression:

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

where $Leverage_{i,t}$ is either the long-term leverage ratio (*LD* in Columns (1) and (2)) or the total leverage ratio (*TD* in Columns (3) and (4)) of firm i in year t. $Inflex_{i,t-1}$ is the proxy for inflexibility. $X_{i,t-1}$ represents control variables, including profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), asset tangibility (*Tangible*), and dividend payer dummy (*Payer*). Columns (2) and (4) replace the continuous inflexibility measure with $Inflex_{High}$, an indicator that equals one if the inflexibility measure of firm i is above the sample median in year $t-1$, and zero otherwise. Detailed variable definitions are provided in Appendix Table A.1. Industry-by-year fixed effects are included in the regressions. Constants are not reported. The sample period is from 1970 to 2017. t-statistics based on standard errors cluster at the industry and year level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	LD		TD	
	(1)	(2)	(3)	(4)
Inflex	-0.668***		-0.823***	
	(-5.00)		(-5.20)	
$\text{Inflex}_{\text{High}}$		-0.042***		-0.047***
		(-9.61)		(-10.08)
Profit	-0.156***	-0.145***	-0.241***	-0.226***
	(-5.59)	(-5.62)	(-5.69)	(-5.59)
Size	0.026***	0.026***	0.025***	0.025***
	(13.94)	(13.95)	(11.83)	(11.84)
B/M	0.163***	0.164***	0.223***	0.226***
	(16.90)	(16.63)	(20.23)	(20.04)
Tangible	0.168***	0.174***	0.151***	0.159***
	(10.10)	(10.22)	(7.39)	(7.51)
Payer	-0.078***	-0.078***	-0.106***	-0.106***
	(-12.25)	(-12.49)	(-12.14)	(-12.25)
Industry-year FE	Yes	Yes	Yes	Yes
Obs	78,551	78,551	78,551	78,551
Adjusted R^2	0.351	0.356	0.387	0.391

Table IA.3
Alternative Inflexibility Measure
This table reports results from the following regression:

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

where $Leverage_{i,t}$ is either the long-term leverage ratio (*LD* in Columns (1) and (2)) or the total leverage ratio (*TD* in Columns (3) and (4)) of firm i in year t. $Inflex_{i,t-1}$ is an alternative inflexibility measure, which is calculated as the average of firm i's original inflexibility from the beginning of our sample period to year $t-1$. $X_{i,t-1}$ represents control variables, including profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), asset tangibility (*Tangible*), and dividend payer dummy (*Payer*). Columns (2) and (4) replace the continuous inflexibility measure with $Inflex_{High}$, an indicator that equals one if the alternative inflexibility measure of firm i is above the sample median in year $t-1$, and zero otherwise. Detailed variable definitions are provided in Appendix Table A.1. Industry-by-year fixed effects are included in the regressions. Constants are not reported. The sample period is from 1970 to 2017. t-statistics based on standard errors clustered at the firm level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	LD		TD	
	(1)	(2)	(3)	(4)
Inflex	-0.556***		-0.689***	
	(-7.34)		(-7.90)	
$Inflex_{High}$		-0.033***		-0.036***
		(-9.33)		(-8.73)
Profit	-0.147***	-0.141***	-0.230***	-0.220***
	(-14.92)	(-14.49)	(-18.20)	(-17.41)
Size	0.026***	0.026***	0.025***	0.026***
	(25.47)	(25.73)	(21.72)	(21.95)
B/M	0.165***	0.167***	0.226***	0.229***
	(28.17)	(28.83)	(33.55)	(34.15)
Tangible	0.168***	0.171***	0.150***	0.153***
	(12.43)	(12.63)	(9.62)	(9.80)
Payer	-0.078***	-0.079***	-0.106***	-0.106***
	(-20.72)	(-21.05)	(-24.45)	(-24.69)
Industry-year FE	Yes	Yes	Yes	Yes
Obs	79,303	79,303	79,303	79,303
Adjusted R^2	0.352	0.356	0.387	0.389

Table IA.4

Inflexibility and Default Risk

This table reports results from the following regression:

$$Default\ Risk_{i,t+k} = \alpha + \beta Inflex_{i,t} + \tau_{j,t+k} + \epsilon_{i,t+k}, \quad k = 1,\ 2,\ 3$$

where the $Default\ Risk_{i,t+k}$ is the default risk of firm i in year $t+k$, 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. Higher Z-score indicates lower default risk, whereas higher failure probability is associated with higher default risk. $Inflex_{i,t}$ is the proxy for inflexibility. In Panel A (Panel B), Columns (1) to (3) regress Z-score (failure probability) in year $t+1$, $t+2$, and $t+3$ on the inflexibility measure in year t, respectively. Columns (4) to (6) replace the continuous inflexibility measure with $Inflex_{High}$, an indicator that equals one if the inflexibility measure of firm i is above the sample median in year t, and zero otherwise. Detailed variable definitions are provided in Appendix Table A.1. Industry-by-year fixed effects are included in the regressions. Constants are not reported. The sample period is from 1970 to 2017. t-statistics based on standard errors clustered at the 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	-28.730***	-27.511***	-25.942***			
	(-11.86)	(-10.75)	(-9.66)			
$Inflex_{High}$				-0.526***	-0.487***	-0.447***
				(-12.34)	(-11.12)	(-10.03)
Industry-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	71,706	65,710	60,222	71,706	65,710	60,222
Adjusted R^2	0.272	0.264	0.257	0.220	0.216	0.214

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	2.466***	2.106***	1.869***			
	(9.90)	(8.31)	(7.27)			
$Inflex_{High}$				0.061***	0.043***	0.037***
				(10.29)	(7.22)	(5.99)
Industry-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	70,217	65,607	60,397	70,217	65,607	60,397
Adjusted R^2	0.067	0.058	0.054	0.060	0.052	0.049

Table IA.5

Credit Supply Shock: Bank-debt-related Leverage Ratio

This table reports results from the following regression:

$$Bank\ Debt_{i,t} = \alpha + \beta Inflex_{i,t-1} \times Dereg_{s,t} + \theta Inflex_{i,t-1} + \gamma' X_{i,t-1} + \tau_{s,t} + \tau_{j,t} + \tau_i + \epsilon_{i,t},$$

where $Bank\ Debt_{i,t}$ is the ratio of total outstanding term loans to the market value of assets of firm i in year t. Market value of assets are calculated as the sum of market value of equity and the difference between total assets and total common equity. $Inflex_{i,t-1}$ is the proxy for inflexibility. $Dereg_{s,t}$ is an indicator that equals one if the headquarter state of firm i had implemented the interstate bank branching deregulation in or before year t, and zero otherwise. $Inflex_{i,t-1} \times Dereg_{s,t}$ is the interaction term between inflexibility and the deregulation dummy. $X_{i,t-1}$ represents control variables, including profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), asset tangibility (*Tangible*), dividend payer dummy (*Payer*), and industry median leverage (*IndustLev*). Detailed variable definitions are provided in Appendix Table A.1. Column (1) does not include fixed effects. Column (2) adds headquarter state-by-year fixed effects and industry-by-year fixed effects. Column (3) additionally includes firm fixed effects. Constants are not reported. The sample period is from 1992 to 2017 due to the availability of data on bank debt. t-statistics based on standard errors clustered at the headquarter state level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)
Inflex×Dereg	0.437***	0.231**	0.427***
	(3.48)	(2.21)	(2.71)
Inflex	-0.535***	-0.293***	-0.257*
	(-4.24)	(-3.43)	(-1.92)
Dereg	-0.005		
	(-1.36)		
Profit	0.010	0.010	-0.026**
	(0.82)	(0.81)	(-2.31)
Size	-0.003***	-0.003***	0.011***
	(-3.03)	(-2.91)	(5.41)
B/M	0.023***	0.041***	0.015***
	(4.91)	(8.59)	(3.68)
Tangible	0.014	0.029**	-0.001
	(1.37)	(2.50)	(-0.04)
Payer	-0.026***	-0.022***	-0.003
	(-9.54)	(-7.32)	(-0.89)
IndustLev	0.086***		
	(8.02)		
State-year FE	No	Yes	Yes
Industry-year FE	No	Yes	Yes
Firm FE	No	No	Yes
Obs	17,488	17,488	17,488
Adjusted R^2	0.067	0.145	0.592

Table IA.6
Credit Supply Shock: Eliminating Impacts of Other Deregulation Events
This table reports results from the following regression:

$$Leverage_{i,t} = \alpha + \beta Inflex_{i,t-1} \times Dereg_{s,t} + \theta Inflex_{i,t-1} + \gamma' X_{i,t-1} + \tau_{s,t} + \tau_{j,t} + \tau_i + \epsilon_{i,t},$$

where $Leverage_{i,t}$ is either the long-term leverage ratio (*LD* in Columns (1) and (2)) or the total leverage ratio (*TD* in Columns (3) and (4)) of firm i in year t. $Inflex_{i,t-1}$ is the proxy for inflexibility. $Dereg_{s,t}$ is an indicator that equals one if the headquarter state of firm i had implemented the interstate bank branching deregulation in or before year t, and zero otherwise. $Inflex_{i,t-1} \times Dereg_{s,t}$ is the interaction term between inflexibility and the deregulation dummy. $X_{i,t-1}$ represents control variables, including profitability (*Profit*), firm size (*Size*), book-to-market ratio (*B/M*), asset tangibility (*Tangible*), dividend payer dummy (*Payer*), and industry median leverage (*IndustLev*). Detailed variable definitions are provided in Appendix Table A.1. The sample excludes years before 1992, during which period the intrastate branching deregulation and the interstate bank deregulation were implemented. Headquarter state-by-year fixed effects, industry-by-year fixed effects, and firm fixed effects are included in Columns (2) and (4). Constants are not reported. t-statistics based on standard errors clustered at the headquarter state level are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	LD		TD	
	(1)	(2)	(3)	(4)
Inflex×Dereg	0.508***	0.253**	0.532**	0.296**
	(3.15)	(2.06)	(2.19)	(2.05)
Inflex	-0.803***	-0.515**	-0.958***	-0.401***
	(-5.27)	(-2.56)	(-3.67)	(-3.08)
Dereg	-0.023***		-0.029***	
	(-4.54)		(-4.68)	
Profit	-0.068***	-0.093***	-0.107***	-0.152***
	(-5.84)	(-8.98)	(-6.52)	(-10.03)
Size	0.023***	0.045***	0.019***	0.050***
	(20.28)	(7.37)	(15.63)	(8.43)
B/M	0.134***	0.071***	0.189***	0.100***
	(16.02)	(10.13)	(20.68)	(10.90)
Tangible	0.134***	0.103***	0.122***	0.143***
	(13.36)	(5.47)	(10.53)	(6.29)
Payer	-0.058***	-0.016***	-0.069***	-0.021***
	(-8.71)	(-3.88)	(-10.28)	(-5.47)
IndustLev	0.389***		0.469***	
	(15.97)		(19.53)	
State-year FE	No	Yes	No	Yes
Industry-year FE	No	Yes	No	Yes
Firm FE	No	Yes	No	Yes
Obs	43,548	43,548	43,548	43,548
Adjusted R^2	0.301	0.695	0.315	0.720