Cost behavior and bond yield spreads

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Abstract

We provide first-time evidence that the bond market is sensitive to firms' asymmetric cost behavior. More specifically, we show that bond yield spreads increase with cost stickiness. The effect of cost stickiness on bond yield spreads is stronger at short-maturities, when investors are pessimistic about the firm's prospects, when the firm is operated less efficiently, and when it is operated in a less competitive product market. Given the size of the bond market and its prominence in external financing, the evidence that bond issuers with stickier cost pay higher risk premiums has important implications for our understanding of credit risk pricing and the economic consequences of asymmetric cost behavior.

Keywords: Bond yield spreads; Sticky costs; Cost of debt; Cost behavior

1. Introduction

We examine the impact of cost behavior on bond yield spreads. Extant empirical evidence shows that costs generally behave asymmetrically: they fall to a lesser extent with sales decreases than they rise with equivalent sales increases (Anderson, Banker, and Janakiraman 2003; Banker and Chen 2006). This nonlinearity phenomenon, known as “cost stickiness”, occurs because of asymmetric frictions in making resource adjustments. Specifically, given the uncertainty of future demand and adjustment costs to reduce or restore committed resources,[1] managers tend to delay reductions of committed resources until they are certain about the permanence of a decline in demand (Anderson et al. 2003). Managers generally also have more flexibility to hire than to fire employees, as labor laws can constrain their ability to downsize their labor force. Banker, Byzalov, and Chen (2013), for instance, find that the degree of cost stickiness is higher in countries with stricter employee protection legislations. Another explanation for cost stickiness is that self-interested managers can maintain unutilized resources beyond the optimal level for their own benefits (Anderson et al. 2003; Chen, Lu, and Sougiannis 2012).

Prior studies analyze the implications of cost stickiness for equity valuation. Banker, Chen, and Park (2014), for example, provide evidence suggesting that, in general, equity investors do not fully adjust their earnings estimations for the implications of cost stickiness, leading to inefficient stock valuation. However, there is thus far no study on the effect of cost stickiness on bond valuation. The determinants of bond pricing have been extensively examined in the literature (see, e.g., Sengupta 1998; Yu 2005; Fortin and Pittman 2004; Bharath et al. 2008;

[1]The costs include severance pay, human capital loss, diminished morale associated with dismissing employees, search and training costs when hiring new employees, cost associated with shutting down productions, disposing of assets, and rebuilding investment and research projects, and loss of market share.

and Graham et al. 2008). However, little attention has been paid to cost stickiness, which is traditionally a subject of interest to management accountants. Given the evidence that equity investors do not fully adjust their earnings estimations for the implications of cost stickiness, it is important to examine the effect of cost stickiness on bond valuation.

Weiss (2010) find that analyst earnings forecast accuracy is lower, and the variability of investors' estimation of future earnings higher, for firms with higher cost stickiness. He also suggests that cost stickiness not only increases the variability of future cash flows but also exacerbates downside risk. That is, when sales fall, both economic losses and variability of profit distributions tend to be wider for firms with stickier costs than for firms with less sticky costs because managers of the stickier-cost firms are slower (voluntarily or involuntarily) to cut costs. Therefore, considering that (1) a firm's default risk increases as its expected cash flow decreases or the variance of the expected cash flows increases and (2) a bond's payoff is an asymmetric function of a borrower's economic performance, the implications of cost stickiness for bonds can be substantial. Moreover, because bond investors are generally institutions, who tend to be more sophisticated than the average equity investor, bond valuation might reflect the implications of cost stickiness more efficiently than equity valuation. Hence, we posit that it is quite plausible that bond yield spread could increase with cost stickiness.

To understand the potential impact of cost stickiness on debt pricing, consider the recent conditions in the oil industry. Many US oil companies took large amounts of debt to expand activities, particularly in fracking operations. With the net demand for oil falling, the price of the U.S. benchmark West Texas Intermediate (WTI) prices for next-month delivery collapsed from about $115 in June 2014 to a 13-year intraday low of $26.19 on January 20, 2016, putting the survival of many levered oil companies in jeopardy. As revenue started to fall, the firms could have reduced production and adjusted their costs. However, many oil companies kept producing and accumulating losses. Their behavior is both constrained and deliberate. First, once resources are deployed, it usually takes time to scale them back. For instance, many oil exploration companies have long-term lease contracts for oil fields and will continue to incur the leasing cost whether they continue to produce oil or not. Second, as Daniel Katzenberg, an analyst at Robert W. Baird & Co, notes, "[i]f they drop rigs and crews, companies run the risk of not being able to ramp up production when crude prices improve."[2] Given the asymmetrical nature of debtholders' payoffs, committing resources to a losing operation with the hope of benefiting if and when price recovers is equivalent to buying call options on a firm's resources, at the expense of the debtholders. One relevant question then is whether lenders generally anticipated such eventualities and (ex-ante) adjusted bond prices accordingly.

Using 3,511 firm-year observations comprising of 6,111 corporate bond issues by 943 firms in the US from 1981 to 2012, we provide strong evidence that higher cost stickiness results in higher bond yield spreads, consistent with cost stickiness increasing the risk of future profit streams and the cost of debt. The impact of cost stickiness on bond offering spreads is economically significant. Our primary regression result suggests that, all else equal, a one-standard deviation increase in cost stickiness is associated with an increase in the yield spreads of 4.778 basis points, and the conditional bond yield difference across the firm with the highest cost stickiness and the firm with the lowest cost stickiness in the sample is 33.005 basis points. This difference translates into an annual (additional) interest cost of over $1.65 million on a $500 million bond issue for the firm with highest cost stickiness. We also find that the stickiness of both of the two major costs, costs of goods sold and selling, general, and administrative expenses, is associated with higher bond yield spreads.

To address concerns that our finding might be biased due to the endogeneity of a firm's

[2]http://www.wsj.com/articles/oil-companies-predicament-who-should-cut-production-1419358086.

cost stickiness, we use two different approaches. First, we use a firm fixed effects estimation approach, where the potential omitted correlated variables are assumed to be time-invariant firm characteristics. Second, we use a difference-in-differences research design that exploits a natural experiment created by the passage of state-level wrongful discharge laws as an exogenous increase in a firm's cost stickiness. Our main results are robust to both approaches.

Cost stickiness can result from managers retaining slack resources because they are optimistic about the future and, hence, perceive any negative sales shock as transitory. Because a temporary sales downturn is more likely to cause short-term liquidity problems than long-term credit problems,[3] a sales decline that is accompanied by a relatively lower cost decline is more likely to affect the pricing of short-term debt than the pricing of long-term debt. Accordingly, we find that the effect of cost stickiness on bond yield spreads is more pronounced at shorter maturities than at longer maturities.

Managers can retain more slack resources than necessary when sales fall if they overestimate their firms' future prospects. The failure to respond appropriately to reductions in sales is likely to exacerbate sales profit downturns and deteriorating future prospects, with the "sticky" expenses becoming "sunk costs" that do not generate any benefits to the firm. Therefore, investors are likely to be particularly concerned about cost stickiness when they hold pessimistic views about a business's prospects or its operating efficiency. Accordingly, we also find that the association between cost stickiness and bond yield spreads is stronger when investors are pessimistic about a firm's prospects and when the firm is operated less efficiently.

Finally, managers can also retain slack resources when sales fall if they obtain personal benefits from the slack (Anderson et al. 2003; Chen, Lu, and Sougiannis 2012). Product market

[3]For instance, U.S. oil companies that have short-dated debts and have to repay the loans soon are facing more stress during the oil price collapse than those that have long-dated debts, who do not have to repay the loans until years in the future when oil price will probably recover.

competition improves corporate governance and mitigates managerial slack (e.g., Giroud and Mueller 2010, 2011) and is thus likely to pressure managers to make value-maximizing cost decisions. Accordingly, we find that the effect of cost stickiness on bond yield spreads is less pronounced for issuers operating in more competitive product markets.

Taken together, the evidence indicates that, all else being equal, bond issuers with sticky costs pay higher risk premiums, with the effects varying in predictable directions. These findings contribute to two important streams of research. First, they provide first-time evidence that asymmetric cost behavior of borrowing firms is relevant and priced in the bond market. Bond price has been related to leverage and profitability as well as perceived information transparency (Sengupta 1998; Yu 2005), audit quality (Fortin and Pittman 2004), earnings manipulation (Bharath et al. 2008), and financial restatements (Graham et al. 2008). However, asymmetric cost behavior, as a prominent internal characteristic of firms, is not among the typical credit risk factors identified in prior studies. In this regard, we extend the bond and credit risk literature.

Second, prior studies find no evidence that equity investors adjust their earnings and value estimations for the implications of cost stickiness (e.g., Banker and Chen 2006; Anderson et al. 2007; Chen et al. 2014). In contrast, our analysis suggests that bond investors understand the important implications of cost behavior on the volatility of future profit streams and incorporate such information in pricing. Therefore, our study also extends the cost behavior literature. Cost behavior is traditionally a subject of interest to management accountants, who are concerned about internal decision-making and control. We find, however, that it also has a significant connection with, and impact on, the external financial market. Hence, our study echoes the call for integrating insights from management accounting with capital market research (Hemmer and Labro 2008).

The remainder of this paper is organized as follows. Section 2 discusses related studies. Section 3 discusses our research design. Section 4 describes the sample. Section 5 reports the empirical results. Section 6 concludes.

2. Summary of the extant literature on cost stickiness

Anderson et al. (2003) provide large-sample evidence that actual costs do not respond proportionally or symmetrically to activity changes. Specifically, they find that selling, general, and administrative (SG&A) costs decrease less with a sales decrease than they increase with an equivalent sales increase, which they present as evidence of cost stickiness. Subsequent studies document that cost stickiness is pervasive and holds across different cost categories, including cost of goods sold (Subramaniam and Weidenmier 2003), research and development (R&D) and advertising costs (Anderson and Lanen 2007), operating costs (Calleja et al. 2006), and labor costs (Dierynck et al. 2012).

During a downturn, profit-maximizing managers face a trade-off between the costs of maintaining excess resources against the adjustment costs of cutting existing resources and building them up again when demand is restored (Anderson et al. 2003; Banker et al. 2013a). Managers can choose to retain slack resources if they believe that the decline in revenue is temporary and/or the adjustment costs of retrenching and then ramping up again are relatively high. Anderson et al. (2003) and Balakrishnan et al. (2004) find that the degree of cost stickiness increases with asset and employee intensity, because it is costly to dispose of assets and to dismiss employees if demand drops and to invest once demand picks up later. Balakrishnan et al. (2014) show that the asymmetric behavior of costs is conditional on the proportion of fixed costs, which cannot be adjusted quickly enough to exogenous demand shocks.

The literature also attributes sticky cost behavior in part to agency problem. Chen et al.

(2012), for instance, suggest that managers' incentives to grow a firm beyond its optimal size or to maintain unutilized resources for their personal benefits induce greater cost stickiness. They also report that effective corporate governance can mitigate the positive association between empire building incentives and the degree of cost asymmetry. Dierynck et al. (2012) and Kama and Weiss (2013) also find that managers are more likely to cut down on slack resources to achieve cost savings when they have incentives to meet earnings targets, such as avoiding reporting losses or meeting analyst forecasts.

Another strand of the cost behavior literature analyzes the properties and consequences of sticky costs. Banker and Chen (2006) document that the predictive power of a time-series earnings forecast model improves substantially when the model incorporates cost stickiness. Weiss (2010) finds that analysts' earnings forecasts are substantially less accurate for firms with sticky costs than for firms with less sticky costs and that the degree of cost asymmetry affects analysts' coverage and market responses to earnings surprises. While, traditionally, fundamental analysis generally assumes that costs change proportionately with revenues (Lev and Thiagarajan 1993), Banker, Chen, and Park (2014) show that investors and analysts do not use such a proportionate cost model. However, they suggest that even though investors seem to understand sticky cost behavior to some extent, they still largely ignore cost sticky information in their earnings estimation and stock valuation. Consistent with these results, Anderson et al. (2007) find that SG&A cost asymmetry is significantly related to future abnormal stock returns, suggesting that equity investors do not fully impound the implication of stickiness-related cost information for future stock prices.

To the best of our knowledge, none of the prior studies examines the effect of cost behavior on the cost of debt or bond pricing. While there is some evidence on the implications of cost stickiness in the equity market, this evidence do not necessarily hold in the bond market for the following reasons. First, bondholders' asymmetric payoff function makes them more sensitive to the downside risk associated with sticky cost behavior than equity holders (i.e., decreased revenues are associated with small cost reductions and thus greater earnings reductions). Second, bondholders are typically institutional investors who are more sophisticated than the average equity investor and have access to more firm-specific information than other investors. Bond investors (and credit rating agencies) could rely less on earnings/cost information when evaluating firm performance, since they could have access to potentially more informative data on a firm's prospects. However, given their sophistication, bond investors are more likely to understand the implications of cost stickiness and price such a cost behavior than equity investors. Based on the facts that a firm's default risk increases as its expected cash flow decreases or the variance of its expected cash flows increases, that a bond's payoff is an asymmetric function of the borrower's economic performance, and that the bond market is dominated by sophisticated institutional investors, we posit that yield spread is likely to increase with cost stickiness.

3. Research design

In this section, we describe our regression models, the measurement of our cost stickiness variable, and our sample selection process.

3.1 Modeling bond yield spreads

We model bond yield spreads (*SPREAD*) as a function of cost stickiness (*STICKY*). The at-issue bond yield spreads represent the risk premium that firms must pay to borrow money in the bond market and is a measure of a firm's cost of debt (Shi 2003; Qiu and Yu 2009). If a firm has more than one bond issue in a given fiscal year, we use the proceeds-weighted spread, with the weight being the proceeds of each bond issue relative to the total proceeds of all bonds issued by the firm during the year. We expect the coefficient on *STICKY*, our test variable, to be positive (i.e., the stickier the costs, the higher the yield spread).

To ensure that we capture the impact of cost stickiness on bond yield spreads, we control for a number of firm- and bond-specific variables used in prior studies (e.g., Bhojraj and Sengupta 2003; Khurana and Raman 2003; Klock et al. 2005; Ortiz-Molina 2006; Francis et al. 2010). More specifically, we estimate the following model:

$$\begin{aligned} SPREAD_{it} = {} & \beta_0 + \beta_1 STICKY_{it-1} + \beta_2 lnTA_{it-1} + \beta_3 LEV_{it-1} + \beta_4 ROA_{it-1} + \beta_5 INTCOV_{it-1} \\ & + \beta_6 CAPINT_{it-1} + \beta_7 STDRET_{it-1} + \beta_8 STDROA_{it-1} + \beta_9 lnPROC_{it} + \beta_{10} RATING_{it} \quad (1) \\ & + \beta_{11} MULTI_{it} + Industry\ Effects + Year\ Effects + \varepsilon_{it} \end{aligned}$$

where

SPREAD is the at-issue yield spreads, defined as the difference between the bond offering yield and the comparable Treasury Bond yield with equivalent duration as the bond issue;

STICKY is our measure for cost stickiness, which we describe in Section 3.2;

lnTA is the logarithm of the book value of total assets;

LEV, leverage, is the ratio of long-term debt to total assets;

ROA, return on assets, is the ratio of operating income to total assets for the fiscal year prior to the bond issuance year;

INTCOV, interest coverage, is the ratio of operating income before depreciation to interest expense;

CAPINT, capital intensity, is the ratio of gross property, plant, and equipment to total assets;

STDRET is the standard deviation of the residuals from the market model using twelve monthly returns starting one month prior to the bond issuance month;

STDROA, volatility in operating performance, measured as the standard deviation of ROA over the four years prior to the bond issuance;

MULTI is an indicator variable that takes the value one for firms that issue bonds more than once during the sample period and zero otherwise;

lnPROC is the logarithm of the value of the debt issue;

RATING is the average of Moody's and S&P bond ratings of the bond at the issue date;[4]

Industry Effects are based on the Fama and French (1997) 48-industry classification; and

the firm characteristics are measured at the end of the fiscal year preceding the bond issues for the stock variables and over the fiscal year preceding the bond issues for the flow variables, assuming a three-month reporting lag.

We control for total assets (*lnTA*) because larger firms tend to be less risky. We control for leverage (*LEV*) because highly leveraged firms generally face a higher probability of default. We include return on assets (*ROA*) in the model because more profitable firms generally have lower default risk. Interest coverage indicates a firm's ability to generate income to cover its interest expense and therefore *INTCOV* is expected to be negatively associated with bond yield spreads. The intensity of a firm's tangible assets (*CAPINT*) is viewed as potential collateral and bond investors are expected to demand lower yields on firms with more tangible assets. CAPINT also controls for operating leverage, a measure of cost structure which correlates with cost stickiness and may itself affect debt pricing.[5] *STDRET* captures idiosyncratic risk and should be positively correlated with yield spreads. *STDROA* measures the volatility of the profitability of the issuer and should be positively correlated with yield spreads. We control for a firm's bond issuance frequency (*MULTI*) because, generally, a frequent bond issuing and trading pattern conveys information about the firm to investors and thus reduces adverse selection costs (Francis et al. 2010). All else being equal, we expect the cost of debt to increase with the bond proceed (*lnPROC*), which captures the size of the debt. However, as Shi (2003) notes, the size of a debt

[4] Bond ratings are computed using a conversion process in which AAA+ rated bonds are assigned a value of 24 and D rated bonds receive a value of 1. In the event that only one of the two rating agencies covers a specific issue, we use the corresponding available number.

[5] In untabulated tests, we control for operating leverage explicitly in multiple ways, following Mandelker and Rhee (1984) Novy-Marx (2011), Balakrishnan et al. (2014), Kahl et al. (2016). Our results do not change qualitatively.

issue might proxy for greater marketability of the debt, which could mitigate the risk-exposure effect associated with a large issuance. We include *RATING* in the model to control for information that the credit agencies possess about the issuers and the bonds that are not captured by the other variables in the model. We control for industry effects because some industries are riskier than others and, therefore, firms in these industries have larger spreads on their debts. We also control for year effects to isolate the impacts of time-series changes in bond yield spreads.

3.2 Measuring cost stickiness

Following Weiss (2010), we estimate our main stickiness measure, $STICKY_{it}$, as:

$$\overline{\log(\Delta COST/\Delta SALE)}_{i\overline{\tau}} - \overline{\log(\Delta COST/\Delta SALE)}_{i\underline{\tau}},\ \ \overline{\tau},\underline{\tau} \in \{t-19, \ldots, t\}, \qquad (2)$$

which is measured on a rolling basis as the difference between the mean of the quarterly cost function slope under upward adjustment made over quarters t-19 through t and the mean of the quarterly cost function slope under downward adjustments made over the same period, where $\overline{\tau}$ represents quarters with sales increases in the interval of quarters t-19 through t, $\underline{\tau}$ represents quarters with sales decreases in the same interval, *SALE* is sales revenue for a quarter, and *COST* is sales revenue minus income before extraordinary items for a quarter. Δ is the quarterly change operator. The stickiness measure reflects the difference between the rate of cost decreases for quarters with decreasing sales and the rate of cost increases for quarters with increasing sales. If costs are sticky, meaning that they decrease less when sales fall than they increase when sales rise by equivalent amounts, then *STICKY* will have a positive value, with a higher value of *STICKY* representing stickier cost behavior.

Weiss (2010) measures cost stickiness using four-quarter and eight-quarter windows. We instead measure it over a twenty-quarter window for a few reasons. As Weiss (2010) notes, stickiness measured over longer windows is more informative about the persistence of firms' cost behavior. More importantly, it often occurs that quarterly sales change in only one direction over a one-year or a two-year window. Because the stickiness formula requires both an increase and a decrease in sales, the formula is not applicable when sales change in only one direction. Unidirectional changes in quarterly sales are much less likely over a five-year horizon, which allows us to have a larger and more representative sample. Moreover, measuring cost stickiness over a longer window is likely to mitigate potential measurement errors associated with non-concurrent adjustments of the numerator (i.e., costs) and the denominator (i.e., sales revenue). Even if costs are not sticky, there will naturally be a response lag between a change in sales and a change in costs. Using a longer period mitigate the impact of the response lag on the cost stickiness measure.[6] However, we also analyze the robustness our main results to measuring cost stickiness over four-quarter and eight-quarter windows.

One potential problem with measuring stickiness over long windows is that the observations can overlap when a firm has multiple debt issues, which is likely to induce autocorrelations in the regression residuals. To account for the autocorrelations, we cluster the regression standard errors by firm. To further address the autocorrelation concern, we also estimate the regression by using the mean values of the variables across each firm, resulting in only one observation by firm. We therefore also estimate a pure cross-sectional regression with the firm as the unit of observation.

4. Sample selection, data sources, and descriptive statistics

4.1 Sample selection and data sources

[6]For example, sales could increase in quarters 1 and 2 and decrease in quarters 3 and 4 while costs increase in all four quarters and both sales and costs decrease in quarters 5 and 6 (as a delayed response to the sales decreases in quarters 3 and 4). In this case, we would not be able to capture stickiness using a period of four quarters even though the firm's costs are sticky, but would be able to capture it using a period of 5 quarters or more.

We start with 116,435 straight (nonconvertible) fixed-rate bond issues from 5,435 U.S. firms over 1981–2012 taken from the Securities Data Corporation (SDC) Global New Issues database. We impose the following sample selection criteria: (1) the issuing firm is not a financial institution or a regulated utility (SIC codes 6000-6999 and 4900-4999, respectively); (2) the issuing firm has the necessary accounting data on Compustat and return data on the Center for Research in Security Prices (CRSP) database; (3) data on bond yield spreads, bond rating, bond proceeds, and bond time to maturity are available on the SDC; and (4) sales and total expenses are non-negative. Data used in the cross-sectional tests are obtained from various sources, which are identified later in the paper. For firms with multiple bond issues in a given year, following Anderson et al. (2004) and Klock et al. (2005), we convert the multiple same-year issues into one observation weighted by issue proceeds so that the unit of observation in our analyses is an issuing firm and not a bond issue. The restrictions yield a final sample of 934 firms, with a total of 6,111 bond issues, constituting 3,511 firm-year observations.

4.2 Descriptive statistics

Table 1 provides descriptive statistics for the variables used in the regression analyses. The cost stickiness measure, *STICKY*, has a mean value of 0.026. *STICKY* displays a large cross-sectional variation, with a standard deviation of 0.464. The table also presents statistics on the characteristics of both the issuers and the bonds. All the statistics are similar in magnitude to those reported in prior studies (e.g., Anderson et al., 2004; Klock et al., 2005; Francis et al., 2010).

Table 2 presents simple correlations between the variables. Pearson correlations are reported above the diagonal and Spearman correlations are reported below the diagonal. Consistent with our conjecture, bond yield spreads (*SPREAD*) are positively correlated with cost stickiness (*STICKY*). As expected, *SPREAD* is also negatively correlated with total assets (*lnTA*), return on assets (*ROA*), interest coverage (*INTCOV*), capital intensity (*CAPINT*), credit rating (*RATING*), and multiple bond issuances (*MULTI*), and positively correlated with leverage (*LEV*), stock return volatility (*STDRET*), operating return volatility (*STDROA*), and bond proceed (*lnPROC*). The correlations between some of the independent variables are high. However, multicollinearity does not seem to be a serious concern. The variance inflation factor (VIF) is under 3 for all our regression specifications. We therefore include all the control variables in the regressions to reduce concerns about omitted correlated variables.

5. Empirical results

5.1 The main effect of cost stickiness on the cost of debt

We start this section with an analysis of the association between bond yield spreads and our main cost stickiness measure, which we estimate over five-year windows. We then examine the sensitivity of our results to measuring cost stickiness over shorter windows. We next examine the effect of the stickiness of different cost categories. We end the section with an analysis of the effect of cost stickiness on rating downward, as an alternative proxy for increased cost of debt.

5.1.1 Bond yield spreads and the five-year-window cost stickiness measure

We report the results of the OLS regressions of yield spreads on cost stickiness in Table 3. Under Column (1), we use a firm-year as the unit of observation and, under Column (2), we use a firm as the unit of observation by averaging all the observations by firm. We use a firm as the unit of observation because of concerns about the effects of overlapping observations on the statistical results based on firm-year observations. The explanatory powers of both models are high, with adjusted R^2 over 68%. The coefficients on the control variables are also generally consistent with our expectations and prior literature. More specifically, offering bond yield spreads decrease with size, profitability, capital intensity, good credit ratings, and issuance frequency, and increase with leverage, return volatility, and issuance size.

Turning to our variable of interest, cost stickiness (*STICKY*), we find a significantly positive association between cost stickiness and bond offering yield spreads, with one-tailed *p*-values of 0.001 in Column (1) and 0.002 in Column (2). The effect is not only statistically significant but also economically significant. For instance, the coefficients on *STICKY* in Column (1) is 10.298. As reported in Table 1, the standard deviation of *STICKY* is 0.464. Therefore, all else being equal, a one-standard deviation increase in cost stickiness corresponds with an increase in the yield spreads of 4.778 basis points, which is economically significant. Given the coefficient on *STICKY* of 10.298, the conditional bond yield difference across the firm with the highest cost stickiness (1.702) and the firm with the lowest cost stickiness (-1.503) in the sample is 33.005 basis points {10.298 x [1.702-(-1.503)]}. For the highest-cost stickiness firm, the yield difference translates into an annual (additional) interest cost of over $1.65 million on its $500 million debt issue. The cost stickiness effect is even stronger under Column (2), where we use a firm as the unit of observation, with the coefficient on *STICKY* more than doubling. In sum, the regression results are consistent with our conjecture that bond yield spreads increase with cost stickiness.

5.1.2 Using alternative cost stickiness measures

As we discussed earlier, cost stickiness measured over longer windows provides a more accurate measurement and a larger sample. However, as a robustness test and to be consistent with prior studies, we repeat our analysis of the effect of sticky cost structure on bond yield spreads using measures of cost stickiness estimated over eight and four quarters. For the eight-quarter window, we use data from quarter *t*-7 through quarter *t* to compute the ratio of change in total costs to change in sales as in Equation (2). The stickiness measure, *STICKY8*, is the difference between the mean rate of cost decreases and the mean rate of cost increases over the same eight-quarter period, accounting for downward and upward adjustments made over the eight quarters. For the four-quarter window, we compute cost stickiness using data from quarter *t*-3 through quarter *t*. The stickiness measure, *STICKY4*, is the difference between the cost function slope in the most recent quarter with a sales increase and the cost function slope in the most recent quarter with a sales decrease.[7] The definitions of both *STICKY*8 and *STICKY4* follow Weiss (2010). The results reported in Table 4 show that the coefficients on *STICKY8* and *STICKY4* are both positive and statistically significant. The coefficients on *STICKY8* and *STICKY4* in Table 4 are smaller than the coefficients on *STICKY* in Table 3, most likely because the stickiness estimates in Table 4 are more noisy. However, the results in Table 4 are still strong, indicating that the effects of cost stickiness on bond yield spreads is robust to measuring cost stickiness over eight and four quarters.

5.1.3 The effect of stickiness of different cost categories

Prior research investigates the stickiness of cost of goods sold (COGS) and selling, general, and administrative costs (SG&A) separately (see, e.g., Weiss 2010). Accordingly, we also examine the impacts on bond yield spreads of stickiness of the two major cost categories: COGS and SG&A. We compute the stickiness of the cost categories, *COGS_STICKY* and *SGA_STICKY* by replacing *COST* in Equation (1) by COGS and SG&A costs. The results reported in Table 5 show that the effect of cost stickiness on bond yield spreads holds for both

[7]If sales only increase or only decrease in all four quarters, then *STICKY4* cannot be computed and the observation is not included in the sample. If there are multiple increases or decreases over the four quarters, we use the most recent increase or decrease.

cost of goods sold and selling, general, and administrative costs. More specifically, the coefficients of both *COGS_STICKY* and *SGA_STICKY* are positive and significant.

5.2 Potential endogeneity bias

Cost stickiness is a choice variable. Even though we control for the determinants of bond yield spreads suggested in prior research, it is possible that cost stickiness and cost of debt are both affected by the same unobserved firm characteristics. To mitigate the possibility that our results could be driven by some endogeneity effect, we use two different approaches: firm fixed effects estimation and the difference-in-differences research design in a panel regression using the adoption of state-level wrongful discharge laws as an exogenous shock to a firm's cost structure, i.e., an exogenous increase in the firm's cost stickiness.

5.2.1 Firm fixed effect estimation

If the unobservable firm-specific characteristics that potentially affect both a firm's cost structure and its bond yield spread are time invariant, then a firm fixed-effect estimation can account for the firm level heterogeneity and thus address the endogeneity problem. We include year fixed effects in the estimation to account for transitory aggregate economic conditions that could affect bond yield spreads. The firm fixed-effect approach can also mitigate the effect of overlapping data on the regression estimates. We use the firm fixed-effect (i.e., within-firm) estimation only for the main effect (and not in the subsequent cross-sectional analyses) because there is not enough within-firm variation in the subgroups to capture cross-sectional differences in the main effect, particularly when using overlapping data, which reduce within-firm variations.

We report the firm fixed-effect results in Column (1) of Table 7. The coefficient on

STICKY remains positive and statistically significant. Therefore, to the extent that both cost stickiness and credit spreads are affected only by time invariant unobservable firm characteristics, the results suggest that the association between cost stickiness and credit spreads is unlikely to be driven by endogenous forces.

5.2.2 Difference-in-differences research design

To further alleviate the endogeneity concern, we also use a difference-in-differences research design. Specifically, we exploit the natural experiment created by the passage of state-level wrongful discharge laws as an exogenous increase in a firm's cost stickiness. These laws, passed by all 50 states between 1967 and 1995, allow employees to sue employers for unjust dismissal and for lost earnings and punitive damages associated with such dismissals. As exceptions to the practice that employers can terminate employees at will, these laws increase the costs associated with dismissing employees (Jung 1997). After a wrongful discharge law is passed in a state, a firm in that state is less likely to lay off employees when sales are down (e.g., during economic downturns) and thus its costs become stickier, because the law increases the cost of terminating workers. There are three exceptions to the terminate-at-will rule and states can choose to adopt none, any, or all three: good faith exception, implied contract exception, and public policy exception.[8] The adoption of wrongful discharge laws occurs at the state level and in various years, and the change in cost stickiness resulting from wrongful discharge laws is exogenous with respect to any specific firm.

To analyze the effect of the adoption of the wrongful discharge laws, we define an indicator variable *POST_WDL*, which equals one if the state where a firm is headquartered has

[8] For detailed discussions and legal definitions of these wrongful discharge laws (i.e., exceptions to the terminate-at-will rule), see Miles (2000), Kugler and Saint-Paul (2004), and Autor, Donohue, and Schwab (2006).

adopted any one of the three exceptions as of year *t*. Hence, *POST_WDL* takes the value 1 when a firm is subject to wrongful discharge laws and, consequently, experiences an exogenous shock in labor costs stickiness. We then estimate the following panel regression:

$$\begin{aligned} SPREAD_{it} = {} & \beta_0 + \beta_1 POST\_WDL_{it} + \beta_2 lnTA_{it\text{-}1} + \beta_3 LEV_{it\text{-}1} + \beta_4 ROA_{it\text{-}1} + \beta_5 INTCOV_{it\text{-}1} \\ & + \beta_6 CAPINT_{it\text{-}1} + \beta_7 STDRET_{it\text{-}1} + \beta_8 STDROA_{it\text{-}1} + \beta_9 lnPROC_{it} + \beta_{10} RATING_{it} \\ & + Firm\ Effects + Year\ Effects + \varepsilon_{it} \end{aligned} \quad (2)$$

We include firm fixed effects in the difference-in-differences model to control for fixed differences between treated firms (i.e., firms headquartered in states that are affected by the laws in year *t*) and control firms (i.e., firms headquartered in states that are unaffected by the laws in year *t*). The fixed effects ensure that β_1 reflects average within-firm changes in bond yield spreads from before to after the exogenous shock to cost stickiness, rather than simple cross-sectional correlations. We also include year effects to account for potential omitted macro-economic factors that could affect bond yield spreads and the likelihood that a state adopts wrongful discharge laws. The identification strategy can be understood with an example. Suppose we wish to estimate the impact of the wrongful discharge law (cost stickiness) passed in Alabama in 1987. We calculate the difference in bond yield spreads before 1987 and after 1987 for all firms headquartered in Alabama. However, other economic factors in 1987 may have affected bond yield spreads and the before-after difference may not be due to cost stickiness (associated with wrongful discharge laws). Choosing a control state, for example Louisiana, would help to control for such factors. We calculate the same difference between before and after 1987 for firms headquartered in Louisiana, which does not pass any wrongful discharge laws in 1987. We can then compare the bond yield spread differences in Alabama and Louisiana before and after 1987. The panel regression we use account for the staggered passage of wrongful discharge laws by different states. As such, the control group is not just states that never pass such a law; it consists of firms in all the states that do not pass a law in a particular year *t*, even if the states have already passed a law before year *t* or will pass a law later on. Our approach is similar to the difference-in-differences estimation used in the literature (e.g., Bertrand and Mullainathan 2003).

We report the results from the difference-in-differences estimation in Column (2) of Table 6. The coefficient on *POST_WDL*, which measures the effect of cost stickiness increase on bond yield spreads, is positive and statistically significant. The magnitude of the coefficient (16.640) is close to that reported in the main test in Table 3.

Wrongful discharge laws should increase the cost stickiness of labor intensive issuers more than other issuers. Therefore, we expect the impact of the exogenous shock to be stronger for firms with higher labor intensity. We test this conjecture in column (3) of Table 6. Specifically, we create an indicator variable, *LABOR*, which equals one if the average labor intensity of the industry is above the sample median and zero otherwise.[9] Following Levine et al. (2015), we calculate labor intensity as the ratio of labor and pension expenses to sales. We note that the coefficient on *POST_WDL* is positive but not statistically significant. However, the coefficient on *POST_WDL*LABOR* is 13.187 and statistically significant, confirming that the labor laws affect labor intensive firms more and that the exogenous increase in the cost stickiness of those firms causes an increase in bond yield spreads.

Our difference-in-differences test relies on the state where a firm is headquartered. Large firms generally have a relatively small portion of their workforces in the states where they are headquartered. Therefore, state labor laws, as exogenous shocks to firms' cost structure, should hold mainly for small firms, which are more likely to have large proportions of their workforces

[9]We also use firm-level labor intensity instead of industry-level labor intensity, and obtain essentially the same results as in column (3) of Table 7.

in the states where they are headquartered. Hence, if the association between state-level wrongful discharge laws and cost stickiness that we document indeed captures the effect of the state laws, the impact should be particularly strong for small firms. To test this conjecture, we create an indicator variable *SMALL*, which equals one if the size of the firm is in the lowest quintile, and zero otherwise. We measure the size of the firm/enterprise as market value of equity plus total liabilities (assets minus book value of equity).[10] The results reported in column (4) of Table 6 are consistent with our conjecture. The coefficient on *POST_WDL* is positive and marginally significant, and the coefficient on *POST_WDL×SMALL* is positive and statistically significant (*t*-value = 34.927). Overall, although cost stickiness can be a firm choice variable, the evidence suggests that the positive association between cost stickiness and bond yield spreads is not likely to be driven by some endogeneity bias.

5.3 Cross-sectional analyses

5.3.1 The effect of bond maturity

As explained earlier, we posit that the effect of cost stickiness on bond yield spreads would decrease with bond maturity. To test this conjecture, we augment Equation (1) with *lnMAT* and the interaction between *STICKY* and *lnMAT*, where *lnMAT* is the natural logarithm of a bond's time to maturity (in years). The results are reported in Table 7. Consistent with our conjecture, the coefficient on the interaction term, *STICKY×lnMAT*, is negative and statistically significant whether we use a firm-year as the unit of observation (under Column 1) or a firm as the unit of observation (under Column 2). Therefore, while bond yields are higher for borrowing firms with stickier costs, the differential yield decreases with bond maturity, because cost stickiness affects longer maturity bonds less.

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[10]Results are similar if we measure size as market value of equity or total assets.

5.3.2 The effect of investors' expectations about future firm prospects

We also posit that the association between cost stickiness and bond yield spreads would decrease with investors' expectations about a firm's future prospects. We measure the market's expectation of an issuer's future prospects by its one-year stock return prior to the bond issuance (*BHRET*), following Basu (1997) and Watts (2003), and by analysts' expected growth in the issuer's earnings (*AEGROWTG*). We define *AEGROWTG* as the difference between the consensus (mean) analysts' forecast of two-year-ahead annual earnings (made before the bond issuance but after the most recent annual earnings announcement) and the most recent actual annual earnings before the bond issuance, scaled by the stock price at the end of the month of the last annual earnings announcement before the bond issuance. A higher *BHRET* or *AEGROWTG* is generally an indication that investors are optimistic about a firm's future operating performance. We augment Equation (1) with *BHRET* and *AEGROWTG* and the interaction terms *STICKY×BHRET* and *STICKY×AEGROWTG*. The results reported in Table 8 are consistent with our expectations that the impact of cost stickiness on bond yield spreads would decrease with perceived firm prospects. The coefficients on the interaction term between cost stickiness and *BHRET* and between cost stickiness and *AEGROWTG* are significantly negative, whether we use a firm-year (Columns (1) and (2)) or a firm (Columns (3) and (4)) as the unit of observation.

5.3.3 The effect of operating efficiency

We also expect that the association between cost stickiness and bond yield spreads to be stronger when bond investors have reasons to believe that a firm is not managed efficiently. Managers of inefficiently operated firms are more likely to have inaccurate expectations about future business conditions and inefficient cost control (see, e.g., Feng, et al. 2015). In contrast, the cost stickiness of an efficiently operated firm is more likely to result from value maximizing decisions based on more accurate expectations about future business conditions. Managers of efficiently operated firms are more likely to avoid the costs (and the associated cash outflows) of rebuilding investment and research projects in the future when sales are restored. We proxy for the level of efficiency with which a firm is operated by Demerjian, Lev, and McVay's (2012) managerial ability measure and by the strength of the firm's internal control. Demerjian, Lev, and McVay's (2012) measure, which we label *REFF*, is a within-industry relative efficiency estimate based on data envelopment analyses (DEA).[11] Internal control weakness disclosure is provided by Audit Analytics. Weak internal control is associated with inefficient management because it reflects poor management and deprives managers of high-quality information for internal decision making, resulting in suboptimal cost behavior. We create an indicator variable, *ICW*, which equals one if the firm discloses internal control weaknesses in the year prior to the bond issuance and zero otherwise.

The results are reported in Table 9. The coefficient on the interaction term between cost stickiness and *REFF* is significantly negative and the coefficient on the interaction term between cost stickiness and *ICW* is significantly positive. These results hold whether we use a firm-year (Columns (1) and (2)) or a firm (Columns (3) and 4)) as the unit of observation. More specifically, the regression results using a firm-year (firm) as the unit of observation indicates that the effect of cost stickiness on bond yield spreads is 87 (120) basis points higher for firms that report internal control weaknesses than for those that do not report internal control weaknesses. Hence, the evidence is consistent with our expectations that, while an issuer with sticky costs would tend to have higher bond yield spreads, the cost stickiness spread effect is

[11]Please refer to Demerjian, Lev, and McVay (2012) and Demerjian, Lev, Lewis, and McVay (2011) for detailed discussions about the measure. The dataset containing the measure is available at https://community.bus.emory.edu/personal/PDEMERJ/Pages/Download-Data.aspx.

mitigated when the firm is operated with relatively high efficiency. However, it is important to note that both the main and the total effects of *STICKY* are very significant, which implies that the effect of *STICKY* holds even for the most efficient firms, although it is stronger for the less efficient ones.

5.3.4 The effect of competition

Finally, we conjecture that the effect of cost stickiness on bond yield spreads would be less pronounced when an issuer faces strong competition. Managers of firms facing higher competition are more likely to make more efficient cost decisions. Product market competition puts pressure on managers to make value maximizing decisions, improving governance and mitigating managerial slack (e.g., Giroud and Mueller 2010, 2011). In a competitive market, the cost stickiness of the firm is more likely to be an optimal choice made by its managers in response to changing market conditions, instead of a manifestation of empire building and other agency problems.

To test our conjecture, we use two measures of competition. The first one is an indicator variable, *Low_HHI*, that equals one if the Herfindahl index of the issuer's industry is in the lowest tercile in the year prior to the bond issuance, indicating higher competition in that year.[12] The second measure is the *PCTCOMP* measure of Li, Lundholm, and Minnis (2013). It is a scaled measure of the number of competition-related words, relative to the total number of words, in the 10-K, with a higher *PCTCOMP* indicating higher competition.[13]

[12]The results also hold, but are a bit weaker, if we use above-median industry Herfindahl index to identify high-competition industries.

[13]Detailed information on the measurement of *PCTCOMP* and the data are available at http://webuser.bus.umich.edu/feng/.

The results, reported in Table 10, are consistent with our conjecture that the effect of cost stickiness on bond yield spreads is less (more) pronounced when a firm faces higher (lower) product market competition. More specifically, the coefficients on the interaction terms, *STICKY×Low_HHI* and *STICKY×PCTCOMP*, are both significantly negative, whether we use a firm-year (Columns (1) and (2)) or a firm (Columns (3) and (4)) as the unit of observation.

6. Conclusion

We posit that higher levels of cost stickiness exacerbate the risk associated with more volatile future cash flows and downside cash flow risk and therefore could increase the cost of debt. Consistent with our conjecture, we find that cost stickiness is associated with higher bond offering yield spreads. We also find that the cost stickiness spread effect is stronger for bonds with shorter maturity, when investors are pessimistic about the firm's prospects, when the firm is operated less efficiently, and when it is operated in a less competitive product market. The study connects a managerial accounting concept related to internal decision making and control (sticky costs) to bond pricing and provides new insights on whether a firm's cost behavior influences capital markets. The study integrates the credit spread research stream and the cost behavior research stream and extends both literatures.

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Appendix

Variable	Measurement
Dependent variable	
SPREAD	Bond yield spread, measured as the yield to maturity of the corporate bond at issuance minus the yield to maturity of a Treasury security with a similar duration and expressed in basis points. If a firm issues multiple bonds in a year, this variable is calculated as a weighted average based on each bond's proceeds.
Cost stickiness variables	
STICKY	$\overline{\log(\Delta COST/\Delta SALE)}_{i\overline{\tau}} - \overline{\log(\Delta COST/\Delta SALE)}_{i\underline{\tau}}, \quad \underline{\tau},\overline{\tau} \in \{t, \ldots, t-19\}$ the difference between the mean total cost function slope under upward adjustment made over quarters *t*-19 through *t* and the mean total cost function slope under downward adjustments made over the same period, where $\underline{\tau}$ represents quarters with sales decreases and $\overline{\tau}$ represents quarters with sales increases in the interval from *t*-19 through *t*, *SALE* is sales revenue for the quarter, and *COST* is measured by sales revenue minus income before extraordinary items for the quarter.
COGS_STICKY	$\overline{\log(\Delta COGS/\Delta SALE)}_{i\overline{\tau}} - \overline{\log(\Delta COGS/\Delta SALE)}_{i\underline{\tau}}, \quad \underline{\tau},\overline{\tau} \in \{t, \ldots, t-19\}$ using the same definition as *STICKY*, with cost of goods sold (*COGS*) replacing total cost.
SGA_STICKY	$\overline{\log(\Delta SGA/\Delta SALE)}_{i\overline{\tau}} - \overline{\log(\Delta SGA/\Delta SALE)}_{i\underline{\tau}}, \quad \underline{\tau},\overline{\tau} \in \{t, \ldots, t-19\}$ using the same definition as *STICKY*, with selling, general, and administrative expense (*SGA*) replacing total cost.
STICKY8	$\overline{\log(\Delta COST/\Delta SALE)}_{i\overline{\tau}} - \overline{\log(\Delta COST/\Delta SALE)}_{i\underline{\tau}}, \quad \underline{\tau},\overline{\tau} \in \{t, \ldots, t-7\}$ using the same definition as *STICKY*, but over quarters *t*-7 through *t* instead of *t*-19 through *t*.
STICKY4	$\log(\Delta COST/\Delta SALE)_{i\overline{\tau}} - \log(\Delta COST/\Delta SALE)_{i\underline{\tau}}, \quad \underline{\tau},\overline{\tau} \in \{t, \ldots, t-3\}$ where $\underline{\tau}$ is the mean of the last four quarters with sales decrease, $\overline{\tau}$ is the mean of the last four quarters with sales increase, *SALE* is sales revenue for the quarter, and *COST* is measured by sales revenue minus income before extraordinary items for the quarter.
Other variables	
MAT	The bond's number of years to maturity. If a firm issues multiple bonds in a year, *MAT* is calculated as a weighted average based on each bond's proceeds. We use the log transformation, *lnMAT*, in the regressions.
BHRET	The percentage buy-and-hold-return of the issuer over the year prior to the bond issuance.
AEGROWTG	The difference between the consensus (mean) analyst forecast (made after the most recent annual earnings announcement and before the bond issuance) of annual earnings two years after the debt issuance and the most recent

	actual annual earnings before the debt issuance, as a percentage of the stock price at the end of the month of the most recent annual earnings announcement.
REFF	Relative efficiency measured as in Demerjian et al. (2012), expressed as a percentage.
ICW	An indicator variable that equals one if the auditor's opinion indicates that the firm has internal control weakness prior to the bond issuance, and zero otherwise.
Low_HHI	An indicator variable that equals one if the Herfindahl Index of the issuing firm's industry is in the lowest one-third in the year prior to the bond issuance, and zero otherwise.
PCTCOMP	The number of competition-related words divided by the total number of words in the 10-K of the issuing firm in the year prior to the bond issuance, following Li, Lundholm, and Minnis (2013).
TA	Book value of total assets (in millions) using the latest available fiscal year-end data (with the assumption of a three-month reporting lag). We use the log transformation, *lnTA*, in the regressions.
LEV	Financial leverage defined as long-term debt over total assets using the latest available fiscal year-end data (assuming a three-month reporting lag).
ROA	Return on assets defined as the ratio of income before extraordinary items as a percentage to total assets using the latest available fiscal year-end data (with the assumption of a three-month reporting lag).
INTCOV	Interest coverage defined as the ratio of net income plus interest expense to interest expense using the latest available fiscal year-end data (with the assumption of a three-month reporting lag).
CAPINT	Capital intensity calculated as the ratio of gross PPE to total assets using the latest available fiscal year-end data (with the assumption of a three-month reporting lag).
STDRET	Standard deviation of the residuals from regressing a firm's percentage returns on value-weighted market percentage returns, using twelve monthly returns before the bond issuance starting one month prior to the bond issuance month.
STDROA	Standard deviation of return on assets (*ROA*) over the four years prior to the bond issuance.
PROC	The proceeds (millions) from the issue. If a firm issues multiple bonds in a year, this variable is calculated as the sum of all the proceeds. We use the log transformation, *lnPROC*, in the regressions.
RATING	The Standard & Poor's credit rating on the bond issue, converted to numerical scale ranging from 1 (D or SD) to 22 (AAA). If a firm issues multiple bonds in a year, this variable is calculated as a weighted average of the ratings based on each bond's proceeds.

MULTI	An indicator variable that equals one if a firm has multiple issues during the sample period, and zero otherwise.

Table 1: Descriptive statistics

Variables	**N**	**Mean**	**Std. Dev.**	**Min**	**Median**	**Max**
Cost Stickiness						
STICKY	3,511	0.026	0.464	-1.503	0.016	1.702
Issuer Characteristics						
TA (in $billion)	3,511	14.266	33.077	17.311	5.196	717.240
LEV	3,511	0.299	0.146	0.000	0.281	0.803
ROA	3,511	5.612	5.152	-14.303	5.569	19.719
INTCOV	3,511	11.454	14.963	0.122	7.235	110.140
CAPINT	3,511	0.413	0.245	0.013	0.374	0.918
STDRET	3,511	7.145	3.438	2.392	6.325	20.333
STDROA	3,511	2.655	2.899	0.158	1.733	17.445
BHRET	3,511	14.997	35.368	-56.868	11.101	154.545
AEGROWTHG	2,459	1.310	3.380	-11.249	1.000	22.467
REFF	3,430	83.783	17.067	10.399	88.837	100.000
ICW	1,004	0.019	0.136	0.000	0.000	1.000
PCTCOMP	1,272	0.420	0.427	0.008	0.291	4.004
LOW_HHI	3,511	0.334	0.472	0.000	0.000	1.000
Issuance Characteristics						
SPREAD	3,511	183.566	149.601	2.000	131.881	1,320.000
PROC (in $million)	3,511	337.912	357.112	4.951	246.760	4,981.300
RATING	3,511	15.001	3.376	4.000	15.000	22.000
MULTI	3,511	0.898	0.302	0.000	1.000	1.000
MATUR	3,511	12.736	7.648	0.000	10.000	50.000

Notes: The table reports summary statistics for the variables used in subsequent analyses. The sample consists of 3,511 firm year observations on 6,111 nonconvertible bond issues by 934 firms in the U.S. from 1981 to 2012. The variables are defined in the Appendix.

Table 2: Simple correlations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) *SPREAD*		**0.067**	**-0.279**	**0.306**	**-0.326**	**-0.155**	0.018	**0.500**	**0.322**	**0.057**	**-0.700**	**-0.267**
(2) *STICKY*	**0.036**		**-0.067**	**0.033**	**-0.090**	-0.011	**0.042**	**0.080**	-0.004	**-0.085**	**-0.028**	-0.026
(3) *lnTA*	**-0.244**	**-0.053**		**-0.157**	**0.107**	**0.140**	**-0.076**	**-0.300**	**-0.100**	**0.647**	**0.477**	**0.372**
(4) *LEV*	**0.270**	**0.036**	**-0.107**		**-0.342**	**-0.485**	**0.129**	**0.240**	**0.066**	**-0.072**	**-0.437**	**-0.068**
(5) *ROA*	**-0.306**	**-0.087**	**0.078**	**-0.369**		**0.481**	**-0.077**	**-0.303**	**-0.239**	**0.108**	**0.422**	**0.063**
(6) *INTCOV*	**-0.330**	**-0.053**	**0.213**	**-0.672**	**0.694**		**-0.138**	**-0.126**	0.022	**0.216**	**0.276**	**-0.043**
(7) *CAPINT*	**-0.007**	**0.053**	**-0.079**	**0.150**	**-0.068**	**-0.099**		**0.048**	0.009	**-0.123**	**-0.060**	0.027
(8) *STDRET*	**0.444**	**0.073**	**-0.298**	**0.167**	**-0.259**	**-0.243**	**0.063**		**0.298**	**-0.083**	**-0.463**	**-0.211**
(9) *STDROA*	**0.265**	-0.007	**-0.087**	0.012	**-0.131**	**-0.055**	**0.029**	**0.267**		**0.070**	**-0.323**	**-0.130**
(10) *lnPROC*	**0.133**	**-0.085**	**0.668**	**-0.060**	**0.117**	**0.267**	**-0.151**	**-0.097**	**0.075**		**0.089**	**0.133**
(11) *RATING*	**-0.722**	-0.004	**0.393**	**-0.376**	**0.433**	**0.469**	**-0.050**	**-0.419**	**-0.312**	0.026		**0.334**
(12) *MULTI*	**-0.239**	-0.017	**0.333**	**-0.035**	**0.066**	**0.082**	**0.028**	**-0.187**	**-0.119**	**0.132**	**0.282**	

Notes: Pearson (Spearman) correlation coefficients are reported in the upper (lower) diagonal. The sample consists of 3,511 firm-year observations on nonconvertible bond issues by U.S. firms from 1981 to 2012. The variables are defined in the Appendix. To be consistent with later regression analyses, we use log transformation of *TA* and *PROC* in estimating correlations. Bolded numbers are significant at the 10% level (two-tailed). To evaluate the concern of multi-collinearity, VIFs are checked for all independent variables. The VIFs are all less than 3.

Table 3: The effect of cost stickiness on bond yield spreads

	Dependent variable: *SPREAD*	
	(1)	(2)
Unit of observation→	a firm-year	a firm
STICKY	**10.298**	**22.342**
	(0.001)	**(0.002)**
lnTA	-5.705	0.251
	(0.001)	(0.477)
LEV	30.417	12.827
	(0.011)	(0.315)
ROA	-2.053	-0.586
	(0.000)	(0.227)
INTCOV	0.062	0.123
	(0.316)	(0.298)
CAPINT	5.979	-11.706
	(0.259)	(0.262)
STDRET	7.449	2.586
	(0.000)	(0.008)
STDROA	2.563	5.995
	(0.000)	(0.000)
lnPROC	2.641	22.453
	(0.144)	(0.000)
RATING	-23.438	-31.357
	(0.000)	(0.000)
MULTI	-20.164	-6.117
	(0.000)	(0.206)
Industry Effects	Yes	Yes
Year Effects	Yes	No
Adjusted R^2	0.685	0.690
Number of obs.	3,511	934

Notes: This table reports the results of regressing the at-issue yield spread (in basis points) on cost stickiness and a vector of firm- and bond-specific control variables. The industry indicators are defined based on the Fama and French (1997) 48-industry classification. The other variables are defined in the Appendix. All the continuous variables are winsorized at the top and bottom one-percentiles. Column (1) reports estimation using firm-year observations. Column (2) reports between estimation using average values of variables at the firm level. The one-tailed *p*-values, reported in parentheses, are based on standard errors clustered at the firm level in Column (1).

Table 4: Alternative measures of cost stickiness

	Dependent variable: *SPREAD*	
	(1)	(2)
STICKY8	**4.490**	–
	(0.023)	
STICKY4	–	**3.319**
		(0.009)
lnTA	-5.508	-6.650
	(0.001)	(0.000)
LEV	29.443	34.887
	(0.010)	(0.004)
ROA	-1.715	-1.556
	(0.000)	(0.000)
INTCOV	0.134	0.169
	(0.129)	(0.092)
CAPINT	0.014	-0.003
	(0.389)	(0.475)
STDRET	6.168	6.003
	(0.000)	(0.000)
STDROA	2.555	2.434
	(0.000)	(0.000)
lnPROC	5.922	6.215
	(0.005)	(0.004)
RATING	-23.825	-23.191
	(0.000)	(0.000)
MULTI	-14.553	-17.734
	(0.002)	(0.001)
Industry Effects	Yes	Yes
Year Effects	Yes	Yes
Adjusted R^2	0.715	0.710
Number of obs.	3,306	2,936

Notes: This table reports the results of regressing the at-issue yield spread (in basis points) on alternative cost stickiness measured over eight quarters (*STICKY8*) and four quarters (*STICKY4*) and a vector of firm- and bond-specific control variables. The industry indicators are defined based on the Fama and French (1997) 48-industry classification. The other variables are defined in the Appendix. All the continuous variables are winsorized at the top and bottom one-percentiles. The samples include 3,306 and 2,936 firm-year observations covering nonconvertible bond issues by U.S. firms. The sample sizes are smaller in this table than in Table 3 because the longer time interval used to estimate stickiness in Table 3 allows for the construction of the stickiness measure for more firms (a longer time interval increases the likelihood that a firm would have both sales increases and sales decreases). The one-tailed *p*-values, reported in parentheses, are based on standard errors clustered at the firm level.

Table 5: Analysis by cost categories

	Dependent variable: *SPREAD*	
	(1)	(2)
COGS_STICKY	**5.204**	
	(0.032)	**–**
SGA_STICKY		**4.521**
	–	**(0.009)**
lnTA	-7.096	-4.854
	(0.000)	(0.008)
LEV	38.472	25.120
	(0.001)	(0.041)
ROA	-1.802	-1.899
	(0.000)	(0.000)
INTCOV	0.060	0.116
	(0.313)	(0.196)
CAPINT	2.731	14.130
	(0.380)	(0.084)
STDRET	6.892	7.297
	(0.000)	(0.000)
STDROA	2.244	1.939
	(0.000)	(0.001)
lnPROC	4.664	3.500
	(0.026)	(0.095)
RATING	-23.343	-25.342
	(0.000)	(0.000)
MULTI	-20.923	-20.763
	(0.000)	(0.000)
Industry effects	Yes	Yes
Year effects	Yes	Yes
Adjusted R^2	0.696	0.700
Number of obs.	3,493	3,045

Notes: This table reports the results of regressing the at-issue yield spread (in basis points) on stickiness of cost of goods sold (*COGS_STICKY*), stickiness of selling, general, and administrative costs (*SGA_STICKY*), and a vector of firm- and bond-specific control variables. The industry indicators are defined based on the Fama and French (1997) 48-industry classification. The other variables are defined in the Appendix. All the continuous variables are winsorized at the top and bottom one-percentiles. The samples include 3,493 and 3,045 firm-year observations covering nonconvertible bond issues by U.S. firms from 1981 through 2012 that meet the sample restrictions described in the text. There are fewer observations than in Table 3 because of missing *COGS_STICKY* and *SGA_STICKY* values. The one-tailed *p*-values, reported in parentheses, are based on standard errors clustered at the firm level.

Table 6: Firm fixed effects and difference-in-differences estimations

	Dependent variable: *SPREAD*			
	(1)	(2)	(3)	(4)
Estimation approach→	Fixed Effects	Difference-in-differences		
STICKY	**7.343**			
	(0.012)	–	–	–
POST_WDL		**16.640**	5.738	10.515
	–	**(0.013)**	(0.389)	(0.088)
POST_WDL*LABOR			**13.187**	
	–	–	**(0.047)**	
LABOR			2.370	
	–	–	(0.412)	
POST_WDL*SMALL				**34.927**
				(0.008)
SMALL				-4.066
				(0.385)
lnTA	-2.092	-5.156	-3.895	-0.736
	(0.300)	(0.110)	(0.184)	(0.434)
LEV	16.604	7.151	13.667	8.403
	(0.198)	(0.364)	(0.259)	(0.345)
ROA	-2.534	-2.638	-2.699	-2.546
	(0.000)	(0.000)	(0.000)	(0.000)
INTCOV	0.234	0.201	0.232	0.237
	(0.087)	(0.134)	(0.106)	(0.101)
CAPINT	9.505	7.512	4.100	3.684
	(0.329)	(0.371)	(0.431)	(0.438)
STDRET	6.951	6.926	7.055	6.886
	(0.000)	(0.000)	(0.000)	(0.000)
STDROA	1.664	1.287	1.358	1.210
	(0.011)	(0.049)	(0.046)	(0.064)
lnPROC	-0.677	-0.293	-1.246	-1.425
	(0.399)	(0.458)	(0.332)	(0.307)
RATING	-22.798	-21.866	-21.957	-21.880
	(0.000)	(0.000)	(0.000)	(0.000)
Firm Effects	Yes	Yes	Yes	Yes
Year Effects	Yes	Yes	Yes	Yes
Adjusted R^2	0.785	0.824	0.817	0.819
Number of obs.	3,511	3,214	3,188	3,214

Notes: Column (1) of this table reports the firm fixed effects estimation results of regressing the at-issue yield spread (in basis points) on cost stickiness and a vector of firm- and bond-specific control variables. Column (2) of the table reports the result of the difference-in-differences estimation, where *POST_WDL* is an indicator variable that equals one if the state where the firm is headquartered has adopted wrongful discharge laws by year *t*, and zero otherwise. *LABOR* is an indicator variable that equals one if the average labor intensity of the industry is above the sample median, and zero otherwise. Labor intensity is calculated as the ratio of labor and pension expenses to sales. *SMALL* is an indicator variable that equals one if the size of the firm is in the lowest quintile and zero otherwise. The size of the firm is calculated as market value of equity plus total liabilities (assets minus book value of equity). The other variables are defined in the Appendix. All the continuous variables are winsorized at the top and bottom one-percentiles. The one-tailed *p*-values, reported in parentheses, are based on standard errors clustered at the firm level.

Table 7: The impact of the term structure on the effect of cost stickiness on bond yield spreads

	Dependent variable: *SPREAD*	
	(1)	(2)
Unit of observation→	a firm-year	a firm
STICKY	56.353	121.455
	(0.000)	(0.008)
lnMAT	-1.844	-13.287
	(0.264)	(0.076)
STICKY×lnMAT	**-18.555**	**-41.286**
	(0.001)	**(0.023)**
lnTA	-5.779	-0.153
	(0.001)	(0.486)
LEV	30.098	7.848
	(0.012)	(0.385)
ROA	-2.068	-0.639
	(0.000)	(0.207)
INTCOV	0.066	0.091
	(0.304)	(0.349)
CAPINT	5.877	-8.297
	(0.263)	(0.326)
STDRET	7.427	2.518
	(0.000)	(0.010)
STDROA	2.539	5.834
	(0.000)	(0.000)
lnPROC	2.936	22.704
	(0.120)	(0.000)
RATING	-23.414	-31.199
	(0.000)	(0.000)
MULTI	-19.769	-5.208
	(0.000)	(0.242)
Industry Effects	Yes	Yes
Year Effects	Yes	No
Adjusted R^2	0.686	0.692
Number of obs.	3,511	934

Notes: This table reports the results of regressing the at-issue yield spreads on cost stickiness and a vector of firm- and bond-specific control variables, with the inclusion of the interaction term of cost stickiness with bond maturity. The industry indicators are defined based on the Fama and French (1997) 48-industry classification. The other variables are defined in the Appendix. All the continuous variables are winsorized at the top and bottom one-percentiles. Column (1) reports estimation using firm-year observations. Column (2) reports between estimation using average values of variables at the firm level. The one-tailed *p*-values, reported in parentheses, are based on standard errors clustered at the firm level in Column (1).

Table 8: The impact of issuer's future prospects on the effect of cost stickiness on bond yield spreads

	Dependent variable: *SPREAD*			
	PROSPECTS = *BHRET*		*PROSPECTS* = *AEGROWTG*	
	(1)	(2)	(3)	(4)
Unit of observation→	a firm-year	a firm	a firm-year	a firm
STICKY	11.080	39.322	8.059	41.408
	(0.001)	(0.000)	(0.017)	(0.000)
PROSPECTS	-0.390	-0.416	-0.649	0.464
	(0.000)	(0.000)	(0.110)	(0.347)
STICKY* × *PROSPECTS	**-0.171**	**-0.628**	**-2.365**	**-6.410**
	(0.024)	**(0.000)**	**(0.011)**	**(0.032)**
lnTA	-7.010	-1.479	-7.582	1.034
	(0.000)	(0.362)	(0.000)	(0.418)
LEV	32.036	19.243	37.167	16.202
	(0.007)	(0.231)	(0.005)	(0.307)
ROA	-1.920	-0.264	-1.984	-0.239
	(0.000)	(0.366)	(0.000)	(0.402)
INTCOV	0.044	0.125	-0.006	-0.160
	(0.364)	(0.292)	(0.481)	(0.266)
CAPINT	3.568	-19.993	11.322	10.336
	(0.346)	(0.134)	(0.140)	(0.313)
STDRET	7.723	2.730	7.354	3.297
	(0.000)	(0.005)	(0.000)	(0.003)
STDROA	2.502	6.390	2.282	8.051
	(0.000)	(0.000)	(0.000)	(0.000)
lnPROC	3.988	22.273	5.417	35.290
	(0.050)	(0.000)	(0.021)	(0.000)
RATING	-23.464	-31.479	-23.056	-31.825
	(0.000)	(0.000)	(0.000)	(0.000)
MULTI	-21.047	-5.329	-26.817	-8.778
	(0.000)	(0.233)	(0.000)	(0.161)
Industry effects	Yes	Yes	Yes	Yes
Year effects	Yes	No	Yes	No
Adjusted R^2	0.697	0.703	0.711	0.715
Number of obs.	3,511	934	2,459	645

Notes: This table reports the results of regressing the at-issue yield spreads on cost stickiness and a vector of firm- and bond-specific control variables, with the inclusion of the interaction term of cost stickiness with measures of issuer's future prospect. We measured future prospect in two ways: (1) the buy-and-hold return of the issuer over the year prior to the bond issuance (*BHRET*) and (2) the difference between the consensus (mean) analysts' forecast of two-year-ahead annual earnings (made before the bond issuance but after the most recent annual earnings announcement) and the most recent actual annual earnings before the bond issuance, scaled by the stock price at the end of the month of the last annual earnings announcement before the bond issuance (*AEGROWTG*). Both *BHRET* and *AEGROWTG* are expressed as percentages. The industry indicators are defined based on the Fama and French (1997) 48-industry classification. The other variables are defined in the Appendix. All the continuous variables are winsorized at the top and bottom one-percentiles. The analysis using *AEGROWTG* is performed on a smaller sample because of missing *AEGROWTG* data. Columns

(1) and (3) report estimation using firm-year observations. Columns (2) and (4) report between estimation using average values of variables at the firm level. The one-tailed *p*-values are reported in parentheses. The *p*-values in Columns (1) and (3) are based on standard errors clustered at the firm level.

Table 9: The impact of issuer's operation efficiency on the effect of cost stickiness on bond yield spreads

	Dependent variable: *SPREAD*			
	EFFICIENCY = REFF		*EFFICIENCY = ICW*	
	(1)	(2)	(3)	(4)
Unit of observation→	a firm-year	a firm	a firm-year	a firm
STICKY	41.399	103.283	18.407	46.529
	(0.001)	(0.000)	(0.003)	(0.001)
EFFICIENCY	-0.202	-0.325	-10.075	-20.790
	(0.039)	(0.110)	(0.354)	(0.206)
STICKY × EFFICIENCY	**-0.395**	**-1.171**	**87.246**	**120.273**
	(0.008)	**(0.001)**	**(0.007)**	**(0.013)**
lnTA	-3.430	3.925	-3.127	-0.344
	(0.037)	(0.198)	(0.257)	(0.483)
LEV	44.247	19.437	56.159	71.477
	(0.000)	(0.234)	(0.028)	(0.068)
ROA	-1.455	-0.306	-2.012	-0.773
	(0.000)	(0.352)	(0.002)	(0.278)
INTCOV	0.083	0.188	0.075	-0.142
	(0.260)	(0.210)	(0.365)	(0.332)
CAPINT	-4.067	-26.064	1.214	-25.544
	(0.274)	(0.090)	(0.479)	(0.222)
STDRET	7.567	1.934	0.903	1.025
	(0.000)	(0.036)	(0.186)	(0.277)
STDROA	2.612	6.258	10.674	12.147
	(0.000)	(0.000)	(0.000)	(0.000)
lnPROC	3.981	21.489	0.752	9.516
	(0.055)	(0.000)	(0.463)	(0.226)
RATING	-23.366	-31.631	-31.246	-30.958
	(0.000)	(0.000)	(0.000)	(0.000)
MULTI	-22.291	-4.082	-40.987	-61.213
	(0.000)	(0.294)	(0.001)	(0.000)
Industry effects	Yes	Yes	Yes	Yes
Year effects	Yes	No	Yes	No
Adjusted R^2	0.674	0.698	0.710	0.729
Number of obs.	3,431	915	1,004	406

Notes: This table reports the results of regressing the at-issue yield spreads on cost stickiness and a vector of firm- and bond-specific control variables, with the inclusion of the interaction term of cost stickiness with measures of issuer's operation efficiency. The efficiency is proxied by *REFF*, a measure estimated based on DEA analysis and an indicator of internal control weakness (*ICW*). The industry indicators are defined based on the Fama and French (1997) 48-industry classification. The other variables are defined in the Appendix. All the continuous variables are winsorized at the top and bottom one-percentiles. The sample includes observations on nonconvertible bond issues by U.S. firms from 1981 through 2012. The internal control analysis is performed on a smaller sample because internal control weakness data are not available prior to 2004.Columns (1) and (3) report estimation using firm-year observations. Columns (2) and (4) report between estimation using average values of variables at the firm level. The one-tailed *p*-values are reported in parentheses. The *p*-values in Columns (1) and (3) are based on standard errors clustered at the firm level.

Table 10: The impact of competition on the effect of cost stickiness on bond yield spreads

	Dependent variable: *SPREAD*			
	COMPETITION = Low_HHI		*COMPETITION = PCTCOMP*	
	(1)	(2)	(3)	(4)
Unit of observation→	a firm-year	a firm	a firm-year	a firm
STICKY	14.521	49.629	21.574	65.560
	(0.000)	(0.000)	(0.001)	(0.000)
COMPETITION	-0.014	-8.438	-5.200	-34.352
	(0.499)	(0.131)	(0.234)	(0.004)
STICKY × COMPETITION	**-12.595**	**-65.208**	**-26.184**	**-67.677**
	(0.023)	**(0.000)**	**(0.007)**	**(0.001)**
lnTA	-6.282	0.246	-5.653	-2.944
	(0.000)	(0.477)	(0.035)	(0.319)
LEV	30.127	11.216	58.669	102.883
	(0.011)	(0.336)	(0.006)	(0.006)
ROA	-1.999	-0.911	-2.224	-2.212
	(0.000)	(0.121)	(0.000)	(0.041)
INTCOV	0.067	0.172	0.090	0.313
	(0.300)	(0.228)	(0.352)	(0.211)
CAPINT	5.907	-7.079	-3.778	-14.264
	(0.259)	(0.350)	(0.410)	(0.300)
STDRET	2.571	2.494	0.852	2.811
	(0.000)	(0.010)	(0.187)	(0.055)
STDROA	7.431	5.788	9.298	10.180
	(0.000)	(0.000)	(0.000)	(0.000)
lnPROC	3.573	23.244	4.272	34.395
	(0.073)	(0.000)	(0.137)	(0.000)
RATING	-23.332	-31.199	-24.010	-24.538
	(0.000)	(0.000)	(0.000)	(0.000)
MULTI	-20.448	-7.209	-19.368	-6.447
	(0.000)	(0.166)	(0.035)	(0.309)
Industry effects	Yes	Yes	Yes	Yes
Year effects	Yes	No	Yes	No
Adjusted R^2	0.690	0.697	0.707	0.688
Number of obs.	3,511	934	1,272	470

Notes: This table reports the results of regressing the at-issue yield spreads on cost stickiness and a vector of firm- and bond-specific control variables, with cost stickiness interacted with product market competition, which is proxied by an indicator for the Herfindahl Index of the issuer's industry in the lowest tercile in the year prior to bond issuance (*Low_HHI*) and the ratio of competition-related words to total words in the issuer's 10-K in the year prior to bond issuance (*PCTCOMP*). The industry indicators are defined based on the Fama and French (1997) 48-industry classification. The other variables are defined in the Appendix. All the continuous variables are winsorized at the top and bottom one-percentiles. The sample includes observations on nonconvertible bond issues by U.S. firms from 1981 through 2012. The *PCTCOMP* measure is available only from 1995 to 2009. Columns (1) and (3) report estimation using firm-year observations. Columns (2) and (4) report between estimation using average values of variables at the firm level. The one-tailed *p*-values are reported in parentheses. The *p*-values in Columns (1) and (3) are based on standard errors clustered at the firm level.