Rate-Sensitive Debt and Financial Flexibility

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September 21, 2012

I am grateful to David Denis for advice and valuable discussion. I also thank Vikas Agarwal, Mark Chen, Assaf Eisdorfer, Shantaram Hegde, Lixin Huang, Jayant Kale, Omesh Kini, Reza Mahani, Steven Mann, Steven Mann, Vassil Mihov, Joshua Pierce, Eric Powers, Sergey Tsyplakov, Andrey Ukhov, Emre Unlu, Hong Yan and seminar participants at Georgia State University, Texas Christian University, University of Connecticut, University of Nebraska-Lincoln and University of South Carolina for helpful comments and suggestions.

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Abstract

We examine the role of rate-sensitive (i.e. short-term and floating-rate) debt in the capital structure of publicly traded industrial US firms. We find that an overwhelming majority of them use at least one kind of rate-sensitive debt. However, larger firms are more likely to use short-term debt while smaller firms prefer floating-rate debt. 70% to 79% of the time rate-sensitive leverage (i.e. the ratio of rate-sensitive debt to total assets) changes in the same direction as total leverage and absorbs from 60% to 85% of the change in the latter. As a result, leverage adjustments are associated with changes in debt structure as measured by the ratio of rate-sensitive to total debt. Moreover, firms have individual targets for rate-sensitive leverage that are determined mostly by their contemporary leverage ratios. Firms adjust their rate-sensitive leverage toward those targets with speeds of 45% to 68%. Our evidence thus suggests that firms not only use rate-sensitive debt as transitory, i.e. the debt that they plan to eventually retire, but also manage their debt structure in such a way as to balance the benefits of financial flexibility and risks associated with carrying rate-sensitive debt.

JEL Classification: G32
Keywords: Financial Flexibility, Debt, Leverage

1. Introduction

Extant research suggests that debt management plays a major role in corporate capital structure policies. According to the survey by Graham and Harvey (2001), the two most important factors considered by firms when making capital structure decisions are financial flexibility and credit ratings. Most CEOs also indicate that their firms have either fixed or flexible leverage targets; however, empirical evidence on leverage targeting is mixed. First of all, recent estimates of the speed of adjustment by Lemmon, Roberts and Zender (2008), Huang and Ritter (2009) and Faulkender, Flannery, Hankins and Smith (2012) are as low as approximately 22%. Evidence of corporate behaviors inconsistent with leverage targeting has also been presented in the literature. For instance, Welch (2004) finds that firms take no action to reverse leverage changes induced by changes in stock prices. Denis and McKeon (2012) find that firms often issue sensible amounts of debt to finance their investing activities even when that results in deviations from applicable leverage targets. At the same time, Kayhan and Titman (2007) find that firms eventually reverse changes in book leverage caused by financial deficit.

DeAngelo, DeAngelo and Whited (2011) propose a theory in which flexibility achieved by preserving borrowing capacity is the main driver of capital structure decisions. In their model, firms have low long-term leverage targets but intentionally deviate from those when they need to finance spontaneously arising investment opportunities. As a result, firms end up carrying substantial amounts of transitory debt, i.e. the debt that they plan to eventually retire. DeAngelo, DeAngelo and Whited (2011) emphasize that transitory debt is identified by the firm's intention to retire it in the future and not by its maturity. Their model treats all debt as homogeneous, presumably long-term debt that firms roll over or pay off at their discretion.

In this paper, we hypothesize that, most often, firms must find it *ex ante* optimal to borrow at flexible rates when financing non-recurring investment opportunities. The disadvantage of financing such opportunities with conventional, i.e. non-callable fixed-rate debt of excessive maturity is obvious because the firm that does so will eventually have to incur additional costs of buying that debt back in a tender offer[1]. Attaching a call option to conventional debt may seem to be a relatively inexpensive solution[2]. However, it still does not eliminate the *ex ante* costs of retiring the debt before its maturity because the call price cannot be lower than the face value of the debt. Thus, issuing a callable n-year fixed-rate bond with the intent to call it after m years ($m < n$) is at best equivalent to issuing an m-year bond and attaching to it the coupon appropriate for the n-year instrument. The firm that does so will lock in an excessive interest rate whenever it faces an upward sloping yield curve[3].

Matching the maturity of newly issued debt with the timing of its prospective retirement would be a complete remedy. However, investment opportunity shocks are random and so is the amount of funds needed to respond to them in a particular year. The firm therefore may not be able to foresee with sufficient degree of confidence when it will have the capability to retire the newly issued debt. Under such circumstances, the firm is likely to choose to issue short-term debt and roll it over as necessary. Alternatively, the firm may issue callable floating-rate debt that will be free from the *ex anti* costs of early retirement because its interest payments do not depend on its maturity. In this paper, we collectively refer to short-term and floating-rate debt as

[1] According to Mann and Powers (2007), tender offer premiums are typically as high as 5.5% of the bond's face value

[2] Powers and Tsyplakov (2008) find that incremental yields of bonds with make-whole call provisions typically fall in the range of 13 to 24 basis points.

[3] Figure 1 plots historical monthly values of the term spread over our sample period of 1975 to 2009. Positive term spread (and upward sloping par yield curve) is observed in as few as 41 out of the total 420 months in our sample period. Moreover, in 291 months the term spread is at least 1%. The term spread is defined as the difference in yields between the ten-year and the six-month Treasury securities. We obtain these yields from the Fred database of Saint-Louis Fed.

rate-sensitive[1], which category naturally includes commercial paper and bank lines of credit studied by Rauh and Sufi (2010), Kahl, Shivdasani and Wang (2011), Gao and Yun (2009) and by Flannery and Lockhart (2009). In summary, we hypothesize that it is beneficial for firms to use rate-sensitive debt as transitory[2].

We test our hypothesis on a sample of publicly traded non-financial U.S. firms that we collect from the merged CRSP and Compustat database. The sample covers the period of 1975 to 2009. We find that the probability of using either kind of rate-sensitive debt by a firm is positively associated with its leverage. However, users of short-term debt tend to differ from users of floating-rate debt in other characteristics, especially in size. While larger firms are more likely to use short-term debt, smaller firms prefer floating-rate debt. This difference in practices can be at least partially attributed to a difference in the sources of debt. Specifically, larger firms are more likely to have access to the commercial paper market, whereas smaller firms are more likely to use bank debt that often bears flexible interest rate (Vickery (2008)). The systematic difference in characteristics between firms using the alternative types of rate-sensitive debt leads us to perform further analysis back-to-back for i) users of short-term debt, ii) users of floating-rate debt and iii) users of both kinds of rate-sensitive debt. Consistent with our hypothesis, we find close similarities in the behavior of firms in all three groups.

Changes in rate-sensitive leverage (i.e. the ratio of rate-sensitive debt to total assets) are closely associated with changes in total leverage. Across users of short-term debt, floating rate debt and both kinds of rate-sensitive debt, rate-sensitive leverage changes in the same direction

[1] We borrow this term from bank management where a certain asset or liability is classified as rate-sensitive in a particular time period if its interest rate will be reset during that period.

[2] That does not imply, however, that all conventional long-term debt carried by a firm is permanent, particularly because the distinction between short-term and long-term debt is qualitative in nature. For instance, a five year note issued to finance an investment opportunity that is expected to pay off also in five years satisfies the definition of transitory debt.

as total leverage in 69.5%, 78.7% and 74.4% of firm years, respectively. Across these observations, the change in rate-sensitive leverage typically accounts for as much as 60%, 82% and 85% of the total change in leverage for the three groups of firms. As rate-sensitive debt absorbs disproportionately large shares in adjustments of total leverage, those adjustments are accompanied by significant changes in debt structure as measured by the ratio of rate-sensitive debt to total debt.

Both kinds of rate-sensitive debt expose the firm to interest rate risk, and short-term debt additionally exposes it to rollover risk. We therefore hypothesize that carrying too much rate-sensitive debt must be costly to the firm, so there must exist an optimal level of rate-sensitive debt. We indeed find that our sample firms have rate-sensitive leverage targets that are determined mostly by their contemporary leverage ratios. Firms adjust their rate-sensitive leverage toward those targets with speeds of 45.4% to 68.2%. Our evidence thus suggests that firms actively manage their debt structures to balance the benefits of financial flexibility and risks associated with carrying rate-sensitive debt. Finally, we find that 58.1% to 62.6% of non-synchronous adjustments of total and rate-sensitive leverage (i.e. those made in opposite directions) are consistent with rate-sensitive leverage targeting.

The rest of the paper is organized as follows. Section 2 describes the sample. Section 3 examines the characteristics of firms that use rate-sensitive leverage. Section 4 presents empirical results on the role of rate-sensitive debt in capital structure adjustments. Section 5 discusses rate-sensitive leverage targeting. Section 6 concludes the paper.

2. Data.

Our sample is constructed using data from the merged CRSP and Compustat database. We include firm years in which the primary security is common stock (code 10 and 11) traded on NYSE, AMEX or NASDAQ at fiscal year-end. We require non-missing data on total assets (AT), total liabilities (LT), preferred stock (PSTKRV or UPSTK), earnings before interest and taxes (EBIT), and market capitalization at fiscal year-end (MKVALT_F) or common shares outstanding (CSHO) and share price at fiscal year-end (PRCC_F). We exclude financial firms (SIC codes 6000-6799), firms with negative book equity and those with zero or missing total debt. We also exclude firms with zero or missing rate sensitive debt (i.e. the sum of short-term and floating-rate debt) in all cases except when calculating leverage targets. The data variables used in this paper are defined as follows.

1. Simple variables:

A_t – total book assets (AT)[1];

E_t – earnings before interest and taxes (EBIT);

NI_t – net income (NI);

D_t^{ST} – short-term debt defined as notes payable (NP);

D_t^{FR} – floating-rate debt or debt tied to prime (DTTP);

L_t – total liabilities (LT);

RD_t – research and development expense (XRD);

DEP_t – depreciation and amortization expense (DP);

FA_t – net fixed assets (PPENT).

[1] Abbreviations in parentheses are names of the corresponding Compustat data fields

2. Calculated variables:

BE_t – book equity equals total book assets minus total liabilities (LT) plus Deferred Taxes and Investment Tax Credit (TXDITC) minus preferred stock (PSTKL or PSTKRV or UPSTK)

ME_t – market value of equity (MKVALT_F or PRCC_F times CSHO)

V_t – market value of the firm, $V_t = A_t - BE_t + ME_t$

D_t^{LT} - long-term debt (DLTT plus short-term portion DD1);

D_t – total debt, $D_t = D_t^{ST} + D_t^{LT}$

DIV_t – cash dividends (DV or DVC plus DVP).

I_t – net investment outlay, I_t = CAPX + IVCH + AQC – SPPE – SIV + $RD_t(1 - T_t)$, where the effective tax rate T_t equals income tax expense (TXT) divided by its sum with the net income (NI) if the latter is positive and zero otherwise.

FD_t – financial deficit. Following Kayhan and Titman (2007), we define it the a sum of net debt and equity issues: $FD_t = \Delta D_t + \Delta SE_t - \Delta RE_t = \Delta D_t + \Delta A_t - \Delta L_t - NI_t + DIV_t$, where $SE_t = A_t - L_t$ is shareholders' equity.

For all Compustat variables in the above definitions except AT, LT, PSTKL, PSTKRV, UPSTK, TXDITC, EBIT, MKVALT_F, PRCC_F and CSHO we replace missing values with zeros. As data on long-term debt tied to prime are available starting from 1974 and in part of our tests we require its availability in year t and $t - 1$, our sample covers the period from 1975 to 2009.

Table 1 reports average annual counts of firms in our sample. Over the period of 1975 to 2009, the total number of our sample firms averages at 2,916 with a peak of 3,988 during 1990-99. Over the entire sample period, firms using short-term debt and those that use floating-rate debt account for 44.1% and 35.7% of all firms, respectively. However, the mean share of the former declines from 55.3% to 33.1% while that of the latter grows from 31.6% to 39.9%. As a result, the share of firms using at least one kind of rate-sensitive debt only slightly decreases from 71.0% in 1975 to 62.2% in 2009.

3. Which firms use rate-sensitive debt?

Table 2 reports the characteristics of firms that have short-term debt in their capital structure, firms that use floating-rate debt and firms that use no rate-sensitive debt of either kind. Our choice of explanatory variables is motivated by Fan, Titman and Twite (2012) who identify firm size, profitability, asset tangibility, and growth opportunities as major determinants of corporate debt maturity structure. We supplement this list with investment outlays and leverage, so our set of potentially relevant firm characteristics includes total assets (A_t), EBIT per dollar of total assets (E_t/A_t), net fixed assets per dollar of total assets (FA_t/A_t), market-to-book ratio (V_t/A_t), net investment outlay per dollar of total assets (I_t/A_t) and book leverage (D_t/A_t). We use book leverage because extant empirical evidence suggests that firms manage it more actively than market leverage. For instance, Welch (2004) finds that firms take no actions to reverse changes in their market leverage caused by changes in stock prices. At the same time, Kayhan and Titman (2007) find that in the long run firms reverse deviations from their book leverage targets.

We can see from Table 2 that users of rate-sensitive debt tend to have higher leverage and lower market-to-book ratios than firms that only use fixed-rate debt. Users of rate-sensitive debt also generate higher earnings and have lower investment spendings. At the same time, users of short-term debt tend to be significantly larger than users of floating-debt.

Median characteristics in the right panel of the table suggest that users of short-term debt typically carry little if any floating-rate debt, whereas users of floating-rate debt typically carry little if any short-term debt. This pattern is of special interest to us because of the possibility that the two kinds of rate-sensitive debt come from different sources. Specifically, Denis and Mihov (2003) find that larger firms, as well as firms with good credit ratings, are more likely to use public debt. In contrast, smaller firms are more likely to use bank debt that often bears variable interest rate (Vickery (2008)).

Credit rating statistics provided in Table 2 are generally consistent with the source of debt hypothesis as the percentage of firms having either short-term or long-term credit rating is the highest among users of short-term debt and the lowest among users of floating rate debt. At the same time, only 13.7% of firms using short-term debt have short-term credit rating which may be a result of less than comprehensive coverage of credit ratings by Compustat. It is equally possible that the difference in the sources of debt is only a partial explanation of the systematic difference in characteristics between firms that use each kind of rate-sensitive debt. Indeed, commercial paper does not require registration with the SEC and thus must be the instrument of choice for firms that have access to the capital market. Nevertheless, those firms still have the option of issuing long-term bonds with floating-rate coupons available to them. Firms that use bank debt are likely to be scrutinized each time they obtain a loan, so it seems logical for them to borrow long-term at a flexible rate and repay the loan early if necessary. At the same time, short-term commercial loans remain a possibility for them.

We extend our analysis by constructing logit regressions to explain which firms use each kind of rate-sensitive debt. The dependent variable in these regressions equals 1 if the firm has short-term (floating-rate) debt in its capital structure in the particular year, and 0 otherwise. To control for the likely clustering of errors both across firms and in time, we use the logit2 procedure for Stata that handles two-dimensional clustering according to Petersen (2009) and is available on Mitchell Petersen's Web site.

The estimated coefficients are reported in Table 3. They indicate that the probability that a firm will use either kind of rate-sensitive debt in year *t* increases in its leverage (D_t/A_t) and decreases in market-to-book ratio (V_t/A_t). They also confirm that larger firms are more likely to use short-term debt whereas smaller firms prefer floating-rate debt.

While specification 1 and 3 only use firm characteristics as explanatory variables, specification 2 and 4 additionally include dummy variables that indicate whether the firm used short-term (floating-rate) debt in the preceding year and whether it has short-term and long-term debt rating. Large positive slopes that we obtain on the "prior-year user" dummy indicate that once firms choose to use short-term or floating-rate debt, they tend to stick with that decision. The slopes on the short-term rating dummy imply that rated firms have a preference for short-term debt and non-rated firms for floating-rate debt. A negative and significant slope on the long-term rating dummy in specification 2 indicates that firms that have long-term debt rating also have a choice of issuing public floating-rate debt available to them. However, the sum of the slopes on the two rating dummies in specification 2 is still positive and significant, implying that firms with both short-term and long-term debt ratings are still more likely to use short-term debt.

The systematic difference in characteristics between firms using the two alternative kinds of rate-sensitive debt and the stickiness of their choice leads us to partition our sample accordingly. To allow for simultaneous use of both kinds of rate-sensitive debt, we categorize our sample firms as i) users of short-term but not floating-rate debt, ii) users of floating-rate but not short-term debt and iii) users of both short-term and floating-rate debt. We sort our sample firms into these categories annually and analyze them back-to-back. We view the similarity of results across all three categories of firms as a natural robustness check.

4. The role of rate-sensitive debt in leverage adjustments.

4.1. Relating changes in rate-sensitive leverage to changes in total leverage

Table 4 reports mean firm characteristics across the firm years in which increases (decreases) in rate-sensitive leverage (i.e. in the ratio of rate-sensitive debt to total assets) are observed. We observe that, on average, changes in rate-sensitive debt have the same sign as changes in total debt across firms in each of the three categories[1]. Because of this correlation, it is not surprising that the firms that increase their rate-sensitive leverage tend to be less profitable and have higher investment expenditures than the firms that reduce it.

The positive association between changes in rate-sensitive leverage and those in total leverage could be a result of our sample firms' pursuing stable debt maturity structure. Whether this explanation is plausible will be the subject of our investigation in the rest of this section.

4.2. Comparative adjustment frequencies

Having found that firms typically adjust their total leverage and its rate-sensitive component in the same direction, we proceed with comparing the percentage of firms that actually do so as opposed to the firms that behave in the opposite way. We address this question in Table 5.

Panel A of the table reports comparative frequencies of adjustment types defined by the combination of signs of the total leverage adjustment ($D_t/A_t - D_{t-1}/A_{t-1}$) and the change in its

[1] Changes in total debt are smaller in magnitude than changes in rate-sensitive debt because of the impact of those firm-year observations in which they have opposite signs

rate-sensitive component ($D_t^{RS}/A_t - D_{t-1}^{RS}/A_{t-1}$). When calculating all frequencies reported in Table 5, we exclude as trivial those firm years in which $D_t/A_t = D_t^{RS}/A_t$ and $D_{t-1}/A_{t-1} = D_{t-1}^{RS}/A_{t-1}$. The table shows, for instance, that among users of short-term debt changes in both ratios are positive in 33.3% and negative in 36.2% of firm years, whereas across the remaining observations they have opposite signs. Overall, users of short-term debt adjust their total and rate-sensitive leverage in the same direction 69.5% of the time. The corresponding frequencies for users of floating-rate debt and for users of both kinds of rate-sensitive debt are 78.7% and 74.4%, respectively.

Changes in common equity due to stock sales (repurchases) and to earnings retention will induce synchronous changes in total and in rate-sensitive leverage even if the firm keeps the amount and structure of its debt constant. To check whether our results in any part can be attributed to equity-driven leverage changes, we modify the definition of leverage adjustments to have them reflect only changes caused by debt management. Specifically, we define active changes in total and rate-sensitive leverage as $D_t/A_t - D_{t-1}/A^P{}_t$ and $D^{RS}{}_t/A_t - D^{RS}{}_{t-1}/A^P{}_t$, where $A^P{}_t = D_{t-1} + BE_t$. Statistics of these active adjustments are reported in Panel C of Table 5. The frequency of synchronous changes in total and rate-sensitive debt in this case is 69.9% for users of short-term debt, 73.7% for users of floating-rate debt and 74.3% for users of both kinds of rate sensitive debt. These figures are very close to the frequencies reported in Panel A, so we conclude that our results in this section are not confounded by equity-driven leverage changes.

4.3. The share of rate-sensitive debt in leverage adjustments

High frequencies of synchronous changes in total and rate-sensitive leverage are consistent with our proposition about the transitory role of rate-sensitive debt but can as well have different explanations. For instance, traditional debt maturity theories imply that firms pursue stable debt structures, which should also produce frequent synchronous changes in all kinds of debt that they carry. We therefore proceed with regressions to explain the magnitude of changes in rate-sensitive leverage. We must acknowledge, however, that no agreement exists in extant literature about the association between leverage and debt structure. For instance, Barclay and Smith (1995) do not control for leverage in their panel regressions for the share of long-term debt in total debt. In the model of Barclay, Marx and Smith (2003), leverage and effective debt maturity are determined simultaneously. Fan, Titman and Twite (2012) do not allow for a causal relation between debt maturity and leverage but arrive at similar sets of determinants for each of them. Finally, Fama and French (2012) use largely similar specifications to explain changes in leverage and in the percent of short-term (long-term) debt without explicitly including the former as a determinant of the latter[1].

We therefore consider the possibility that changes in both ratios are determined by the same factors. Although we do not have a ready list of candidate determinants for changes in rate-sensitive leverage, the determinants of adjustments in total leverage are well-known from the literature on capital structure. Those are leverage deficit ($[D/A]_t^* - D_{t-1}/A_{t-1}$) according to the trade-off theory and financial deficit according to the pecking order theory.

We defined financial deficit in Section 2, so we only need to define leverage deficit at this point. We specify firm-specific leverage targets necessary for calculation of the leverage deficit as $[D_{i,t}/A_{i,t}]^* = \boldsymbol{\beta}\mathbf{X}_{i,t-1} + \eta_i$, where $\mathbf{X}$ is a matrix of firm characteristics, $\boldsymbol{\beta}$ a vector of coefficients and η_i firm dummies. It is necessary to include these dummies because leverage ratios of individual firms are known to be persistent (Lemon, Roberts and Zender (2008)). As the

[1] Fama and French (2012) regressions include deviations from target leverage and target debt structure as explanatory variables. We will discuss rate-sensitive leverage targeting in Section 6.

components of **X** we use the set of firm characteristics from Flannery and Rangan (2006) that includes

$\left[\frac{D}{A}\right]_t^{Ind}$ *or* $\left[\frac{D}{V}\right]_t^{Ind}$ - median leverage of firms in the same industry. We use the industry classification from Fama and French (1997);

E_t/A_t – EBIT per dollar of book assets;

V_t/A_t – market-to-book ratio of assets;

$ln(A_t)$ – logarithm of the value of book assets expressed in millions of 1983 dollars[1];

DEP_t/A_t – depreciation expense per dollar of book assets;

FA_t/A_t – net fixed assets as a percent of total assets;

RD_t/A_t – R&D expenses per dollar of book assets;

RDD_t – an indicator variable that equals 1 if the data on the firm's R&D expenses in year are missing on Compustat and 0 otherwise.

We obtain the vector of coefficients $\boldsymbol{\beta}$ by estimating the partial adjustment model

$$\frac{D_{i,t}}{A_{i,t}} = \lambda \mathbf{X}_{i,t-1}\boldsymbol{\beta} + (1-\lambda)\frac{D_{i,t-1}}{A_{i,t-1}} + \hat{\eta}_i + \delta_{i,t} \tag{1}$$

where $\hat{\eta}_i = \lambda \eta_i$ and $\delta_{i,t}$ is the error term.

OLS estimates of the slope on the lagged dependent variable on short panel data in specifications such as (1) are known to be biased (Bond (2002)). To mitigate the bias, Lemmon, Roberts and Zender (2008) propose to use the system GMM approach of Blundell and Bond (1998). Flannery and Hankins (2011) compare properties of several different methods and find that the system GMM approach indeed allows estimating the SOA with the smallest bias. We therefore use the system GMM approach to estimate regression (1). We obtain a λ of 22.6% that

[1] We obtain the consumer price index from the FRED database of St. Louis Fed.

is sufficiently close to the system GMM estimates of 21.9%-22.1% obtained by Lemmon, Roberts and Zender (2008) and by Faulkender, Flannery, Hankins and Smith (2012).

Specification 1 in Table 6 is a regression of the change in rate-sensitive leverage ($D^{RS}_t/A_t - D^{RS}_{t-1}/A_{t-1}$) on leverage deficit and financial deficit. The slopes on both explanatory variables in this regression are positive and significant, which indicates that these variables could be common determinants of changes both in total and in rate-sensitive leverage. Specification 2 additionally includes the change in total leverage ($D_t/A_t - D_{t-1}/A_{t-1}$) as an explanatory variable and produces large positive and significant slopes on it for all three groups of firms-users of rate-sensitive debt. More importantly, the slopes on leverage deficit and financial deficit in Specification 2 are either statistically insignificant or economically small. We thus conclude that the change in total leverage per se is the actual determinant of the change in rate-sensitive leverage. As a robustness test, we repeat the analysis in Specification 3 and 4 using active changes in total and rate-sensitive leverage to obtain the same results.

The values of the slope on the change in total leverage in Specification 2 and 4 are well above 0.5 for all three groups of firms in question. Thus, rate-sensitive debt typically absorbs a major part of the change in the firm's overall leverage ratio, which implies that leverage adjustments must be accompanied by changes in debt structure. To show this, we use the change in the ratio of rate-sensitive debt to total debt ($D^{RS}_t/D_t - D^{RS}_{t-1}/D_{t-1}$) as the dependent variable in specifications 5 and 6. Similar to the specifications discussed earlier, the slopes on leverage deficit and financial deficit are statistically and economically significant if the change in total leverage is not included as an explanatory variable (Specification 5). When we include total leverage in Specification 6, however, we obtain both large and significant slopes on it and much smaller slopes on leverage deficit and on financial deficit. Specification 6 also has substantially higher explanatory power than Specification 5, which indicates that the change in total leverage is also the most important determinant of the split between rate-sensitive and conventional debt in the capital structures of our sample firms.

In summary, 69.5% to 78.7% of the time our sample firms adjust their rate-sensitive leverage in the same direction as total leverage. In those observations, rate-sensitive debt accounts for 60% to 85% of the overall adjustment in the leverage ratio by magnitude. This suggests that firms issue long-term debt when they expect it to become a long-term addition to their leverage and rate-sensitive debt otherwise. This way, they build a cushion of rate-sensitive debt when they anticipate future leverage reductions and later implement those reductions mainly by retiring rate-sensitive debt.

5. Rate-sensitive leverage targeting.

We have argued that it is optimal for firms to use rate-sensitive debt as transitory. At the same time, it may be undesirable for them to carry excessive loads of rate-sensitive debt because of the resulting exposure to interest-rate risk and, in case of short-term debt, to rollover risk. This trade-off between lower *ex ante* costs of retiring the debt before maturity and the said risks suggests that there must exist an optimal level of rate-sensitive leverage. Therefore, we examine in this section whether our sample firms indeed pursue rate-sensitive leverage targets.

5.1. Partial adjustment regressions for rate-sensitive leverage.

We apply the methodology commonly used in empirical literature on capital structure by investigating whether the dynamics of rate-sensitive leverage are consistent with the partial adjustment model

$$\frac{D_{i,t}^{RS}}{A_{i,t}} = \lambda \left[\frac{D_{i,t}^{RS}}{A_{i,t}} \right]^{*} + (1-\lambda) \frac{D_{i,t-1}^{RS}}{A_{i,t-1}} + \delta_{i,t} \tag{2}$$

where $\left[\frac{D_{i,t}^{RS}}{A_{i,t}} \right]^{*}$ is the rate-sensitive leverage target of firm i in year t, λ the speed of adjustment (SOA), and $\delta_{i,t}$ an error term. We define the rate-sensitive leverage target as $\left[\frac{D_{i,t}^{RS}}{A_{i,t}} \right]^{*} = \mathbf{X}_{i,t}\boldsymbol{\beta} + \eta_i$, where $\mathbf{X}$ is a matrix of firm characteristics, $\boldsymbol{\beta}$ a vector of coefficients and η_i a firm dummy. As determinants of the rate-sensitive leverage target, we use the same firm characteristics as in our logit regressions in Section 3, namely book leverage D_t/A_t, log of total assets $Ln(A_t)$, EBIT per dollar of total assets E_t/A_t, percent of fixed assets FA_t/A_t, net investment per dollar of total assets I_t/A_t, and market-to-book value of assets V_t/A_t.

As we discussed in Section 4.2, estimating specification (2) by OLS with fixed effects on short panel data produces biased SOA values. A common practice in contemporary literature on capital structure is to use the system GMM estimator of Blundell and Bond (1998) instead. Flannery and Hankins (2011) find it to be least biased among several estimators that they compare on simulated panel data. Our concern is, however, that Flannery and Hankins (2011) test the estimators on balanced panels, and our main sample is unbalanced by its nature. Moreover, it is obviously less balanced than the panel data on which we, as well as other authors, estimate leverage targets because our main sample does not include firm years with zero rate-sensitive debt. We eventually choose not to use the system GMM approach here but to estimate regression (2) by OLS and employ a Monte-Carlo simulation to estimate its bias on our sample.

Column 1 in Panel A of Table 7 reports the initial OLS estimation results for users of short-term debt. The regression includes firm dummies, so it is sufficient for us to calculate standard errors robust to heteroskedasticity and time series effects (see Petersen (2009)). We report standard errors instead of t-statistics in Table 7 because this time we are primarily concerned with the precision of the estimated slopes as opposed to their statistical significance.

With the only exception of the slope on the market-to-book value (V_t/A_t), all coefficients in Column 1 are highly statistically significant. However, all slopes but those on lagged rate-sensitive leverage ($D^{RS}{}_{t-1}/A_{t-1}$) and on total leverage (D_t/A_t) have relatively low economic significance. For instance, a variation in leverage from 0 to 0.9 in our sample induces a variation in the dependent variable from 0 to approximately 0.20. In comparison, a variation in the size variable $Ln(A_t)$ from 0 to 6 (which corresponds to the variation in total assets approximately from \$1 million to \$500 billion) induces a variation in the dependent variable from 0 to 0.05 only. Leverage ratio D_t/A_t is therefore the most important determinant of the rate-sensitive leverage target.

Our OLS estimate of the slope on $D^{RS}{}_{t-1}/A_{t-1}$ is biased downward, which implies an upward bias in the estimated SOA λ. To adjust for the bias, we construct a simulation procedure with a data generating process based on equation (2). In order to closely model both the structure of our data and the distribution of the error term $\delta_{i,t}$, we build on the set of firm-year observations that are present in our sample. We first calculate errors $\delta_{i,t}$ from the above regression, the values of rate-sensitive leverage target $\left[\frac{D_{i,t}^{RS}}{A_{i,t}}\right]^*$ and those of end-of-year rate-sensitive leverage deficit $\left[\frac{D_{i,t}^{RS}}{A_{i,t}}\right]^* - \frac{D_{i,t}^{RS}}{A_{i,t}}$ for all firm-year observations in our sample. For each firm, we start with the rate-sensitive leverage target in the first year of its presence in the sample and add to it the value of end-of-year rate-sensitive leverage deficit from a randomly chosen firm year. We then calculate the levels of rate-sensitive leverage for the firm in subsequent years as $\frac{D^{RS}_{i,t}}{A_{i,t}} = \hat{\lambda}\mathbf{X}_{i,t}\hat{\boldsymbol{\beta}} + \left(1-\hat{\lambda}\right)\frac{D^{RS}_{i,t-1}}{A_{i,t-1}} + \hat{\eta}_i + \tilde{\delta}_{i,t}$ using its actual characteristics $\mathbf{X}_{i,t}$ in those years and the parameter estimates $\hat{\lambda}$, $\hat{\boldsymbol{\beta}}$, and $\hat{\eta}_i$ from the initial OLS regression reported in Column 1 of Panel A. We come up with the error terms $\tilde{\delta}_{i,t}$ by randomly drawing them with replacement from the set of errors $\hat{\delta}_{i,t}$ from the said OLS regression.

We follow the above procedure to generate 500 samples of data and estimate regression (2) by OLS on each of them. Column 2 of Panel A reports average coefficients across those estimations and their standard errors. For users of short-term debt, this simulation produces the speed of adjustment (SOA) λ = 1 – 0.1941 = 0.8059 whereas the SOA specified in the data generating process was 1 – 0.3435 = 0.6565. Thus, on the subset of firms-users of short-term debt the OLS estimator is biased upward by approximately 14.9%, and the true SOA is approximately 65.7% − 14.9% = 50.8%. This estimate is sufficiently high for us to conclude that firms indeed have rate-sensitive leverage targets that depend on their contemporary leverage and, to a lesser extent, on other characteristics.

To obtain more precise estimates of the rate-sensitive leverage targets and to assess their precision, we correct the parameters of the data generating process for their estimated bias. For instance, the slope on D_t/A_t in the original data generating process was 0.2167, and the average slope in our simulation was 0.2464. The corresponding slope that we use in the new data generating process is therefore 0.2167 – (0.2464 – 0.2167) = 0.1870. The full set of the new parameters of the data generating process is shown in Column 3. We again generate 500 data samples using these new parameters and estimate regression (2) on each sample again. Average slopes from the new simulation are reported in Column 4. They lie well within one standard deviation from the benchmark slopes from Column 1, so we accept the parameters of the last data generating process as unbiased estimates of the true slopes in regression (2).

To conserve space, Panel B of Table 7 only reports results from the initial OLS estimation, parameters of the final DGP that we accept as unbiased estimates of the true slopes and results from the last simulation for the other two groups of firms-users of rate-sensitive debt. Our final SOA estimates are 45.4% for users of floating-rate debt and 68.2% for users of both short-term and floating-rate debt. These values are also consistent with rate-sensitive leverage targeting by our sample firms. They imply that firms actively manage their debt structure in such a way as to balance the benefits of financial flexibility and risks associated with carrying rate-sensitive debt.

5.2. Non-synchronous adjustments of total and rate-sensitive leverages.

When establishing the transitory role of rate-sensitive debt in Section 4, we focused on those 70% to 79% of firm-years in which total and rate-sensitive leverage change in the same direction. We gave up on the remaining 21% to 30% observations because in those firm years changes in rate-sensitive leverage obviously could not be driven by changes in total leverage. We now return to the issue of non-synchronous adjustments of total and rate-sensitive leverage to investigate whether they can be at least partially explained by rate-sensitive leverage targeting. We specifically hypothesize that i) a firm must be more likely to adjust its rate-sensitive leverage synchronously with total leverage if doing so will bring it closer to the target rate-sensitive leverage and ii) a firm must be more likely to adjust its rate-sensitive and total leverage in opposite directions if a synchronous adjustment would drive it further away from its target rate-sensitive leverage.

In order to test our hypothesis, we sort the firm-year observations in our sample into eight bins by the combination of signs of rate-sensitive leverage deficit ($[D^{RS}_{i,t}/A_{i,t}]^* - D^{RS}_{i,t\text{-}1}/A_{i,t\text{-}1}$), change in total leverage ($D_{i,t}/A_t - D_{i,t\text{-}1}/A_{i,t\text{-}1}$) and change in rate-sensitive leverage ($D^{RS}_{i,t}/A_{i,t} - D^{RS}_{i,t\text{-}1}/A_{i,t\text{-}1}$). The number of firm years in each bin is reported in Panel A of Table 8. We note that non-synchronous adjustments account for 8.4% to 19.9% of the firm years in which rate-sensitive leverage deficit and the change in total assets have the same sign as opposed to 45.3% to 59.9% in the remaining firm years.

Panel B summarizes the statistics from Panel A. It shows that 58.1% of non-synchronous adjustments of total and rate-sensitive leverage across users of short-term debt, 59.3% across users of floating-rate debt and 62.6% across users of both kinds of rate-sensitive debt, are consistent with rate-sensitive leverage targeting.

5.3. The role of real-time adjustment costs.

Clarification is needed on the phenomenon of rate-sensitive leverage targeting in comparison with our earlier finding that changes in rate-sensitive leverage are determined by changes in total leverage. As rate-sensitive leverage targets are primarily determined by total leverage, the two characterizations are not genuinely different. Indeed, Specification 2 in Table 6 can be reduced to

$$\frac{D^{RS}_{i,t}}{A_{i,t}} - \frac{D^{RS}_{i,t-1}}{A_{i,t-1}} = \alpha\left(\frac{D_{i,t}}{A_{i,t}} - \frac{D_{i,t-1}}{A_{i,t-1}}\right) + \varepsilon_{i,t} \tag{3}$$

by dropping low-importance explanatory variables from it, and the partial adjustment model (2) can be rearranged as

$$\frac{D_t^{RS}}{A_t} - \frac{D_{t-1}^{RS}}{A_{t-1}} = \lambda\left(\left[\frac{D_{i,t}^{RS}}{A_{i,t}}\right]^* - \frac{D_{i,t-1}^{RS}}{A_{i,t-1}}\right) + \delta_{i,t} \tag{4}$$

It is easy to show that in the idealized case of $\lambda = 1$ and $\varepsilon_{i,t} = \delta_{i,t} = 0$ both models generate identical predictions of the change in rate-sensitive leverage in all firm years. In our sample, according to Table 8, rate-sensitive leverage deficit and the change in total leverage (and thus the changes in rate-sensitive leverage predicted by the two models) are different although well correlated, and they have the same sign in 65.5%, 73.6% and 72.4% of the firm years across users of short-term debt, floating-rate debt and both kinds of rate-sensitive debt, respectively.

Of the two models, the partial adjustment specification (4) appears to be more comprehensive as it incorporates both our main argument about the expected costs of early debt retirement and the recognition of risks associated with carrying rate-sensitive debt. The question is why on real data the explanatory power of the change in total leverage is not fully subsumed by that of the rate-sensitive leverage deficit.

We hypothesize that the reason is that flexible-rate instruments such as commercial paper and credit lines allow firms to issue debt promptly and in arbitrary increments. Thus, they can be used in bridge financing to reduce firms' real-time (as opposed to expected) leverage adjustment costs. We therefore expect that in the firm years with sufficiently large (small) changes in total leverage, changes in rate-sensitive leverage will be larger (smaller) than those predicted by the partial adjustment model that we estimated on the full sample.

We test this hypothesis on the set of firm years in which changes in total leverage and rate-sensitive leverage deficits have the same sign, i.e. $\left(\frac{D_{i,t}}{A_{i,t}} - \frac{D_{i,t-1}}{A_{i,t-1}}\right)\left(\left[\frac{D_{i,t}^{RS}}{A_{i,t}}\right]^* - \frac{D_{i,t-1}^{RS}}{A_{i,t-1}}\right) > 0$.

Using rate-sensitive leverage targets that we obtained earlier, we partition this set based on whether the incremental model (3) predicts a larger or smaller change in rate-sensitive leverage than the partial adjustment model (4), i.e. based on the sign of the difference

$$\alpha\left|\frac{D_{i,t}}{A_{i,t}}-\frac{D_{i,t-1}}{A_{i,t-1}}\right|-\lambda\left|\left[\frac{D_{i,t}^{RS}}{A_{i,t}}\right]^{*}-\frac{D_{i,t-1}^{RS}}{A_{i,t-1}}\right|.$$

Table 9 reports the slopes from estimating regressions (4) on the full set of firm-years with $(D_t/A_t - D_{t-1}/A_{t-1})(D^{RS}{}_t/A_t - D^{RS}{}_{t-1}/A_{t-1}) > 0$ and separately on each subset. For all three groups of firms-users of rate-sensitive debt, we obtain below-average SOAs in the firm years with $\alpha\left|\frac{D_{i,t}}{A_{i,t}}-\frac{D_{i,t-1}}{A_{i,t-1}}\right|-\lambda\left|\left[\frac{D_{i,t}^{RS}}{A_{i,t}}\right]^{*}-\frac{D_{i,t-1}^{RS}}{A_{i,t-1}}\right|<0$ and above-average SOAs in the firm years with $\alpha\left|\frac{D_{i,t}}{A_{i,t}}-\frac{D_{i,t-1}}{A_{i,t-1}}\right|-\lambda\left|\left[\frac{D_{i,t}^{RS}}{A_{i,t}}\right]^{*}-\frac{D_{i,t-1}^{RS}}{A_{i,t-1}}\right|>0$. For instance, in case of users of sort-term debt we obtain the SOA of 60.2% on the full set of firm years with $\left(\frac{D_{i,t}}{A_{i,t}}-\frac{D_{i,t-1}}{A_{i,t-1}}\right)\left(\left[\frac{D_{i,t}^{RS}}{A_{i,t}}\right]^{*}-\frac{D_{i,t-1}^{RS}}{A_{i,t-1}}\right)>0$[1] , 53.5% across firm years with smaller-than-average changes in total leverage and 81.0% across observations with larger-than average changes in it. This result is consistent with our hypothesis that firms balance rate-sensitive leverage targeting considerations and real-time leverage adjustment costs when making incremental decisions regarding their rate-sensitive debt load.

[1] This value is above the SOA of 51% that we earlier estimated because this time we exclude the firm years in which rate-sensitive leverage deficit

6. Conclusions

Rate-sensitive debt plays the role of transitory debt in corporate capital structure. Approximately 70% to 75% of the time firms adjust their total leverage and its rate-sensitive component in the same direction. The share of rate-sensitive debt in total leverage changes across those synchronous adjustments is as high as 60% to 85% which implies that firms tend to add and retire rate-sensitive debt first. As rate-sensitive debt plays a major role in leverage adjustments, changes in leverage are associated with changes in debt composition, i.e. increases (reductions) in total leverage are accompanied by increases (reductions) in the ratio of rate-sensitive debt to total debt.

Furthermore, our sample firms pursue rate-sensitive leverage targets that are determined mostly by their contemporary leverage ratios. 70.6% to 79.5% of the time firms adjust their rate-sensitive leverage toward those targets with a speed of 56.4 to 66.6%. Our evidence thus suggests that firms not only use rate-sensitive debt as transitory, i.e. the debt that they plan to eventually retire, but also manage their debt composition actively to balance the benefits of financial flexibility and risks associated with carrying rate-sensitive debt.

7. References

Barclay, Michael J., and Smith, Clifford W., 1995, The Maturity Structure of Corporate Debt, *Journal of Finance* 50, 609-631.

Barclay, Michael J., Leslie M. Marx, and Smith, Clifford W., 2003, The Joint Determination of Leverage and Maturity, *Journal of Corporate Finance* 9, 149-167.

Blundell, Richard, and Stephen Bond, 1998, Initial Conditions and Moment Restrictions in Dynamic Panel Data Models, *Journal of Econometrics* 87, 115–143.

Bond, Stephen, 2002, Dynamic Panel Data Models: A Guide to Micro Data Methods and Practice, *Portuguese Economic Journal* 1, 141–162.

DeAngelo, Harry, Linda DeAngelo and Toni M. Whited, 2011, Capital Structure Dynamics and Transitory Debt, *Journal of Financial Economics* 99, 235-261.

Denis, David J. and Stephen B. McKeon, 2012, Financial Flexibility and Capital Structure Policy: Evidence from Pro-active Leverage Increases, *Review of Financial Studies* 25, 1897-1929.

Denis, David J. and Vassil T. Mihov, 2003, The Choice among Bank Debt, Non-Bank Private debt, and Public Debt: Evidence from New Corporate Borrowings, *Journal of Financial Economics* 70, 3-28.

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

Fama, Eugene F. and Kenneth R. French, 2012, Capital Structure Choices, *Critical Finance Review* 1, 59–101.

Fan, Joseph P.H., Sheridan Titman, and Garry Twite, 2012, "An International Comparison of Capital Structure and Debt Maturity Choices," *Journal of Financial & Quantitative Analysis* 47, 23-56.

Faulkender, Michael, Mark J. Flannery, Kristine Watson Hankins, and Jason M. Smith, 2012, Cash Flows and Leverage Adjustments, *Journal of Financial Economics* 103, 632-646.

Flannery, Mark J., and Kristine Watson Hankins, 2011, Estimating Dynamic Panel Models in Corporate Finance, Working paper.

Flannery, Mark J., and G. Brandon Lockhart, 2009, Credit Lines and the Substitutability of Cash and Debt, SSRN working paper.

Flannery, Mark J., and Kasturi P. Rangan, 2006, Partial Adjustment toward Target Capital Structures, *Journal of Financial Economics* 79, 469-506.

Gao, Pengjie and Hayong Yun, 2009, Commercial Paper, Lines of Credit, and the Real Effects of the Financial Crisis of 2008: Firm-Level Evidence from the Manufacturing Industry, SSRN working paper.

Graham, John R., Campbell R. Harvey, 2001, The Theory and Practice of Corporate Finance: Evidence from the Field. *Journal of Financial Economics* 60, 187–243.

Guedes, Jose, and Tim Opler, 1996, The Determinants of the Maturity of Corporate Debt Issues, *Journal of Finance* 51, 1809-1833.

Huang, Rongbing and Jay R. Ritter, 2009, Testing Theories of Capital Structrue and Estimating the Speed of Adjustment, *Journal of Financial and Quantitative Analysis* 44, 237-271.

Kahl, Matthias, Anil Shivdasani, and Yihui Wang, 2010, Why Do Firms Use Commercial Paper? SSRN working paper

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

Lemmon, Michael L., Michael R. Roberts, and Jaime F. Zender, 2008, Back to the Beginning: Persistence and the Cross-Section of Corporate Capital Structure, *Journal of Finance* 63, 1575–1608.

Mann, Steven V., and Eric A. Powers, 2007, Determinants of Bond Tender Premiums and the Percentage Tendered, *Journal of Banking and Finance* 31, 547-566.

Petersen, Mitchell A., 2009, Estimating Standard Errors in Finance Panel Data Sets: Comparing Approaches. *Review of Financial Studies* 22, 435-480

Powers, Eric A., and Sergey Tsyplakov, 2009, What is the Cost of Financial Flexibility? Theory and Evidence for Make-whole Call Provisions, *Financial Management* 37, 485-512.

Rauh, Joshua D., and Amir Sufi, 2010, Capital Structure and Debt Structure, *Review of Financial Studies* 23, 4242-4280.

Vickery, James, 2008, How and Why Do Small Firms Manage Interest Rate Risk? *Journal of Financial Economics* 87, 446-470.

Welch, Ivo, 2004, Capital Structure and Stock Returns, *Journal of Political Economy* 112, 106-131.

Figure 1. Historical values of the term spread.

The term spread is defined as the difference in yields between the ten-year and the six-month on-the-run Treasury securities.

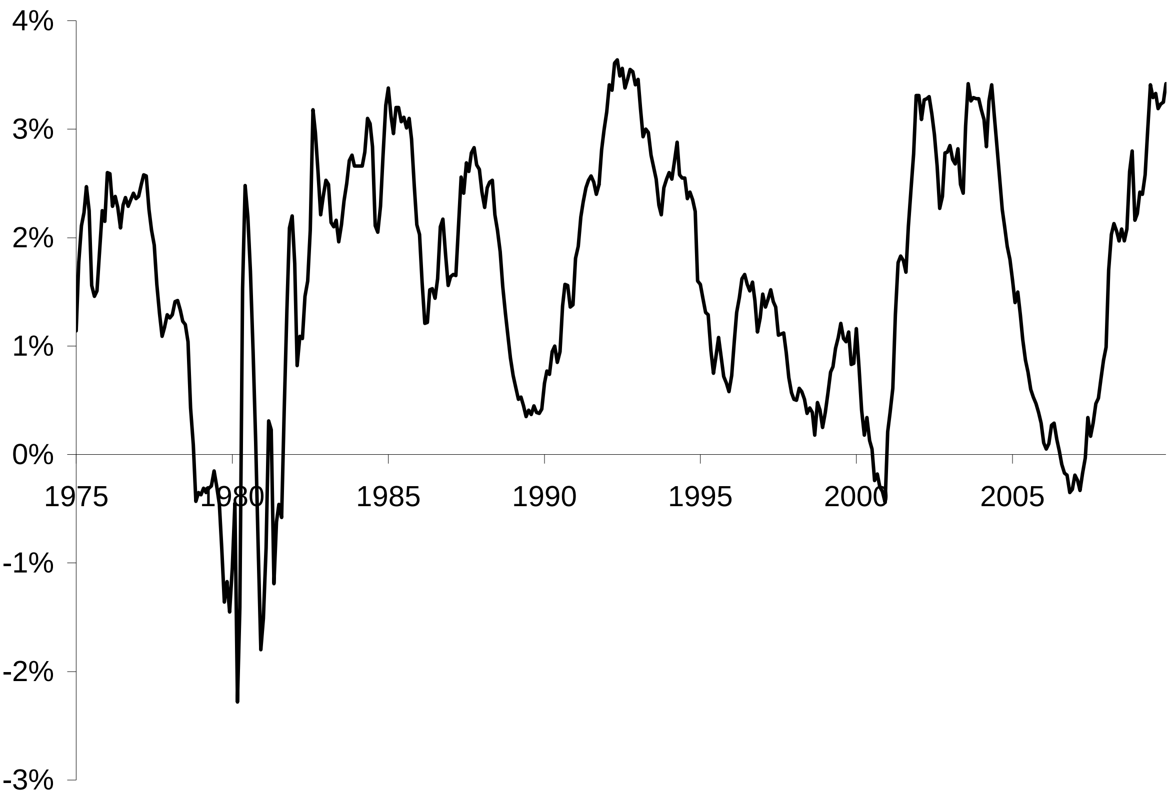

Table 1. Counts of Sample Firms

The reported firm counts are averages of annual counts of firms in the sample over the specified time period.

	1975-09	1975-89	1990-99	2000-09
Firm counts				
All firms	2,916	2,215	3,988	2,897
Users of conventional long-term debt only	973	642	1,352	1,094
Users of short-term debt	1,285	1,225	1,702	958
Users of floating-rate debt	1,040	700	1,435	1,155
Users of either short-term or floating-rate debt	1,943	1,573	2,636	1,803
As a percent of all firms				
Users of short-term debt	44.1%	55.3%	42.7%	33.1%
Users of floating-rate debt	35.7%	31.6%	36.0%	39.9%
Users of either short-term or floating-rate debt	66.6%	71.0%	66.1%	62.2%

Table 2. Characteristics of sample firms

E_t, A_t, FA_t, D_t, D_t^{ST} and D_t^{FR} are the firm's EBIT, total assets, net fixed assets, total debt, short-term debt and floating-rate debt, respectively. V_t is the market value of the firm (total assets minus book equity plus the market value of equity). I_t is net investment (see Data section for definition). The left panel reports averages of annual means for the specified characteristics over the sample period of 1975 to 2009 and the right panel reports averages of their annual medians.

	All firms	Users of			All firms	Users of		
		No rate-sensitive debt	Short-term debt	Floating-rate debt		No rate-sensitive debt	Short-term debt	Floating-rate debt
A_t, \$000,000's	1,953	1,107	3,414	1,039	213	150	319	230
E_t/A_t, %	6.1	4.7	6.6	7.1	8.0	7.7	7.9	8.0
V_t/A_t	1.56	1.78	1.46	1.40	1.25	1.39	1.20	1.19
I_t/A_t, %	11.3	12.5	10.0	11.4	8.9	9.9	8.2	8.8
FA_t/A_t, %	33.4	32.1	32.6	35.1	26.6	24.8	26.6	28.9
D_t/A_t, %	25.1	19.8	27.0	30.0	23.6	15.4	26.3	28.9
D_t^{ST}/D_t, %	14.0	–	30.5	9.0	1.0	–	19.5	0.4
D_t^{FR}/D_t, %	16.9	–	10.8	47.7	–	–	–	46.1
Percentage of firms with								
Long-term credit rating	20.2	16.6	25.4	17.4				
Short-term credit rating	7.8	4.8	13.7	3.4				

Table 3. Logit regressions to explain which firms use rate-sensitive debt.

In specification 1 and 2, the dependent variable equals 1 if the firm uses short-term debt in year t and 0 otherwise. In specification 3 and 4, the dependent variable equals 1 if the firm uses floating-rate debt in year t and 0 otherwise. E_t, A_t, FA_t and D_t are the firm's EBIT, total assets, net fixed assets and total debt, respectively. V_t is the market value of the firm (total assets minus book equity plus the market value of equity). I_t is net investment (see Data section for definition). The short-term rating dummy equals 1 if the firm has a short-term credit rating in year t and 0 otherwise. The long-term rating dummy equals 1 if the firm has a long-term credit rating in year t and 0 otherwise. The Prior-Year User dummy equals 1 if the firm used short-term (floating-rate) debt in year t – 1 and 0 otherwise. The reported t-statistics are adjusted for the clustering of errors both across firms and in time.

	Usage of short-term debt		Usage of floating-rate debt	
	1	2	3	4
Intercept	-1.32 (-18.90)	-2.62 (-40.47)	-0.90 (-10.48)	-2.42 (-32.83)
D_t/A_t	2.23 (19.15)	1.90 (19.12)	3.44 (34.93)	2.44 (27.35)
E_t/A_t	0.02 (0.16)	-0.19 (-2.74)	1.56 (15.11)	1.11 (15.33)
V_t/A_t	-0.10 (-3.94)	-0.09 (-4.37)	-0.13 (-7.46)	-0.09 (-7.97)
I_t/A_t	-0.65 (-6.86)	0.20 (2.36)	0.17 (1.95)	1.12 (9.48)
FA_t/A_t	-0.48 (-3.64)	-0.42 (-4.67)	0.25 (2.79)	0.05 (0.74)
$Ln(A_t)$	0.15 (7.70)	0.09 (4.57)	-0.14 (-6.64)	-0.08 (-3.65)
Prior-year user dummy		3.48 (60.99)		3.41 (102.76)
Short-term rating dummy		1.02 (15.54)		-0.89 (-6.86)
Long-term rating dummy		-0.49 (-6.83)		0.06 (0.53)

Table 4. Changes in rate-sensitive leverage: descriptive statistics

E_t, A_t, FA_t, D_t, and D_t^{RS} are the firm's EBIT, total assets, net fixed assets, total debt, and rate-sensitive debt (i.e. the sum of short-term debt and floating-rate debt), respectively. I_t is net investment (see Data section for definition). The table reports the mean values of the specified characteristics over the sample period of 1975-2009. Firm years in which both $D_t = D_t^{RS}$ and $D_{t-1} = D_{t-1}^{RS}$ are excluded from the analysis.

	Users of short-term debt		Users of floating-rate debt		Users of both short-term debt and floating-rate debt	
	$\frac{D_t^{RS}}{A_t} > \frac{D_{t-1}^{RS}}{A_{t-1}}$	$\frac{D_t^{RS}}{A_t} < \frac{D_{t-1}^{RS}}{A_{t-1}}$	$\frac{D_t^{RS}}{A_t} > \frac{D_{t-1}^{RS}}{A_{t-1}}$	$\frac{D_t^{RS}}{A_t} < \frac{D_{t-1}^{RS}}{A_{t-1}}$	$\frac{D_t^{RS}}{A_t} > \frac{D_{t-1}^{RS}}{A_{t-1}}$	$\frac{D_t^{RS}}{A_t} < \frac{D_{t-1}^{RS}}{A_{t-1}}$
Number of firm years	10,127	10,316	5,728	8,057	8,090	8,285
A_t, \$000,000's	4,479	4,960	976	1,051	1,519	1,439
FA_t/A_t	34.9%	34.9%	39.0%	35.7%	31.8%	31.4%
E_t/A_t	5.6%	7.6%	3.9%	7.6%	4.7%	7.2%
V_t/A_t	1.43	1.50	1.39	1.52	1.35	1.39
I_t/A_t	10.0%	8.8%	13.6%	9.2%	11.2%	7.7%
D_t/A_t	28.7%	26.3%	35.4%	27.5%	34.1%	29.0%
D_{t-1}/A_{t-1}	25.9%	28.2%	30.5%	30.8%	29.1%	32.2%
$D_t/A_t - D_{t-1}/A_{t-1}$	2.8%	-1.9%	4.9%	-3.3%	5.0%	-3.2%
D_t^{RS}/A_t	9.3%	5.0%	21.8%	12.4%	20.7%	12.0%
D_{t-1}^{RS}/A_{t-1}	5.7%	8.2%	14.8%	18.0%	12.8%	19.2%
$D_t^{RS}/A_t - D_{t-1}^{RS}/A_{t-1}$	3.6%	-3.2%	7.0%	-5.6%	7.9%	-7.3%

Table 5. Frequency of leverage adjustments by type.

A_t, D_t, $D^{RS}{}_t$ and $[D_t/A_t]^*$ are total assets, total debt, rate-sensitive debt and the leverage target in year t, respectively. $A^P{}_t = D_{t-1} + BE_t$. Leverage targets are estimated in a partial adjustment model as described in Section 5.2. Firm years in which both $D_t = D_t^{RS}$ and $D_{t-1} = D_{t-1}^{RS}$ are excluded from the analysis.

Panel A. Type of adjustment identified by the signs of changes in total and rate-sensitive leverage.

		Users of short-term debt	Users of floating-rate debt	Users of both short-term debt and floating-rate debt
$D_t/A_t - D_{t-1}/A_{t-1} > 0$	$D_t^{RS}/A_t - D_{t-1}^{RS}/A_{t-1} > 0$	33.3%	31.7%	36.9%
	$D_t^{RS}/A_t - D_{t-1}^{RS}/A_{t-1} < 0$	14.3%	11.5%	13.1%
$D_t/A_t - D_{t-1}/A_{t-1} < 0$	$D_t^{RS}/A_t - D_{t-1}^{RS}/A_{t-1} > 0$	16.2%	9.8%	12.5%
	$D_t^{RS}/A_t - D_{t-1}^{RS}/A_{t-1} < 0$	36.2%	47.0%	37.5%
$(D_t/A_t - D_{t-1}/A_{t-1})(D_t/A_t - D_{t-1}/A_{t-1}) > 0$		69.5%	78.7%	74.4%
Total number of firm years		20,443	13,785	16,344

Panel B. Type of adjustment identified by the signs of changes in total and rate-sensitive leverage due to debt management.

		Users of short-term debt	Users of floating-rate debt	Users of both short-term debt and floating-rate debt
$D_t/A_t - D_{t-1}/A^P{}_t > 0$	$D_t^{RS}/A_t - D_{t-1}^{RS}/A_t^P > 0$	37.3%	33.6%	39.2%
	$D_t^{RS}/A_t - D_{t-1}^{RS}/A_t^P < 0$	16.3%	15.0%	14.1%
$D_t/A_t - D_{t-1}/A^P{}_t < 0$	$D_t^{RS}/A_t - D_{t-1}^{RS}/A_t^P > 0$	13.8%	11.3%	11.6%
	$D_t^{RS}/A_t - D_{t-1}^{RS}/A_t^P < 0$	32.6%	40.1%	35.1%
$(D_t/A_t - D_{t-1}/A^P{}_t)(D_t/A_t - D_{t-1}/A^P{}_t) > 0$		69.9%	73.7%	74.3%
Total number of firm years		27,290	19,933	17,333

Table 6. Regressions to explain changes in rate-sensitive leverage.

A_t, D_t, $D^{RS}{}_t$ and FD_t are total assets, total debt, rate-sensitive debt and financial deficit in year t, respectively. $A^P{}_t = D_{t-1} + BE_t$. Leverage targets are estimated in a partial adjustment model as described in Section 5.2. Specification 1, 2, 3 and 5 are estimated on the full sample. Firm years in which $(D^{RS}{}_t/A_t - D^{RS}{}_{t-1}/A_{t-1})(D_t/A_t - D_{t-1}/A_{t-1}) < 0$ and those in which both $D_t = D_t^{RS}$ and $D_{t-1} = D_{t-1}^{RS}$ are excluded.

Dependent variable	$D^{RS}{}_t/A_t - D^{RS}{}_{t-1}/A_{t-1}$		$D^{RS}{}_t/A_t - D^{RS}{}_{t-1}/A^P{}_t$		$D^{RS}{}_t/D_t - D^{RS}{}_{t-1}/D_{t-1}$	
Specification	1	2	3	4	5	6
Users of short-term debt						
R^2	0.08	0.54	0.14	0.51	0.02	0.08
Intercept	0.00 (1.19)	0.00 (4.29)	0.00 (1.93)	-0.00 (-0.50)	0.00 (1.19)	0.00 (1.66)
$[D/A]_t^* - D_{t-1}/A_{t-1}$	0.07 (14.63)	0.00 (0.93)	0.06 (12.46)	0.00 (0.48)	0.10 (10.36)	0.04 (4.04)
FD_t/A_t	0.06 (2.20)	0.01 (1.42)	0.09 (3.57)	0.01 (2.42)	0.08 (2.95)	0.02 (2.73)
$D_t/A_t - D_{t-1}/A_{t-1}$		0.60 (46.95)				0.56 (16.10)
$D_t/A_t - D_{t-1}/A^P{}_t$				0.60 (39.50)		
Users of floating-rate debt						
R^2	0.15	0.65	0.26	0.64	0.03	0.08
Intercept	-0.00 (-2.49)	0.00 (1.46)	-0.00 (-0.24)	-0.00 (-0.58)	-0.01 (-2.81)	-0.00 (-1.53)
$[D/A]_t^* - D_{t-1}/A_{t-1}$	0.10 (16.64)	0.01 (2.17)	0.06 (9.02)	-0.00 (-0.04)	0.08 (7.73)	0.02 (1.92)
FD_t/A_t	0.17 (5.50)	0.03 (4.14)	0.23 (5.77)	0.02 (2.98)	0.13 (5.19)	0.03 (2.60)
$D_t/A_t - D_{t-1}/A_{t-1}$		0.82 (67.12)				0.54 (16.79)
$D_t/A_t - D_{t-1}/A^P{}_t$				0.86 (55.89)		

Table 6 (cont'd)

Dependent variable	$D^{RS}{}_t/A_t - D^{RS}{}_{t-1}/A_{t-1}$		$D^{RS}{}_t/A_t - D^{RS}{}_{t-1}/A^P{}_t$		$D^{RS}{}_t/D_t - D^{RS}{}_{t-1}/D_{t-1}$	
Specification	1	2	3	4	5	6
Users of both short-term and floating-rate debt						
R^2	0.22	0.62	0.29	0.60	0.04	0.10
Intercept	0.01 (6.35)	0.00 (0.18)	0.01 (8.64)	-0.00 (-3.59)	-0.00 (-0.03)	-0.00 (-1.51)
$[D/A]_t^* - D_{t-1}/A_{t-1}$	0.13 (18.12)	0.00 (0.53)	0.11 (15.36)	0.00 (0.54)	0.11 (8.72)	0.02 (1.34)
FD_t/A_t	0.31 (23.13)	0.04 (4.94)	0.35 (22.91)	0.05 (7.02)	0.22 (8.23)	0.04 (1.51)
$D_t/A_t - D_{t-1}/A_{t-1}$		0.85 (69.54)				0.71 (19.61)
$D_t/A_t - D_{t-1}/A^P{}_t$				0.84 (55.94)		

Table 7. Partial adjustment regressions for rate-sensitive leverage

E_t, A_t, FA_t, D_t, and D_t^{RS} are the firm's EBIT, total assets, net fixed assets, total debt, and rate-sensitive debt (i.e. the sum of short-term debt and floating-rate debt), respectively. I_t is net investment (see Data section for definition). Standard errors are reported in parentheses.

Panel A. Users of short-term debt

	1	2	3	4
Data	Actual/DGP	Simulated	DGP	Simulated
D^{RS}_{t-1}/A_{t-1}	0.3435* (0.0062)	0.1941 (0.0004)	0.4928	0.3412 (0.0004)
D_t/A_t	0.2167* (0.0039)	0.2464 (0.0006)	0.1871	0.2191 (0.0006)
$Ln(A_t)$	-0.0091* (0.0007)	-0.0105 (0.0001)	-0.0077	-0.0093 (0.0001)
FA_t/A_t	-0.0543* (0.0042)	-0.0624 (0.0007)	-0.0462	-0.0548 (0.0006)
E_t/A_t	-0.0467* (0.0043)	-0.0448 (0.0007	-0.0486	-0.0463 (0.0006)
V_t/A_t	-0.0001 (0.0003)	0.0000 (0.0001)	-0.0001	-0.0001 (0.0000)
I_t/A_t	0.0416* (0.0036)	0.0327 (0.0005)	0.0504	0.0418 (0.0005)

* Significant at the 1% level

Table 7 (cont'd)

Panel B. Other users of rate-sensitive debt

	Users of floating-rate debt			Users of both short-term and floating-rate debt		
Data	Actual	DGP	Simulated	Actual	DGP	Simulated
D^{RS}_{t-1}/A_{t-1}	0.3326* (0.0070)	0.5464	0.3312 (0.0005)	0.1345* (0.0069)	0.3179	0.1336 (0.0004)
D_t/A_t	0.4328* (0.0068)	0.3470	0.4314 (0.0006)	0.4913* (0.0069)	0.4284	0.4910 (0.0006)
$Ln(A_t)$	-0.0098* (0.0012)	-0.0067	-0.0099 (0.0001)	-0.0111* (0.0013)	-0.0092	-0.0116 (0.0001)
FA_t/A_t	-0.0076 (0.0092)	-0.0150	-0.0074 (0.0004)	-0.0383* (0.0089)	-0.0340	-0.0399 (0.0009)
E_t/A_t	-0.0446* (0.0083)	-0.0712	-0.0434 (0.0007)	-0.0300* (0.0084)	-0.0467	-0.0294 (0.0007)
V_t/A_t	-0.0009 (0.0010)	-0.0019	-0.0009 (0.0001)	-0.0002 (0.0010)	-0.0010	-0.0002 (0.0001)
I_t/A_t	0.1023* (0.0049)	0.1309	0.1031 (0.0004)	0.0983* (0.0059)	0.1309	0.0991 (0.0005)

* Significant at the 1% level

Table 8. Non-synchronous adjustments of total and rate-sensitive leverage.

E_t, A_t, FA_t, D_t, and D_t^{RS} are the firm's EBIT, total assets, net fixed assets, total debt, and rate-sensitive debt, respectively. I_t is net investment (see Data section for definition). Firm years in which both $D_t = D_t^{RS}$ and $D_{t-1} = D_{t-1}^{RS}$ are excluded from the analysis. $[D^{RS}_t/A_t]^*$ is the rate-sensitive leverage target obtained by estimating partial adjustment regressions (2) as reported in Table 7.

Panel A. Comparative adjustment frequencies.

$\left[\frac{D_t^{RS}}{A_t}\right]^* - \frac{D_{t-1}^{RS}}{A_{t-1}}$	$\frac{D_t}{A_t} - \frac{D_{t-1}}{A_{t-1}}$	$\frac{D_t^{RS}}{A_t} - \frac{D_{t-1}^{RS}}{A_{t-1}}$	Users of short-term debt		Users of floating-rate debt		Users of both short-term and floating-rate debt	
			Firm years	Percent	Firm years	Percent	Firm years	Percent
+	+	+	5,274	80.1	3,509	83.5	5,028	85.7
		–	1,311	19.9	691	16.5	839	14.3
		Total	6,585	100.0	4,200	100.0	5,867	100.0
+	–	+	2,018	51.6	852	45.3	1,312	59.9
		–	1,893	48.4	1,030	54.7	877	40.1
		Total	3,911	100.0	1,882	100.0	2,189	100.0
–	+	+	1,531	48.7	866	49.4	1,015	43.7
		–	1,611	51.3	888	50.6	1,307	56.3
		Total	3,142	100.0	1,754	100.0	2,322	100.0
–	–	+	1,304	19.2	501	8.4	728	12.2
		–	5,501	80.8	5,448	91.6	5,260	87.8
		Total	6,805	100.0	5,949	100.0	5,988	100.0

Table 8 (cont'd)

Panel B. Non-synchronous adjustments of total and rate-sensitive leverage

	Users of short-term debt		Users of floating-rate debt		Users of both short-term and floating-rate debt	
	Firm years	Percent	Firm years	Percent	Firm years	Percent
$\left(\left[\frac{D_t^{RS}}{A_t}\right]^* - \frac{D_{t-1}^{RS}}{A_{t-1}}\right)\left(\frac{D_t}{A_t} - \frac{D_{t-1}}{A_{t-1}}\right) > 0$	2,615	41.9	1,192	40.7	1,567	37.4
$\left(\left[\frac{D_t^{RS}}{A_t}\right]^* - \frac{D_{t-1}^{RS}}{A_{t-1}}\right)\left(\frac{D_t}{A_t} - \frac{D_{t-1}}{A_{t-1}}\right) < 0$	3,629	58.1	1,740	59.3	2,619	62.6
Total number of non-synchronous adjustments	6,244	100.0	2,932	100.0	4,185	100.0
As a percent of the total number of firm years	30.5		21.3		25.6	

Table 9. The effect of real-time adjustment costs.

A_t, D_t, and D_t^{RS} are the firm's total assets, total debt, and rate-sensitive debt, respectively. Firm years in which $\left(\frac{D_t}{A_t}-\frac{D_{t-1}}{A_{t-1}}\right)\left(\left[\frac{D_t^{RS}}{A_t}\right]^*-\frac{D_{t-1}^{RS}}{A_{t-1}}\right)>0$, as well as those in which both $D_t = D_t^{RS}$ and $D_{t-1} = D_{t-1}^{RS}$ are excluded from the analysis. $[D^{RS}_t/A_t]^*$ is the rate-sensitive leverage target obtained by estimating partial adjustment regressions (2) as reported in Table 7. λ is the speed of adjustment obtained in the said regressions. α is the slope on $D_t/A_t - D_{t-1}/A_{t-1}$ in regression (3) (Specification 2 in Table 6).

Subsample	All firm years in which $\left(\frac{D_t}{A_t}-\frac{D_{t-1}}{A_{t-1}}\right)\left(\left[\frac{D_t^{RS}}{A_t}\right]^*-\frac{D_{t-1}^{RS}}{A_{t-1}}\right)>0$	$\alpha\cdot\left\lvert\frac{D_t}{A_t}-\frac{D_{t-1}}{A_{t-1}}\right\rvert-\lambda\cdot\left\lvert\left[\frac{D_t^{RS}}{A_t}\right]^*-\frac{D_{t-1}^{RS}}{A_{t-1}}\right\rvert$ < 0	$\alpha\cdot\left\lvert\frac{D_t}{A_t}-\frac{D_{t-1}}{A_{t-1}}\right\rvert-\lambda\cdot\left\lvert\left[\frac{D_t^{RS}}{A_t}\right]^*-\frac{D_{t-1}^{RS}}{A_{t-1}}\right\rvert$ > 0
Users of short-term debt (α = 0.60, λ = 0.51)			
R^2	0.645	0.573	0.586
Intercept	0.000 (1.30)	-0.001 (-2.08)	0.000 (1.99)
$\left[\frac{D_t^{RS}}{A_t}\right]^*-\frac{D_{t-1}^{RS}}{A_{t-1}}$	0.602 (77.97)	0.535 (80.17)	0.81 (53.22)
Users of floating-rate debt (α = 0.82, λ = 0.45)			
R^2	0.658	0.524	0.702
Intercept	0.002 (3.55)	0.002 (2.54)	-0.000 (-0.14)
$\left[\frac{D_t^{RS}}{A_t}\right]^*-\frac{D_{t-1}^{RS}}{A_{t-1}}$	0.534 (72.98)	0.45 (55.97)	0.66 (76.80)
Users of both short-term and floating-rate debt (α = 0.85, λ = 0.68)			
R^2	0.717	0.646	0.682
Intercept	0.001 (1.28)	-0.002 (-2.21)	-0.002 (2.29)
$\left[\frac{D_t^{RS}}{A_t}\right]^*-\frac{D_{t-1}^{RS}}{A_{t-1}}$	0.769 (121.45)	0.72 (98.70)	0.88 (81.72)