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Proactive Capital Structure Adjustments: Evidence from Corporate Filings

Arthur Korteweg
University of Southern California Marshall School of Business
korteweg@marshall.usc.edu

Michael Schwert
The Wharton School of the University of Pennsylvania
schwert@wharton.upenn.edu (corresponding author)

Ilya A. Strebulaev
Stanford University Graduate School of Business and National Bureau of Economic Research
istrebulaev@stanford.edu

Abstract

We use new hand-collected data from corporate filings to study the drivers of corporate capital structure adjustment. Classifying firms by their adjustment frequencies, we reveal previously unknown patterns in their reasons for financing and the financial instruments used. Some are consistent with existing theory, whereas others are understudied. Many leverage changes are outside of the firm's control (e.g., executive option exercise) or incur negligible adjustment costs (e.g., credit-line usage). This implies a lower frequency of proactive leverage adjustments than indicated by prior research using accounting data, suggesting that costs of adjustment are higher, or the benefits lower, than previously thought.

I. Introduction

The empirical literature on capital structure tends to follow one of two directions. One is to use accounting data (e.g., Compustat) to study the firm's debt-versus-equity choice and weigh the conflicting predictions of different theories (e.g., trade-off theory, pecking order, market timing). Another is to study the firm's use of specific financial instruments (e.g., lines of credit, private placements of equity) to similar ends. Although each line of inquiry has proven fruitful, they have developed separately, leaving us without a full picture of the financing options available to firms and how these options relate to the debt-versus-equity choice. In this article, we take a different approach to shed light on the reasons why firms change their capital structures and on the financial instruments they use.

Our analysis combines the standard accounting data used in prior research with a novel, hand-collected sample of capital structure adjustments based on

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detailed financial statements and textual information from corporate filings. The results show that in contrast to the one-size-fits-all approach used in many empirical articles, there is no such thing as a "typical firm" when it comes to capital structure choices. Changes in leverage are driven by a variety of economic factors that depend on individual firms' operating performance and investment policies. Some choices are in line with extant theory, but the model with the most explanatory power varies with the firm's profile. Other behaviors are either not consistent with theory or have not been closely studied.

Moreover, we find that the underlying economics of leverage adjustments are difficult to discern from accounting data alone. For example, various debt instruments count as long-term debt in Compustat, but their adjustment costs[1] and contractual terms vary widely. In addition, many leverage changes are due to outside actions, such as the exercise of executive stock options and warrants, that are unrelated to the firm's concurrent debt and equity-issuance choices. Our hope is that this article will motivate other researchers to use the detailed information available from corporate filings in future studies of capital structure.

We begin our inquiry by examining the frequency of capital structure changes. This question has sparked much debate in the literature, and the empirical evidence is mixed. For example, Leary and Roberts (2005) and Strebulaev and Whited (2012) find that big active capital structure changes are infrequent, whereas Welch (2004), (2012) argues that firms adjust leverage very often. Following the literature (e.g., Hovakimian, Opler, and Titman (2001), Korajczyk and Levy (2003), Hovakimian (2004), and Leary and Roberts (2005)), we construct a large sample of leverage adjustments using changes in leverage that exceed 5% of book assets in a given quarter.[2] We find that the average firm changes leverage once every 5 quarters, in line with Leary and Roberts (2005). However, there is a remarkable degree of heterogeneity in adjustment frequencies, with 8% of firms adjusting leverage more than twice per year, whereas 17% of firms never adjust during the sample period. As a result, a small number of firms account for a disproportionate number of adjustment events, with the most active quartile accounting for more than half of all adjustments.

To better understand the heterogeneity in adjustment frequencies, we take random samples of firms from the top, middle, and bottom frequency deciles and hand-collect detailed information from quarterly and annual corporate filings. We find that the frequency of leverage adjustment is systematically related to firms' other observable characteristics, their reasons for interacting with the external capital markets, and the financial instruments they use to raise capital.

[1]We use the term *adjustment costs* in a broad sense, including not only the costs of issuing and repurchasing securities (Altinkilic and Hansen (2000), Eckbo, Masulis, and Norli (2007)) but also other frictions such as adverse share price effects, coordination costs (e.g., creditor holdout problems), adverse tax consequences of debt concessions, and asset fire sales (see Kane, Marcus, and McDonald (1985), Gilson (1997)).

[2]The capital structure literature also uses the term *refinancings* or *rebalancings.* Because these terms have historically acquired a host of meanings, we prefer to use the term *adjustment* in the specific sense defined here, focused on understanding material leverage adjustments. There are other types of capital structure adjustments, such as changes in debt structure or cash and payout policy, that we do not study in this article.

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TABLE 1

Classification of Firms

Table 1 reports a classification of firms into four types, based on the frequency with which they adjust capital structure and on clusters of characteristics. Type N firms never change their leverage ratio in a material way during the sample period. Type I firms infrequently adjust their leverage. Frequently adjusting firms are split into two clusters based on their characteristics. Type F-G firms are young growth firms, whereas Type F-W firms mainly access capital markets for working capital and investment needs. We hand-collect the reasons for adjustment and the financial instruments used from companies' quarterly (10-Q) and annual (10-K) filings. "NA" means "not applicable." The classifications are based on a sample of firms from the CRSP–Compustat merged database from 1995 to 2009. "Fraction of firms" is the fraction of sample firms in each group, averaged over the quarterly cross sections in the panel. "Fraction of equity" and "Fraction of debt" are each group's market share of equity market value and book debt, respectively, averaged across the quarterly cross sections in the panel. "Fraction of adjustments" is the fraction of total leverage adjustments made by each type of firm. For the purposes of computing market shares, we assign firms in the bottom 6 deciles of adjustment frequency (as defined in Table 3, based on the set of firms with at least one adjustment during the sample period) to type I, and we sort firms in the top-4 deciles into types F-G and F-W using statistical cluster analysis. The program used to sort firms into types is provided in the Supplementary Material.

Type	N	I	F-G	F-W
Adjustment frequency	Never	Infrequent	Frequent (growth)	Frequent (working capital)
Key characteristics	Small Low leverage High cash	Mature Large Profitable	Young High market-to-book Small High research and development Unprofitable High cash	Young Low market-to-book High leverage High capital expenditures Profitable Low cash
Reasons for adjustment	NA	Mergers and acquisitions Debt repayment Equity repurchase	Operating losses Investment needs Debt conversion	Working capital Seasonality Investment needs Debt repayment
Instruments used	NA	Credit lines Long-term debt Public equity	Convertible debt Private placements Options/warrants	Credit lines
Fraction of firms	0.119	0.581	0.046	0.254
Fraction of equity	0.074	0.714	0.004	0.208
Fraction of debt	0.059	0.756	0.002	0.183
Fraction of adjustments	0	0.393	0.105	0.502

We identify four types of firms based on the frequency of capital structure adjustments and similarities in key characteristics, as summarized in Table 1. Type N ("never") firms do not adjust their capital structure over our sample period. These tend to be small firms with high cash balances, low leverage, and low investment needs that are able to rely on internal finance. Type I ("infrequent") firms adjust infrequently, generally less than once a year. They are large, mature, profitable firms that only need external finance for mergers and acquisitions (M&As) or to adjust capital structure by retiring debt or repurchasing equity.

The most actively adjusting firms change their capital structure more than twice a year. We divide them into two subtypes based on a statistical cluster analysis of their characteristics. Type F-G companies are young, small, growth (hence the *G* in *F-G*) firms that have cash but still need external financing, primarily to fund research and development (R&D) and other investment needs and to cover persistent operating losses. They are mostly in research-intensive industries such as pharmaceuticals, medical and lab equipment, and computer products. They represent less than 5% of all firms and only 0.4% (0.2%) of market equity (book debt) value, but they make over 10% of all adjustments. Type F-W firms are also relatively young but do not have as many growth opportunities. They mainly need external finance for working capital (hence the *W* in *F-W*), to cover seasonal

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operating needs, and for capital expenditures. These firms tend to be in the retail and wholesale industries and have above-average leverage ratios. Approximately 25% of firms (21% of market equity and 18% of book debt) are of type F-W, but they are responsible for over half of all adjustments.

These firm types also differ in the financial instruments involved in capital structure changes. Type F-W firms are by far the most active users of lines of credit, with 78% of quarters involving a drawdown or repayment. Lines of credit are also commonly used by type I firms, with the main purpose being short-term funding for M&As. Type F-W and I firms also issue long-term debt to fund capital expenditures and M&A activity. Finally, public equity is used by both of these firm types to implement share-repurchase programs and rebalance capital structure.

In contrast, adjustments by type F-G firms tend to involve convertible debt and private placements of equity and preferred stock. Many type F-G firms also issue equity "passively" due to actions outside of the firm's direct control, such as the exercise of executive stock options and the conversion of convertible debt. Compared with the other types, equity is employed much more frequently by type F-G firms, in about half of adjustment quarters, whereas credit lines are used less often.

The financing behaviors that we describe are consistent with existing capital structure theories to a certain degree, but the predominant theory is different for each type.[3] Type N firms, which do not refinance during our sample period, may be best described by the pecking-order theory (Myers and Majluf (1984), Myers (1984)), which states that cash-rich firms should use internal funds for investments and avoid using external financing due to adverse-selection costs. These firms are more difficult to square with the trade-off theory of capital structure because even in the presence of adjustment costs, they would be expected to rebalance their leverage at least once in a while.

The use of debt (rather than equity) for investment by type I and F-W firms is also consistent with the pecking-order theory, especially for type F-W firms, which tend to have low cash balances. But other models offer a more complete description of the data. In particular, the fact that these firms often use lines of credit fits the predictions of DeAngelo, DeAngelo, and Whited (2011) quite well. In their model, firms have a target capital structure but issue transitory debt as a cost-effective means of funding investment. Bolton, Wang, and Yang (2020) develop a model that predicts similar financing dynamics.

Funding investment with credit lines is also consistent with the models in Bolton, Chen, and Wang (2011), Acharya, Almeida, Ippolito, and Perez (2014), and Nikolov, Schmid, and Steri (2019). The last article points out that credit lines are useful because, unlike straight debt, they allow the firm to fund investment contingent on the realization of investment opportunities. Because profitability is correlated with investment opportunities, there is a positive correlation between profits and credit-line usage. Indeed, both type I and F-W firms are highly profitable.

[3]We encourage a cautious interpretation of our evidence in the context of capital structure theory. Our analysis documents a number of interesting patterns in corporate financing activity, but these results are based on the endogenous outcomes of managers' equilibrium decisions. Without exogenous variation in the economic drivers of these decisions, we cannot make causal statements or predict how the same firms would behave under counterfactual circumstances.

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Sufi (2009) instead proposes that this correlation arises because credit lines are less useful to manage liquidity for low-profitability firms because cash-flow covenants essentially make them contingent rather than fully committed. This perspective fits well with F-W firms' use of credit lines for seasonal working capital needs.

Turning to type F-G firms, the fact that they are young, small, and unprofitable but with high growth opportunities means that they face large information asymmetries. Relying on private placements of equity and convertible debt reduces their asymmetric information costs. In particular, Stein (1992) predicts that convertibles are an attractive means of issuing delayed equity for these firms, with a lower adverse price impact than issuing straight equity. Additionally, the lower coupon rate on convertibles preserves cash flow (Billingsley and Smith (1996)). Cash preservation could also motivate the prevalence of stock options and warrants for these firms.

Although certain aspects of firms' behavior fit with extant theory, others are not well covered in the literature. First, the fact that the most frequently adjusting firms mainly use external financing for operating reasons is not captured well by standard models that focus on investment in new projects or on pure capital structure adjustments.[4] Second, type F-G firms would usually be expected to access the external capital markets infrequently due to high information-asymmetry costs, which would be puzzling without the more detailed information from corporate filings data. At the same time, the characteristics of type I firms are associated with lower issuance costs that should enable them to optimize capital structure frequently. Third, although type F-G firms mainly self-insure using cash (instead of lines of credit), at times, they use credit lines to cover their operating losses, counter to the predictions of the models discussed previously. In fact, for the frequently adjusting firms, 34% of credit-line adjustments are associated with operating losses. This behavior is underexplored in the literature, although the dynamic agency model of DeMarzo and Sannikov (2006) points to a possible explanation: In the face of operating losses, a credit line increases flexibility by delaying the termination of a firm's projects, at the cost of delaying payouts to management.

Our findings also have important implications for the dynamic capital structure literature. Dynamic trade-off models predict that firms do not continuously optimize their leverage ratios due to the presence of fixed adjustment costs (e.g., Fischer et al. (1989), Goldstein et al. (2001), and Strebulaev (2007)). In this light, the empirical literature interprets the low frequency of proactive leverage changes in the accounting data as evidence that adjustment costs have a material effect on corporate financial policies (e.g., Leary and Roberts (2005)). Our analysis of corporate filings suggests that accounting-based studies overstate the actual occurrence of capital structure adjustment using standard long-term debt and equity securities.

Two key insights support this conclusion. First, a significant proportion of what would be measured as proactive adjustments in the accounting data are in fact

[4]Most existing dynamic models of the firm do not allow for negative operating cash flows (e.g., Fischer, Heinkel, and Zechner (1989), Goldstein, Ju, and Leland (2001), Hennessy and Whited (2005), (2007), Strebulaev (2007), and Nikolov and Whited (2014)). One exception is DeMarzo and Sannikov (2006).

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"passive" events in which leverage changes are not driven by contemporaneous actions by the firm. Rather, these are actions by investors (e.g., options exercise; see McKeon (2015)) or ongoing financing activity initiated by the firm in an earlier period (e.g., share repurchases that span multiple periods). Passive adjustments account for more than 10% of leverage adjustments in our sample, and they account for as much as 20% for type F-G firms. Only by examining detailed financial statements can a researcher determine whether a leverage change is due to the firm's current actions, its previous actions, or the actions of investors.

Second, we find that 39% of long-term debt changes in Compustat are due to credit-line usage rather than actual issuance or repayment of long-term debt. Lines of credit are often classified as long-term debt in accounting data because they have contractual maturity of over 1 year. On this basis, numerous studies of capital structure confound the costly issuance of long-term debt with transitory credit-line usage that involves minimal fixed adjustment costs after the up-front costs of arranging the credit facility are paid.[5]

We show that excluding option exercise and line-of-credit usage reduces the average frequency of adjustment by half, from once every 1.25 years (Leary and Roberts (2005)) to once every 2.5 years. This implies that either the benefits of leverage optimization with long-term debt and equity securities are lower or the costs of adjustment are higher than what is suggested by earlier studies that base their conclusions on accounting data. Consistent with this finding, Graham and Leary (2011) point out that recent research (e.g., van Binsbergen, Graham, and Yang (2010), Korteweg (2010)) finds modest value effects for wide ranges of leverage ratios.

The empirical literature has identified some of the stylized facts that we describe, but it tends to focus on specific forms of financing or capital structure dynamics rather than the connections among them. Byoun (2008), Elsas and Florysiak (2011), Faulkender, Flannery, Hankins, and Smith (2012), and Eckbo and Kisser (2021) consider heterogeneity in the rate at which firms adjust leverage and relate the speed of adjustment to a range of firm characteristics. However, these articles do not address the importance of lines of credit in explaining these adjustments and the implications for theories of costly capital structure adjustment. On this front, Lins, Servaes, and Tufano (2010) and Lee (2019) show that firms use credit lines to fund investment opportunities, whereas DeAngelo, Goncalves, and Stulz (2018) show that firms proactively repay debt to preserve financial flexibility.

DeAngelo, DeAngelo, and Stulz (2010) and McLean (2011) identify near-term cash needs as a motivation for seasoned equity issuance, but unlike the private placements of equity by type F-G firms, both articles study public equity issuance by mostly non-growth firms. In line with our findings on type F-G firms, several earlier articles show that private placements of convertible debt and equity are used

[5]This set of studies includes Hovakimian et al. (2001), Korajczyk and Levy (2003), Hovakimian (2004), Hovakimian, Hovakimian, and Tehranian (2004), Welch (2004), Leary and Roberts (2005), Fama and French (2005), Flannery and Rangan (2006), Byoun (2008), Huang and Ritter (2009), DeAngelo et al. (2011), Elsas and Florysiak (2011), Denis and McKeon (2012), Strebulaev and Whited (2012), Welch (2012), Danis, Rettl, and Whited (2014), DeAngelo and Roll (2015), Eisfeldt and Muir (2016), Fracassi, Petry, and Tate (2016), Frank and Shen (2019), and Eckbo and Kisser (2021).

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by firms with poor operating performance and severe information asymmetry (e.g., Hertzel and Smith (1993), Wu (2004), Brophy, Ouimet, and Sialm (2009), Brown and Floros (2012), Gomes and Phillips (2012), Denis and McKeon (2020), and Lim, Schwert, and Weisbach (2021)). Denis and McKeon (2020) document that these firms go through repeated cycles of raising cash and subsequently burning through that cash, not unlike the staged financing dynamic of venture-capital-backed start-ups, which explains their high average cash balances.

Other in-depth articles on specific financing events include those by Denis and McKeon (2012), who examine leverage increases through debt issuance; Elsas, Flannery, and Garfinkel (2014), who study the financing of large investments; and Dittmar, Duchin, and Zhang (2020), who study the timing and causal mechanisms explaining seasoned equity offerings. We build on these strands of the empirical literature by considering the full menu of financing options and relating these options to the frequency of and reasons for financing activity.

Finally, this article is similar in spirit to that by Duchin, Gilbert, Harford, and Hrdlicka (2017), who provide a detailed analysis of nonfinancial firms' holdings of financial assets and document rich heterogeneity in what is reported as cash on a firm's balance sheet. We focus instead on the liability side of the balance sheet and find that adjustments to liability structure reported in accounting data can mask important differences in the financial instruments used and the motivations for capital structure adjustment.

The remainder of the article is organized as follows: Section II describes the data and the classification of adjustment events. Section III discusses empirical patterns in leverage-adjustment rates. Section IV examines the reasons for capital structure adjustment. Section V explores the financial instruments firms use to adjust leverage. Section VI discusses the implications for research on capital structure adjustment costs. Section VII concludes.

II. Data

Our empirical analysis uses two separate data sets. The first is a panel of quarterly Compustat data, constructed in line with the extant literature on capital structure changes. We call this the *Compustat sample.* The second data set consists of hand-collected quarterly U.S. Securities and Exchange Commission (SEC) filings for leverage-adjustment events from subsets of firms in the Compustat sample that adjust at low, intermediate, and high frequencies. We call this the *adjustment sample.* In this section, we describe the construction of each data set in turn.

A. Compustat Sample

Table 2 summarizes the Compustat sample construction. We use data from the CRSP–Compustat merged database and employ a standard sample-construction procedure. We gather all observations from the Compustat Fundamentals Quarterly table in calendar years 1995–2009. We exclude data before 1995 because the SEC's Electronic Data Gathering, Analysis, and Retrieval (EDGAR) system does not

TABLE 2

Sample Construction

Table 2 reports the steps involved in constructing our sample. We sample from the CRSP–Compustat merged database in years 1995–2009. First, we remove financial firms (SIC 6000–6999), utilities (SIC 4900–4999), quasi-public firms (SIC above 8999), subsidiaries (STKO = 1 or 2), and non-U.S. firms (FIC ≠ USA). Second, we require nonmissing data for the following variables: total assets (ATQ) and the lagged value; short-term debt (DLCQ) and the lagged value; long-term debt (DLTTQ) and the lagged value; quarterly sale of common and preferred stock (SSTKQ); quarterly purchase of common and preferred stock (PRSTKCQ); cash and short-term investments (CHEQ); depreciation and amortization (DPQ); property, plant, and equipment (PPENTQ); operating income before depreciation (OIBDPQ); research and development expense (XRDQ); interest expense (XINTQ); and market capitalization. Third, we require at least 8 consecutive nonmissing observations for each firm. Fourth, we remove firms whose total assets drop below $10 million (2009 dollars) at any time during the sample period. The adjustment sample consists of a random sample of 90 out of 180 firms from the top decile of adjustment frequency, 60 out of 180 firms from the middle decile, and all firms from the bottom decile. We define a leverage adjustment as having occurred in a quarter if the absolute value of the difference between the change in equity and the change in debt, scaled by lagged total assets, exceeds 5%.

Panel A. Compustat Sample

Data Restriction	Firms	Firm-Quarters
Compustat excluding certain types of firms	9,686	279,674
Nonmissing variable requirements	4,895	75,544
Longest streak of at least 8 quarters	2,512	48,911
Exclude firms whose assets fall below $10 million	2,192	43,227
Final Compustat sample	2,192	43,227

Panel B. Adjustment Sample

Adjustment Frequency	Firms	Firm-Quarters
Top decile (random sample)	90	1,374
Middle decile (random sample)	60	1,308
Bottom decile	183	5,306

contain electronic filings before then. We exclude financial firms (SIC 6000–6999), utilities (SIC 4900–4999), quasi-public firms (SIC above 8999), subsidiaries (STKO = 1 or 2), and non-U.S. firms (FIC ≠ USA). This ensures our sample consists of independent firms whose financing decisions are unconstrained by regulation. This yields a sample of 279,674 firm-quarter observations for 9,686 unique firms.

Next, we drop firm-quarter observations with missing values for total assets (ATQ); short-term debt (DLCQ); long-term debt (DLTTQ); quarterly sale of common and preferred stock (SSTKQ); quarterly purchase of common and preferred stock (PRSTKCQ); cash and short-term investments (CHEQ); depreciation and amortization (DPQ); property, plant, and equipment (PPENTQ); operating income before depreciation (OIBDPQ); R&D expense (XRDQ); interest expense (XINTQ); and market capitalization, calculated from the shares outstanding and end-of-quarter stock price in CRSP.[6] We also drop observations with negative values of interest expense or cash and short-term investments. Finally, to compute the adjustment events defined later in the article, we require that the firm's total assets, as well as short- and long-term debt, are nonmissing in the previous quarter. These restrictions decrease the sample size to 75,544 observations for 4,895 firms.

We examine the behavior of firms that adjust leverage repeatedly, so we desire a level of continuity in the data. To this end, we require that each firm have at least 8 consecutive nonmissing quarterly observations in Compustat. This continuity

[6]Most income statement items in the Compustat Fundamentals Quarterly table are reported as cumulative numbers over the fiscal year. We use quarterly variables, defined as the difference between the current and previous values of the cumulative variables, except for the first quarter of the fiscal year (for which we use the reported value without first-differencing).

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requirement reduces the sample to 48,911 observations for 2,512 firms. Finally, we remove firms whose total assets drop below $10 million (in 2009 dollars) at any time during the sample period to mitigate the influence of very small firms. The final Compustat sample consists of 43,227 observations for 2,192 firms.[7]

For each firm-quarter, we determine whether there was a proactive leverage adjustment using a standard definition in the literature (Hovakimian et al. (2001), Korajczyk and Levy (2003), Hovakimian (2004), and Leary and Roberts (2005)). Firm i adjusts leverage in quarter t if the absolute value of the difference between the change in equity, $\Delta E_{i,t}$, and the change in debt, $\Delta D_{i,t}$, exceeds 5% of the previous quarter's total book assets, $A_{i,t-1}$:

$$\frac{|\Delta E_{i,t} - \Delta D_{i,t}|}{A_{i,t-1}} > 0.05. \tag{1}$$

The change in equity is defined as the difference between the quarterly sale of common and preferred stock and the quarterly purchase of common and preferred stock.[8] The change in debt is the change in balance sheet debt, defined as the sum of short-term debt and long-term debt, relative to the previous quarter.

This approach to identifying proactive, material changes in leverage comes from the literature on capital structure adjustment, but there are other types of adjustment that this method does not capture. First, we may miss quarters in which firms issue (or repurchase) both debt and equity but leave leverage unchanged (Hovakimian et al. (2004)). These dual-issuance and dual-repurchase events are rare, accounting for 0.35% and 0.06% of observations in our Compustat sample, respectively. Moreover, 75% of dual issues and 28% of dual repurchases are associated with an absolute leverage change of more than 5%, which qualifies them for our sample. Second, we do not capture financing actions that change the composition of the firm's debt structure without materially changing total leverage (Rauh and Sufi (2010)). Finally, our measure does not include leverage changes that occur through the firm's cash-payout or retention policy. With the exception of large special dividend payments, these decisions change leverage slowly over time through an accumulation of small changes. We focus instead on changes in the firm's liability structure that immediately and materially affect leverage. For recent

[7]Our sample-selection approach is similar to that used in other articles on capital structure adjustment, with minor differences. Our sample selection differs from Leary and Roberts (2005) because we restrict the sample to the post-EDGAR period starting in 1995, whereas they start in 1984; we require more nonmissing variables to correlate with adjustment frequency, whereas they only require leverage and issuance variables; we only require 2 years of consecutive data, whereas they require 4 years; and they have no minimum size restriction. As discussed later in the article, these differences do not appear to materially affect the results.

[8]The change in equity captures the net cash received from the issuance and purchase of stock and is sourced from the statement of cash flows. As discussed by Fama and French (2005), this measure may understate the total equity issued because the cash-flow statement does not include employee stock grants or stock issued in mergers, which do not generate cash flow for the firm. Fama and French (2005) instead use the split-adjusted change in the number of shares outstanding over the fiscal year multiplied by the average of (split-adjusted) stock prices over the fiscal year. This alternative measure may be less precise at a quarterly level because of timing differences in the grant date versus the vesting date. For this reason, and because we want to stay close to the adjustment events as identified in the bulk of the literature, we use the cash-flow measure of equity issuance.

work on the connection between external financing and cash policy, see DeAngelo et al. (2010), (2018), Faulkender et al. (2012), Nikolov and Whited (2014), McKeon (2015), and Eisfeldt and Muir (2016).

B. Adjustment Sample

We calculate the adjustment frequency for each firm in the Compustat sample as the ratio of the number of adjustment observations to the total number of quarterly observations for that firm. After sorting the Compustat sample into deciles by adjustment frequency, we randomly sample 90 out of 180 firms from the top decile, 60 out of 180 firms from the middle decile (the 45th–54th percentile), and all 183 firms from the bottom decile. We collect and examine the SEC filings for all quarters identified as adjustments for this sample of firms. For each adjustment observation, we manually read and interpret the firm's quarterly filing with the SEC to determine the reasons for adjusting leverage and the financial instruments used. The Appendix contains definitions and examples of each reason and type of financial instrument.

We classify the reasons for the change in leverage into five categories: operating, investment, financial, passive, and other reasons. Operating reasons relate to the firm's ongoing operations and include funding operating losses, seasonality, changes in inventory, accounts receivable, and accounts payable. Investment reasons include long-term investment needs (i.e., capital expenditures), asset divestiture, and M&As. Financial reasons include equity repurchases, capital structure rebalancing, debt repayment, maturing debt, forced conversions, and restructuring or reorganization. Passive reasons are capital structure changes that are outside of the firm's direct control and attributable to investor actions, decisions from earlier periods, or other reasons aside from actions by the firm in the present quarter. These include convertible-debt conversions, executive compensation, changes related to a neighboring quarter, apparent Compustat errors, and accounting changes. Examples of financing activities that are related to neighboring quarters include equity sales made pursuant to a previous private placement agreement, borrowing in one quarter to repay debt the next quarter, and share repurchases that are part of a previously authorized repurchase program. In these situations, we classify the initial action as an active decision and the follow-on actions as passive. Finally, other reasons include general purposes and lawsuit costs.[9]

The financial instruments are divided into four categories: short-term debt, long-term debt, equity, and previously issued securities. Short-term debt matures in less than 1 year and includes lines of credit, commercial paper, and bridge loans.[10] Long-term debt matures in more than 1 year and includes term loans, long-term notes, convertible debt, capital leases, debt to another firm, and guarantees. Equity

[9]Firms often state explicitly that financing proceeds will be used for general purposes. In the absence of clear evidence on the firm's motivation for financing, we use the information provided by management in its discussion of financing activities, even if this information lacks economic substance.

[10]We classify credit lines as short-term debt because they have short effective maturity, even though their contractual maturity often classifies them as long-term debt in Compustat. Consistent with this interpretation, Roberts (2015) shows that bank loan facilities are renegotiated every 9 months on average.

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includes public equity, private equity, and preferred stock. Previously issued securities include stock options and warrants, the exercise of which triggers the issuance of new company stock.

We examine each SEC filing in two stages. First, we examine the detailed financial statements in the filing. The balance sheet and statement of cash flows in a 10-Q or 10-K filing are more detailed than the information available from Compustat, so we can often identify the source of the leverage change from these tables. For instance, if the firm experiences a decrease in short-term debt, it may be apparent from the detailed balance sheet that this is attributable to the repayment of borrowings from the firm's revolving-credit facility. Alternatively, if the firm experiences a cash inflow from equity issuance, the statement of cash flows may reveal that it is due to the exercise of stock options and warrants. This financial statement analysis often requires knowledge of the previous quarter's balance sheet and statement of cash flows, so we also review the previous quarter's filing on EDGAR whenever possible. However, we do not exclude observations for which we cannot find the previous quarter's filing.

Second, we study management's discussion of the firm's substantial financing activities and the reasons for such financings, typically located in the "Liquidity and Capital Resources" section of the 10-Q and 10-K filings. When a firm issues securities, this discussion often contains an explicit use of proceeds. For example, the firm may describe that it used a credit facility to build up inventory to meet seasonal demand. If no explicit reason is disclosed, we infer how and why the firm's capital structure changed from the detailed balance sheet and statement of cash flows; the tables detailing debt, equity, and outstanding options and warrants; and management's discussion of financing activities. For example, the context may reveal that the firm used external financing to fund operating losses.

There are often multiple identifiable reasons for adjustment and financial instruments used in a single filing. We are only interested in the financing activities that cause us to observe a capital structure change in the Compustat data. Thus, we flag only financing actions (and their related reasons) that are large enough for the firm to breach the adjustment threshold (5% of the previous quarter's assets) in that period. For instance, if the firm issues debt for 3% of assets and repurchases shares for 2% of assets, we flag both actions and their associated reasons. If the firm instead issues debt for 5% of assets and repurchases shares for 2% of assets, we flag only the debt issuance because it triggers an adjustment on its own, whereas the repurchase does not. If a financing action is in the opposite direction of the Compustat-based adjustment trigger, it must be large enough to breach the adjustment threshold (5% of the previous quarter's assets) on its own. This might occur if a firm issues equity for 10% of assets and debt for 5% of assets, so the adjustment identified from Compustat is due to a leverage decrease, but the debt issuance would trigger a leverage increase in the absence of the equity issuance. In that case, we flag both financing actions and their associated reasons.

III. Adjustment Frequency

Table 3 presents adjustment statistics for the Compustat sample. Consistent with the findings of Leary and Roberts (2005), firms proactively adjust leverage in

TABLE 3

Statistics on Leverage Adjustments in the Compustat Sample

Table 3 reports statistics on leverage adjustments in the Compustat sample. The "Never" column contains the subsample of firms that never adjust, where an adjustment is defined as having occurred in a quarter if the absolute value of the difference between the change in equity and the change in debt, scaled by lagged total assets, exceeds 5%. The adjustment-frequency deciles sort firms by adjustment frequency, defined as the ratio of the number of adjustments to the total number of quarterly observations. "Minimum (maximum) frequency in decile" is the adjustment frequency of the firm that represents the lower (upper) cutoff for the decile. "Decile adjustment frequency" is the ratio of the number of adjustments to the total number of observations in each decile. "Percentage of all adjustments" is the ratio of the number of adjustments in that decile to the total number of adjustments in the full sample. "Fraction of firms" is the fraction of sample firms in each decile, averaged over the quarterly cross sections in the panel. "Fraction of equity" and "Fraction of debt" are each decile's market share of equity market value and book debt, respectively, averaged across the quarterly cross sections in the panel.

		Adjustment-Frequency Decile										
	Never	1	2	3	4	5	6	7	8	9	10	Full Sample
Number of firms	372	183	220	186	141	182	182	183	182	181	180	2,192
Number of firm-quarters	5,134	5,306	4,950	3,504	3,417	4,070	4,066	3,112	3,707	3,179	2,782	43,227
Quarters per firm	13.8	29.0	22.5	18.8	24.2	22.4	22.3	17.0	20.4	17.6	15.5	19.7
Number of adjustments	0	260	434	405	494	726	884	819	1,200	1,292	1,685	8,199
Minimum frequency in decile (%)	0	2	7	10	13	17	20	24	29	37	47	0
Decile adjustment frequency (%)	0	5	9	12	14	18	22	26	32	41	61	19
Maximum frequency in decile (%)	0	7	10	13	16	19	24	29	36	46	100	100
Percentage of all adjustments (%)	0	3	5	5	6	9	11	10	15	16	21	100
Cumulative percentage (%)	0	3	8	13	19	28	39	49	64	79	100	100
Fraction of firms	0.17	0.08	0.10	0.08	0.06	0.08	0.08	0.08	0.08	0.08	0.08	1.00
Fraction of equity	0.13	0.10	0.16	0.08	0.15	0.09	0.07	0.11	0.06	0.04	0.01	1.00
Fraction of debt	0.12	0.14	0.12	0.09	0.09	0.12	0.12	0.07	0.06	0.05	0.03	1.00

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19% of quarters. However, there is a striking amount of heterogeneity in the propensity to change capital structure. Of the 2,192 firms in the Compustat sample, 372 firms (17%) never adjust leverage by more than 5% during an average time of 5 years in the sample.[11] For the remaining firms, which have at least one adjustment event, Table 3 reports statistics by decile of adjustment frequency (as defined in Section II.B). Approximately 60% of these firms adjust less than once per year, whereas 10% adjust more than twice per year.

The skewness of the adjustment-frequency distribution implies that a small number of firms account for a disproportionate number of adjustment events. One-quarter of the firms in the sample account for more than half of leverage adjustments in the Compustat sample, whereas the 8% most active firms account for 21% of adjustments. This finding implies that prior research based on this type of adjustment event (e.g., Hovakimian et al. (2001), Korajczyk and Levy (2003), Hovakimian (2004), Hovakimian et al. (2004), Leary and Roberts (2005), Danis et al. (2014), and Eckbo and Kisser (2021)) overweight the influence of a small subset of firms. This begs the question of whether these firms are systematically different from the average firm.

The first seven columns of Table 4 report descriptive statistics of the Compustat sample. In order, the columns show the full sample, the top decile of adjustment frequency and the type F-G and F-W firms (which we define shortly), the middle and bottom deciles of adjustment frequency, and the firms that never adjust leverage during the sample period. The deciles are identical to Table 3, with the exception of the middle decile, which runs from the 45th to the 54th percentile and combines the top half of the fifth decile and the bottom half of the sixth decile of Table 3. The last three columns of Table 4 confirm that the firms randomly selected from the top and middle deciles for the adjustment sample are representative of the broader population, with no statistically significant differences from the respective deciles of the Compustat sample.

Frequently and infrequently adjusting firms differ in important ways. Among the firms that adjust at least once, all of the variables in Table 4 except depreciation are monotonically related to adjustment frequency. Firms in the top adjustment decile are smaller and younger than the average Compustat firm, and they tend to operate at a loss. Firms in the middle and bottom deciles of adjustment frequency, which together constitute the type I ("infrequent") classification from Table 1, are generally similar to the average Compustat firm, with bottom-decile firms being larger, older, and more profitable.

As discussed in the introduction, we observe two distinct types of frequently adjusting firms. To formalize our classification scheme, we conduct a *k*-means cluster analysis of firms in the top decile of adjustment frequency. The results are reported in Figure 1. This analysis reveals that the top decile consists of a mix of firms that are moderately profitable and have low R&D expense (cluster 1) and firms that are unprofitable but spend heavily on R&D investment (cluster 2).

[11] We should note that the preponderance of firms that never adjust leverage in our sample is partly driven by the requirement that the firm must have at least 8 consecutive quarters of nonmissing data. The mean (median) firm in our sample has 20 (16) quarters of data in the Compustat sample. Among firms with an above-median number of observations, 9.7% never adjust leverage.

TABLE 4

Characteristics of Firms with Different Adjustment Frequencies

Table 4 reports summary statistics on firms in the Compustat and adjustment samples. The reported statistics are means and medians (in parentheses) at the firm-quarter observation level. The columns labeled "Full Sample" and "Never" are identical samples to Table 3. "Top Decile" and "Bottom Decile" are adjustment-frequency deciles 10 and 1, respectively, of Table 3. We split the top decile into type F-G and F-W firms according to the cluster analysis in Figure 1 and the organizing framework in Table 1. The "Middle Decile" contains the 45th–54th percentile of firms sorted by adjustment frequency. The "High Sample" and "Middle Sample" columns are the random samples from the top and middle adjustment deciles, as described in Section II.B. Income and balance sheet variables are scaled by book assets, except for market leverage and net market leverage. Net market leverage uses total debt minus cash and cash equivalents as the numerator. Asset market-to-book is winsorized at 10. Quarterly profitability and research and development (R&D) expense are winsorized at the 1st and 99th percentiles. For the Compustat subsamples, *, **, and *** indicate statistically significant differences from the full sample mean at the 10%, 5%, and 1% levels, respectively. For the adjustment samples, the asterisks indicate statistically significant differences from the corresponding group means in the Compustat sample, respectively. Standard errors for differences in means tests are clustered by firm.

	Compustat Sample							Adjustment Sample		
		Top Decile						High Sample		
	Full Sample	All	F-G	F-W	Middle Decile	Bottom Decile	Never	F-G	F-W	Middle Sample
Years since initial public offering	14.05	8.23***	8.15***	8.26***	13.23	18.32***	10.86***	8.20	7.66	12.07
	(9.83)	(6.67)	(7.33)	(6.51)	(10.01)	(13.25)	(7.84)	(7.25)	(5.92)	(9.75)
log(ASSETS)	5.58	4.75***	3.47***	5.19***	5.62	5.89**	4.97***	3.42	5.20	5.29
	(5.37)	(4.49)	(3.38)	(5.21)	(5.43)	(5.60)	(4.72)	(3.36)	(5.39)	(5.05)
Book leverage	0.21	0.37***	0.43***	0.35***	0.22	0.15***	0.07***	0.43	0.35	0.21
	(0.15)	(0.31)	(0.26)	(0.32)	(0.19)	(0.08)	(0)	(0.21)	(0.31)	(0.18)
Market leverage	0.19	0.30***	0.12***	0.36***	0.19	0.16**	0.07***	0.10	0.36	0.19
	(0.10)	(0.22)	(0.08)	(0.30)	(0.13)	(0.06)	(0)	(0.06)	(0.33)	(0.13)
Net market leverage	0.03	0.22***	−0.01*	0.30***	0.07**	−0.02**	−0.25***	−0.04	0.29	0.08
	(0.02)	(0.18)	(−0.01)	(0.27)	(0.03)	(−0.05)	(−0.19)	(−0.02)	(0.29)	(0.03)
Cash and equivalents	0.23	0.15***	0.40***	0.07***	0.21	0.24	0.37***	0.41	0.09	0.20
	(0.13)	(0.04)	(0.38)	(0.02)	(0.11)	(0.16)	(0.32)	(0.38)	(0.03)	(0.09)
Interest expense (%)	0.43	1.04***	1.76***	0.79***	0.44	0.27***	0.14***	1.42	0.84	0.42
	(0.23)	(0.63)	(0.77)	(0.61)	(0.28)	(0.12)	(0.01)	(0.50)	(0.62)	(0.28)
1(DIVIDENDS > 0)	0.21	0.11***	0.04***	0.13***	0.20	0.28**	0.16***	0.05	0.14	0.18
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Profitability (%)	1.55	−1.23***	−11.45***	2.31***	1.76	2.46***	0.82***	−11.93	1.70	1.23
	(2.74)	(1.46)	(−11.57)	(2.37)	(2.92)	(2.75)	(1.79)	(−12.73)	(2.03)	(2.47)
Property, plant, equipment	0.24	0.23	0.19**	0.25	0.24	0.24	0.17***	0.18	0.21	0.24
	(0.17)	(0.17)	(0.11)	(0.20)	(0.20)	(0.17)	(0.11)	(0.10)	(0.17)	(0.21)

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TABLE 4 (continued)

Characteristics of Firms with Different Adjustment Frequencies

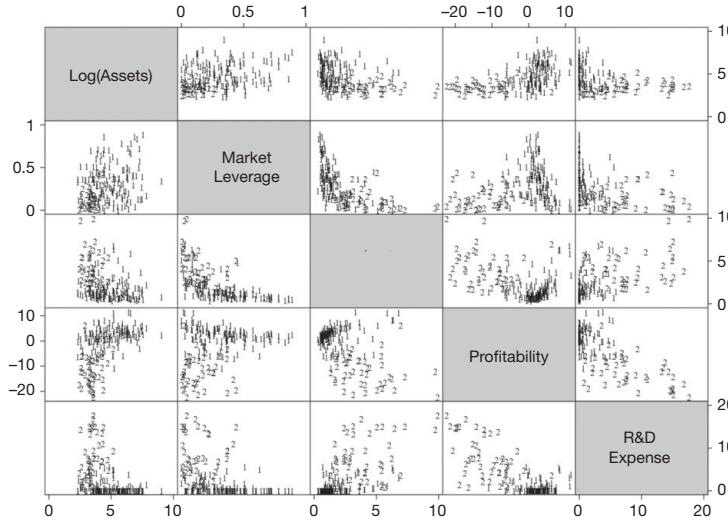
	Compustat Sample							Adjustment Sample		
		Top Decile						High Sample		
	Full Sample	All	F-G	F-W	Middle Decile	Bottom Decile	Never	F-G	F-W	Middle Sample
Capital expenditures (%)	1.35	1.68***	1.52	1.73***	1.34	1.17***	1.03***	1.55	1.49	1.35
	(0.84)	(0.95)	(0.71)	(1.04)	(0.84)	(0.82)	(0.62)	(0.71)	(0.86)	(0.81)
Depreciation (%)	1.22	1.33	1.54*	1.25	1.32*	1.13*	1.12***	1.54	1.09	1.33
	(1.06)	(1.03)	(1.10)	(1.02)	(1.12)	(1.00)	(0.98)	(1.18)	(0.85)	(1.16)
Asset market-to-book	1.88	2.26**	4.43***	1.51***	1.90	1.69***	1.76*	4.83	1.49	1.83
	(1.36)	(1.35)	(3.69)	(1.02)	(1.43)	(1.25)	(1.26)	(4.08)	(1.01)	(1.33)
1(R&D EXPENSE > 0)	0.71	0.50***	1.00***	0.33***	0.74	0.75	0.83***	1.00	0.31	0.74
	(1)	(1)	(1)	(0)	(1)	(1)	(1)	(1)	(0)	(1)
R&D expense (%, if nonzero)	2.99	4.76***	7.49***	1.94***	2.95	2.07***	3.27*	8.66	1.71	3.32
	(1.95)	(3.04)	(6.06)	(1.25)	(1.99)	(1.56)	(2.57)	(7.84)	(1.18)	(1.98)
Number of firms	2,192	180	45	135	180	183	372	28	62	60
Number of firm-quarters	43,227	2,782	715	2,067	4,014	5,306	5,134	461	913	1,308
Number of adjustments	8,199	1,685	425	1,260	782	260	0	278	554	254

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FIGURE 1

Cluster Analysis of Frequently Adjusting Firms

Figure 1 reports a cluster analysis of firms in the top decile of adjustment frequency. The analysis uses the *k*-means algorithm to find *k* cluster-center vectors in the data and assign observations to the nearest cluster center, minimizing the sum of squared distances to the respective cluster centers. Our analysis uses each firm's average log assets, market leverage, asset market-to-book, profitability, and research and development (R&D) expense to sort firms into $k = 2$ groups. All variables in the cluster analysis are standardized to ensure they are weighted equally. The matrix of plots shows how the two groups, labeled 1 and 2, sort along pairs of the characteristics. Each cell is a scatterplot with the variable in the same column on the horizontal axis and the variable in the same row on the vertical axis. Each point is marked by the number of the cluster to which the corresponding firm belongs. For example, the plot just to the left of the cell labeled "R&D Expense" and below "Profitability" shows that the firms in cluster 1 tend to be high profitability with low R&D expense, whereas the cluster 2 companies tend to have low profitability and high R&D expense. In the classification from Table 1, cluster 1 contains type F-W firms, and cluster 2 contains type F-G firms.



For reasons that will become clearer as we discuss these firms' reasons for external financing, we refer to cluster 1 as *type F-W* ("working capital") firms and cluster 2 as *type F-G* ("growth") firms. In terms of industries, type F-W consists primarily of retail and wholesale firms, whereas the industries most represented among type F-G firms are pharmaceuticals, medical and lab equipment, and computer products. The summary statistics in Table 4 reveal further differences in balance sheet characteristics between the two groups. Specifically, type F-G firms are smaller and have higher market-to-book ratios and more cash holdings. They have lower financial leverage in market-value terms but higher book leverage, the difference being due to their high market-to-book ratios.

Type N firms, which never adjust leverage during our sample period, are in many ways similar to the type F-G firms that adjust leverage more than twice a year. Type N firms also tend to be smaller, younger, less profitable, and significantly more cash-rich than the average firm. However, these firms are marginally profitable on average, which, along with their high cash balances, helps to explain why they do not raise external financing. It is likely that the costs of asymmetric information associated with the size, age, and R&D spending of type N firms drive both their cash-retention and financing policies. Although type F-G firms share many attributes with type N firms, their lack of profitability drives them to use their

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cash more quickly, which requires them to access external financing frequently despite facing potentially high adjustment costs.

The patterns in Table 4 are broadly consistent with the results in Table V of Leary and Roberts (2005), which confirms that our sample is representative of the samples used in prior work on capital structure adjustments. However, our presentation of the data also reveals important nonlinearities that were not previously identified. For example, there is a nonmonotonic relation between profitability and the propensity to adjust leverage; both the firms that adjust frequently and the firms that never adjust are less profitable than the average Compustat firm. The firms in the former set resolve their operating shortfalls by raising external financing, whereas those in the latter set use their existing cash balances instead.

In sum, the Compustat sample reveals a great deal of heterogeneity in corporate policies regarding capital structure adjustment. The rate of leverage adjustment differs dramatically across firms, with some firms materially changing leverage more than twice a year, whereas others never do so during our sample period. These firms differ systematically in their characteristics in ways that raise questions about their financial policies. To better understand the corporate financial policies underlying the patterns observed in the Compustat sample, we turn to our hand-collected data on firms in the adjustment sample.

IV. Why Do Firms Adjust Leverage?

The Compustat data provide useful information on capital structure changes in a large sample, but they do not provide direct insight as to why firms adjust leverage and what financial instruments they use. To answer these questions, we use hand-collected information from corporate filings for the adjustment sample, which contains leverage changes from the top, middle, and bottom deciles of adjustment frequency in the Compustat sample.

Table 5 summarizes our findings on the reasons for capital structure adjustment, following the classification scheme described in Section II.B. For each subset of firms, we report the frequency of each reason as a percentage of all adjustment events (at the firm-quarter level, under the column labeled "Quarters") and the frequency of firms that report each reason at least once over the sample period (at the firm level, under the column labeled "Firms"). We allow there to be multiple reasons for a given adjustment event, so the numbers in each column sum to more than 100%.[12]

The most striking pattern in Table 5 is that operating reasons are the dominant driver of capital structure changes for both types of firms in the top decile of adjustment frequency, accounting for approximately two-thirds of observations, whereas firms in the bottom decile are rarely motivated by short-term operating needs. The specific motivations of type F-G and F-W firms are quite different. Type F-G firms use external financing to cover operating losses in 67% of quarters

[12]Some observations from 1995 and 1996 in the adjustment sample are not found in EDGAR because electronic filing was being introduced in this period. We are able to locate filings for 44 out of 94 events in 1995 and 126 out of 131 events in 1996. Only 2 out of 1,121 observations from 1997 to 2009 are missing a quarterly filing in EDGAR.

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TABLE 5

Reasons for Leverage Adjustment

Table 5 reports the reasons associated with leverage adjustments by firms in the high-, middle-, and low-adjustment-frequency subsamples. The high-frequency subsample is split into type F-G and F-W firms according to the cluster analysis in Figure 1 and the organizing framework in Table 1. See Section II.B for a description of the classification of adjustment reasons from quarterly U.S. Securities and Exchange Commission (SEC) filings. For each subsample, the first column reports the number of firm-quarters that list a given reason for adjustment, as a percentage of the total number of adjustments. The second column reports the number of firms that quote a reason at least once during the sample period, as a percentage of the number of firms in the subsample. The denominators in both columns exclude firm-quarters and firms for which filings are not available in the Electronic Data Gathering, Analysis and Retrieval (EDGAR) system. The percentages add up to more than 100% because multiple reasons can be given for the same adjustment event. "Only passive adjustment" indicates observations for which the only reasons for adjustment are passive.

	High Frequency				Mid Frequency		Low Frequency	
	F-G		F-W					
	Quarters	Firms	Quarters	Firms	Quarters	Firms	Quarters	Firms
Operating Reasons								
Funding operating losses	66.9	96.4	18.3	43.6	10.3	24.1	2.8	3.9
Seasonality	0	0	36.0	40.3	3.7	3.5	0	0
Change in inventory level	2.6	17.9	28.6	58.1	8.2	12.1	2.0	2.8
Change in accounts receivable	0.4	3.6	4.6	19.4	8.6	17.2	2.8	3.3
Change in accounts payable	1.1	7.1	5.3	17.7	4.1	10.3	0.4	0.6
Any operating reason	68.4	96.4	64.0	77.4	25.8	46.6	5.5	7.2
Investment Reasons								
Investment needs	16.2	50.0	17.3	50.0	7.8	24.1	11.4	13.9
Asset divestiture	1.5	14.3	1.5	9.7	5.3	17.2	1.6	2.2
Mergers and acquisitions	1.1	10.7	8.6	30.7	18.4	48.3	21.3	23.9
Any investment reason	18.4	57.1	26.3	69.4	31.6	67.2	33.5	37.2
Financial Reasons								
Equity repurchase	3.0	10.7	7.2	14.5	13.1	20.7	22.8	27.2
Capital structure rebalance	2.3	14.3	6.7	27.4	10.7	25.9	7.1	9.4
Debt repayment	7.5	35.7	23.6	69.4	24.2	53.5	15.4	18.9
Maturing debt	2.6	17.9	1.1	8.1	0.8	3.5	2.8	3.9
Forced conversion	3.0	14.3	0.6	4.8	0.4	1.7	0.8	1.1
Restructuring/reorganization	0.4	3.6	0.2	1.6	1.2	5.2	1.2	1.7
Any financial reason	18.1	60.7	35.4	83.9	39.8	70.7	45.7	51.7
Passive Reasons								
Convertible debt conversion	7.9	32.1	0.4	3.2	0.4	1.7	0	0
Executive compensation	5.6	17.9	1.5	8.1	3.3	12.1	5.5	7.2
Related to neighboring quarter	12.0	35.7	5.9	14.5	3.3	13.8	2.0	2.8
Apparent Compustat error	2.6	10.7	1.0	6.5	3.3	8.6	0.8	1.1
Accounting change	0	0	0	0	0.4	1.7	0	0
Passive adjustment	30.8	78.6	8.8	27.4	10.7	31.0	9.1	11.7
Only passive adjustment	23.3	67.9	8.0	24.2	8.2	24.1	6.7	8.3
Other Reasons								
General purposes	7.9	32.1	4.0	17.7	20.1	43.1	22.4	29.4
Lawsuit costs	0.4	3.6	0.2	1.6	0.4	1.7	0	0
No. of obs.	266	28	525	62	244	58	254	180
No. of obs. not in EDGAR	12	0	29	0	10	2	6	3
No. of obs. in sample	278	28	554	62	254	60	260	183

involving a change in leverage. This is in line with the lack of profitability and high R&D expenditure of type F-G firms shown in Table 4. Type F-W firms also cite operating losses more often than firms in the middle and bottom deciles, but their main motivation is to fund working capital and seasonal cash needs.[13] This is intuitive, given the high concentration of retailers and wholesalers among the type F-W firms.

Type I firms in the middle- and low-frequency subsamples are more likely to access the capital markets for investment and financial reasons. Compared with

[13]Note that we interpret changes in working capital as a reason for external financing rather than a source of financing. Prior literature studying trade credit as a source of financing includes Petersen and Rajan (1997) and Barrot (2016).

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type F-G firms, firms in the bottom decile are 15% more likely to engage with the capital markets for investment reasons (33.5% vs. 18.4% of firm-quarters) and 28% more likely to do so for financial reasons (45.7% vs. 18.1% of firm-quarters). Differences in the percentages of firms adjusting leverage for these reasons at least once are more difficult to interpret because firms that adjust more often are more likely to mention each of these reasons at least once. Type F-W firms fall between the type F-G and I firms with respect to investment reasons and behave more like type I firms with respect to financial motivations for leverage adjustment. Notably, type F-G and F-W firms are far less likely than type I firms to cite "general purposes" as the use of financing proceeds, which suggests that the frequently adjusting firms engage with the capital markets out of necessity rather than for opportunistic reasons.

Many of the adjustment events identified in Compustat are outside of the firm's direct control, initiated by agents outside of the firm or due to actions taken by the firm in earlier periods. For brevity, we refer to these events collectively as "passive" adjustments. In Table 5 we report the frequency of passive adjustments and the fraction of adjustments due to passive reasons alone (i.e., not also involving a proactive reason). Passive adjustments account for a material share of the leverage changes observed in the Compustat data. Among type F-G firms, passive reasons account for more than one-fifth of capital structure adjustments, whereas they explain approximately 10% of such events for type F-W and I firms. The most common sources of passive adjustment are multiperiod actions and executive compensation. The former relates to decisions made by the firm in earlier periods, such as ongoing share-repurchase programs. The latter relates to the exercise of stock options by the firm's executives in the current period.[14]

This is an important shortcoming of the standard approach to identifying proactive leverage adjustments in Compustat, which implicitly assumes that net flows in debt and equity are initiated by the firm. Only by examining each adjustment in detail can one determine whether a leverage change is due to a current decision by the firm, a consequence of previous actions by the firm, or a decision by the firm's employees and investors. McKeon (2015) shows that almost all small equity issuances (of less than 2% of assets) in Compustat are stock option exercises. Our results show that a nontrivial proportion of large leverage adjustments (of more than 5% of assets) are also outside of the firm's direct control.

To shed further light on these patterns, Table 6 splits the sample into leverage-increasing and leverage-decreasing events. This split reveals differences in the direction of leverage adjustment across groups. Type F-G firms reduce leverage in nearly 70% of adjustment quarters, whereas type F-W firms and firms in the bottom decile increase leverage in over 60% of quarters, and firms in the middle decile are equally likely to increase or decrease leverage. The uneven split for type I firms is consistent with the higher profitability of these firms leading them to issue debt and repurchase shares more often to offset the passive decreases in leverage that occur as assets grow from the accumulation of earnings (Strebulaev (2007)).

Both type F-G and F-W firms are more likely to be motivated by operating needs when increasing leverage, although these reasons also factor heavily in explaining

[14]Executive compensation and convertible-debt conversion can also be viewed as related to previous quarters because the stock options and convertible bonds were issued in an earlier period.

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TABLE 6

Reasons for Adjustment Split by Direction of Leverage Change

Table 6 reports the reasons associated with leverage adjustments by firms in the high-, middle-, and low-adjustment-frequency subsamples, splitting the adjustment events for each subsample into leverage-increasing (L-Incr.) and leverage-decreasing (L-Decr.) quarters based on the direction of the leverage change. The high-frequency subsample is split into type F-G and F-W firms according to the cluster analysis in Figure 1 and the organizing framework in Table 1. See Section II.B for a description of the classification of adjustment reasons from quarterly U.S. Securities and Exchange Commission (SEC) filings. The table reports the number of firm-quarters that list a given reason for adjustment, as a percentage of the total number of adjustments that result in a leverage change in the direction shown in the column heading. The denominator excludes firm-quarters for which filings are not available in the Electronic Data Gathering, Analysis and Retrieval (EDGAR) system. The percentages add up to more than 100% because multiple reasons can be given for the same adjustment event. "Only passive adjustments" indicates observations for which the only reasons for adjustment are passive.

	High Frequency				Middle Frequency		Low Frequency	
	F-G		F-W					
	L-Incr.	L-Decr.	L-Incr.	L-Decr.	L-Incr.	L-Decr.	L-Incr.	L-Decr.
Operating Reasons								
Funding operating losses	73.8	64.0	26.4	6.2	7.4	13.1	1.9	4.2
Seasonality	0	0	33.7	39.5	4.1	3.3	0	0
Change in inventory level	6.3	1.1	41.6	9.1	11.5	4.9	2.5	1.0
Change in accounts receivable	0	0.5	6.7	1.4	9.8	7.4	3.8	1.0
Change in accounts payable	3.8	0	6.7	3.3	4.9	3.3	0.6	0
Any operating reason	77.5	64.5	70.5	54.3	25.4	26.2	5.7	5.2
Investment Reasons								
Investment needs	16.3	16.1	23.8	7.6	10.7	4.9	15.8	4.2
Asset divestiture	0	2.2	0.3	3.3	0	10.7	0.6	3.1
Mergers and acquisitions	3.8	0	12.1	3.3	34.4	2.5	34.2	0
Any investment reason	18.8	18.3	34.3	14.3	45.1	18.0	49.4	7.3
Financial Reasons								
Equity repurchase	10.0	0	11.8	0.5	26.2	0	36.7	0
Capital structure rebalance	0	3.2	5.4	8.6	10.7	10.7	5.1	10.4
Debt repayment	3.8	9.1	1.3	57.1	2.5	45.9	1.3	38.5
Maturing debt	2.5	2.7	0.3	2.4	0	1.6	1.3	5.2
Forced conversion	0	4.3	0.3	1.0	0	0.8	0	2.1
Restructuring/reorganization	0	0.5	0	0.5	0	2.5	0	3.1
Any financial reason	16.3	18.8	14.3	67.1	28.7	50.8	39.2	56.3
Passive Reasons								
Convertible debt conversion	1.3	10.8	0	1.0	0	0.8	0	0
Executive compensation	1.3	7.5	0.3	3.3	0	6.6	0.6	13.5
Related to neighboring quarter	10.0	12.9	8.6	1.9	4.1	2.5	2.5	1.0
Apparent Compustat error	5.0	1.6	1.0	1.0	4.1	2.5	0.6	1.0
Accounting change	0	0	0	0	0	0.8	0	0
Passive adjustment	17.5	36.6	9.5	7.6	8.2	13.1	3.8	17.7
Only passive adjustment	15.0	26.9	8.6	7.1	8.2	8.2	3.2	12.5
Other Reasons								
General purposes	7.5	8.1	2.9	5.7	11.5	28.7	16.5	32.3
Lawsuit costs	0	0.5	0	0.5	0.8	0	0	0
No. of obs.	85	193	331	223	122	122	158	96
No. of obs. not in EDGAR	5	7	16	13	5	5	3	3
No. of obs. in sample	80	186	315	210	127	127	161	99

these firms' leverage-decreasing events. For adjustments motivated by investment and financial reasons, there are clear differences between leverage-increasing and leverage-decreasing events. Investment reasons are more commonly associated with leverage-increasing actions, whereas financial reasons are more likely to motivate leverage-decreasing events. Debt repayment is the most common financial reason for leverage-decreasing adjustment by type F-W and I firms. Although this finding does not constitute conclusive evidence, it is consistent with firms reducing expected costs of financial distress under the trade-off theory (Korteweg (2010)) and proactively rebuilding financial flexibility (DeAngelo et al. (2018); see also the CFO survey in Graham and Harvey (2001), which shows that financial flexibility is

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the most important factor in determining a firm's amount of debt). Share repurchases account for a large fraction of leverage-increasing events for type I firms, whereas they are far less common for type F-G and F-W firms, in line with the notion that type I firms are more likely to engage with the capital markets for opportunistic reasons rather than out of necessity.

Passive adjustments are substantially more common in leverage-decreasing quarters, due to the exercise of executive stock options and the conversion of convertible debt by bondholders. The fraction of passive adjustments in leverage-decreasing quarters for type F-G firms is nearly 4 times as high as the corresponding fraction for leverage-increasing quarters, and a similar pattern is observed for firms in the low-frequency subsample. This suggests that the economic costs of reducing leverage are higher, or the benefits of preserving flexibility are lower, than implied by accounting data because up to one-fifth of leverage reductions identified in Compustat are not initiated by the firm. We will revisit this issue in Section VI.

V. How Do Firms Adjust Leverage?

Thus far, we have revealed systematic patterns in the observable characteristics of frequently and infrequently adjusting firms and their reasons for engaging with the capital markets. It is difficult to assess the economic mechanisms underlying these patterns without also knowing *how* firms are adjusting their leverage ratios. In this section, we explore the financial instruments that frequently and infrequently adjusting firms use and shed light on the capital structure policies associated with the funding motives uncovered in the prior section.

Table 7 summarizes the financial instruments used to adjust capital structure following the classification scheme described in Section II.B. For each subsample of firms, we report the frequency of each financial instrument issued or repurchased as a proportion of all adjustment events (firm-quarters), as well as the firms in each subsample that use each instrument at least once during the sample period. Firms can issue or repurchase multiple types of securities in a given quarter, so the numbers in each column add to more than 100%.

Type F-W firms, which adjust capital structure frequently for working capital reasons, use revolving lines of credit in more than three-quarters of adjustment events. Lines of credit also play a prominent role for type I firms, accounting for more than one-third of leverage changes in the middle and bottom deciles. It is intuitive that firms with frequently changing needs for external financing choose to rely on lines of credit. If the firm has an existing line of credit with a bank, the cost of drawing cash and paying it back is negligible, which minimizes the information and transaction costs of accessing capital. However, the bank must be compensated for providing flexibility through up-front and annual fees, as well as the interest rate on the facility, so firms with less frequent financing needs find it less attractive to use lines of credit or even forego them altogether.[15]

[15]The literature suggests that bank loans have a higher cost of capital than bonds. Faulkender and Petersen (2006) find that firms with access to public debt markets are able to achieve higher leverage. Schwert (2020) finds that after adjusting for seniority differences, bank loans have higher credit spreads than bonds issued by the same firm.

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TABLE 7

Financial Instruments Involved in Capital Structure Adjustments

Table 7 reports the financial instruments issued or repurchased in adjustment events by firms in the high-, middle-, and low-adjustment-frequency subsamples. The high-frequency subsample is split into type F-G and F-W firms according to the cluster analysis in Figure 1 and the organizing framework in Table 1. See Section II.B for a description of the classification of financial instruments from quarterly U.S. Securities and Exchange Commission (SEC) filings. For each subsample, the first column reports the percentage of firm-quarters that involve the financial instrument, as a percentage of the total number of adjustments. The second column reports the number of firms that use the financial instrument at least once during the sample period, as a percentage of the number of firms in the subsample. The denominators in both columns exclude firm-quarters and firms for which filings are not available in the Electronic Data Gathering, Analysis and Retrieval (EDGAR) system. The percentages add up to more than 100% because multiple reasons can be given for the same adjustment event. Financial instruments are not categorized for apparent Compustat errors, which are quarters when an adjustment is identified in the data but did not truly occur.

	High Frequency							
	F-G		F-W		Mid Frequency		Low Frequency	
	Quarters	Firms	Quarters	Firms	Quarters	Firms	Quarters	Firms
Short-Term Debt								
Line of credit	17.3	50.0	78.3	87.1	46.7	63.8	30.3	31.1
Commercial paper	3.0	10.7	0.6	4.8	1.6	5.2	3.9	3.3
Bridge loan	1.1	3.6	0.6	3.2	0.8	1.7	1.2	1.7
Any short-term debt instrument	21.1	53.6	79.1	88.7	48.8	63.8	35.4	35.6
Long-Term Debt								
Term loan	7.9	21.4	5.9	21.0	15.2	31.0	13.0	17.2
Long-term note	4.1	17.9	5.3	32.3	5.3	13.8	16.1	17.8
Convertible debt	22.2	50.0	4.0	17.7	9.8	17.2	8.7	11.7
Capital lease	0	0	2.1	14.5	0	0	1.6	2.2
Debt to another firm	4.9	21.4	3.2	9.7	0.8	1.7	1.2	1.7
Any long-term debt instrument	36.1	60.7	18.1	56.5	28.7	50.0	38.2	45.6
Equity								
Public equity	7.9	35.7	10.7	35.5	21.7	44.8	29.5	36.1
Private equity	33.1	71.4	3.8	14.5	12.3	34.5	6.7	7.8
Preferred stock	11.3	39.3	1.7	6.5	1.2	5.2	2.4	3.3
Any equity security	51.5	92.9	16.2	43.6	35.3	60.3	38.6	45.6
Previously Issued Securities								
Stock options/warrants	10.2	39.3	2.1	12.9	3.3	12.1	6.3	8.3
Apparent Compustat error	2.6	10.7	1.0	6.5	3.3	8.6	0.8	1.1
No. of obs.	266	28	525	62	244	58	254	180
No. of obs. not in EDGAR	12	0	29	0	10	2	6	3
No. of obs. in sample	278	28	554	62	254	60	260	183

The prevalence of credit-line usage highlights an important benefit of our data set. We are able to identify the specific types of debt the firm uses to adjust leverage, whereas Compustat only reports total debt amounts split by maturity, specifically short-term (under 1 year) versus long-term (over 1 year) maturity. Prior research has used this distinction to isolate costly leverage optimization by focusing on long-term debt changes (e.g., Byoun (2008), Danis et al. (2014)). We find that this approach can be misleading. Out of 559 changes in long-term debt (in excess of 5% of lagged assets) in the adjustment sample, we find that in 39% of cases, the change is made via a credit line, with no actual issuance or repayment of long-term debt. This is due to lines of credit with more than 1 year to maturity, which accounting rules classify as long-term debt. Thus, even studies that ignore short-term debt and rely only on changes in long-term debt to identify capital structure optimization still contain a large amount of transitory credit-line usage.

In contrast to the type F-W firms, conditional on an adjustment event, type F-G and I firms are more likely to use long-term debt or equity. However, these two groups of firms exhibit significant differences in the types of financing they use within these broad categories. In line with the standard view of how large firms

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access financing, type I firms issue traditional long-term debt, either corporate bonds or term loans, and engage with the public equity markets. On the other hand, because the type F-G firms face higher asymmetric information and worse creditworthiness, they tend to use convertible debt (Stein (1992)) and private placements of equity (Lim et al. (2021)). Type F-G firms are also more likely to experience leverage changes from the exercise of stock options and warrants, which results from firms' past decisions to compensate executives with stock options and to offer warrants as a sweetener in equity private placements.

Type F-G firms are especially interesting in the context of theories based on information asymmetry, such as the pecking-order model of Myers and Majluf (1984). These firms derive their value from growth options, as evidenced by their high expenditure on R&D and lack of profitability, and would typically be interpreted as having a high degree of asymmetric information and high costs of accessing external finance. In that light, their reliance on external capital appears to be puzzling. However, the rate of cash burn by these firms, on the order of 12% of book assets per quarter based on their operating losses (see Table 4), implies that they face a choice between raising financing and shutting down their operations. These firms rely on equity private placements, which are a "last resort" form of financing due to their onerous terms (Brophy et al. (2009)) but do offer some of the benefits of relationship financing. Type F-G firms often issue equity to the same investors repeatedly, which reduces information costs after the initial transaction.

To draw connections between the reasons for leverage adjustment and the financial instruments used, Table 8 reports the percentage of quarters involving each reason for financing when the capital structure adjustment uses short-term debt, long-term debt, or equity. As before, it is possible to have more than one reason or financial instrument associated with a firm-quarter observation, so the total observations across columns add up to more than the observation counts in prior tables, and the percentages within a column can add to more than 100%.

The results are intuitive in light of the patterns discussed previously. Short-term debt is used to fund working capital for type F-W and I firms and M&A transactions for type I firms. Proactive repayment of short-term debt is common for all types of firms, whereas short-term debt is rarely associated with "passive" adjustments outside of the firm's control. The reasons for long-term debt usage vary by firm type, but this form of financing is most commonly associated with investment needs. These patterns are consistent with the pecking-order theory, as well as theories of transitory debt, such as that by DeAngelo et al. (2011), in which firms issue debt to finance investment activity but repay it quickly to maintain financial flexibility.

Equity-issuance and equity-repurchase activity varies substantially across firm types. Type I firms tend to repurchase equity for financial reasons and to issue equity for general purposes, consistent with opportunistic motives rather than necessity. At the other end of the spectrum, type F-G firms routinely issue equity to fund ongoing losses. Despite their differences, these behaviors are consistent with the pecking-order theory. In that light, the behaviors of type I and F-G firms could reflect differences in their operating performance and investment opportunities rather than different models of financial policy.

TABLE 8

Adjustment Reasons Split by Financial Instruments Used

Table 8 reports the reasons for leverage adjustment reported by firms in the high-, middle-, and low-adjustment-frequency subsamples, splitting the adjustment events for each subsample into three categories of financial instruments used: short-term debt (SD), long-term debt (LD), and equity (EQ). The high-frequency subsample is split into type F-G and type F-W firms according to the cluster analysis in Figure 1 and the organizing framework in Table 1. See Section II.B for a description of the classification of adjustment reasons from quarterly U.S. Securities and Exchange Commission (SEC) filings. The table reports the number of firm-quarters that list a given reason for adjustment, as a percentage of the total number of adjustments using the type of financial instrument in the column heading. The denominator excludes firm-quarters for which filings are not available in the Electronic Data Gathering, Analysis and Retrieval (EDGAR) system. The percentages add up to more than 100% because multiple reasons can be given for the same adjustment event. "Only passive adjustments" indicates observations for which the only reasons for adjustment are passive. Apparent Compustat errors are excluded because reasons and financial instruments are not identified for these observations.

	High Frequency											
	F-G			F-W			Middle Frequency			Low Frequency		
	SD	LD	EQ	SD	LD	EQ	SD	LD	EQ	SD	LD	EQ
Operating Reasons												
Funding operating losses	73.2	56.3	85.4	17.6	32.6	14.1	5.9	5.7	18.6	2.2	1.0	4.1
Seasonality	0	0	0	45.5	7.4	2.4	7.6	1.4	0	0	0	0
Change in inventory level	7.1	1.0	1.5	34.2	12.6	8.2	16.8	1.4	0	4.4	1.0	1.0
Change in accounts receivable	0	0	0.7	5.1	4.2	1.2	17.7	2.9	0	6.7	1.0	1.0
Change in accounts payable	3.6	2.1	0	6.3	2.1	1.2	8.4	0	0	1.1	0	0
Any operating reason	78.6	56.3	86.1	73.3	50.5	21.2	37.8	7.1	18.6	8.9	2.1	5.1
Investment Reasons												
Investment needs	12.5	17.7	22.6	16.6	32.6	20.0	5.9	10.0	7.0	11.1	19.6	7.1
Asset divestiture	1.8	3.1	1.5	1.7	3.2	1.2	8.4	7.1	0	2.2	2.1	0
Mergers and acquisitions	0	3.1	0	8.0	14.7	10.6	20.2	32.9	3.5	40.0	27.8	5.1
Any investment reason	14.3	22.9	24.1	25.5	46.3	30.6	34.5	50.0	10.5	53.3	47.4	12.2
Financial Reasons												
Equity repurchase	0	0	5.8	3.4	4.2	44.7	9.2	2.9	36.1	7.8	10.3	59.2
Capital structure rebalance	1.8	6.3	3.7	5.5	13.7	40.0	16.0	14.3	29.1	8.9	10.3	17.4
Debt repayment	21.4	12.5	5.1	27.5	23.2	5.9	37.8	32.9	15.1	30.0	14.4	3.1
Maturing debt	3.6	5.2	1.5	0.7	4.2	0	0	2.9	0	1.1	6.2	0
Forced conversion	1.8	6.3	2.2	0.2	1.1	0	0	1.4	1.2	0	2.1	0
Restructuring/reorganization	0	1.0	0	0.2	1.1	0	0	4.3	0	0	3.1	0
Any financial reason	26.8	29.2	16.8	33.3	41.1	68.2	47.1	44.3	52.3	44.4	38.1	68.4
Passive Reasons												
Convertible-debt conversion	1.8	21.9	2.9	0.2	2.1	0	0	1.4	0	0	0	0
Executive compensation	1.8	3.1	1.5	0.5	0	2.4	5.0	0	0	3.3	2.1	0
Related to neighboring quarter	5.4	7.3	21.9	2.7	3.2	34.1	2.5	2.9	5.8	0	0	5.1
Accounting change	0	0	0	0	0	0	0	1.4	0	0	0	0
Passive adjustment	8.9	33.3	27.0	3.1	5.3	35.3	7.6	5.7	5.8	4.4	3.1	5.1
Only passive adjustment	0	18.8	15.3	2.4	3.2	31.8	2.5	5.7	5.8	0	1.0	5.1
Other Reasons												
General purposes	5.4	7.3	11.7	1.5	4.2	14.1	5.0	21.4	43.0	7.8	23.7	37.8
Lawsuit costs	0	0	0.7	0	0	1.2	0	1.4	0	0	0	0
No. of obs.	56	96	137	415	95	85	119	70	86	90	97	98

VI. How Often Do Firms Rebalance Leverage?

Our novel data allow us to shed light on the debate over how often firms rebalance their capital structures. Leary and Roberts (2005) and Strebulaev and Whited (2012) find that big active capital structure changes are infrequent, whereas Welch (2004), (2012) argues that firms adjust leverage very frequently. Importantly, these studies treat all adjustment events in the same way when drawing inferences, effectively focusing on the experience of the typical firm. Given the substantial heterogeneity in the characteristics of adjustment events, the experience of the average firm is not very informative for the question of interest. Moreover, differences in the costs associated with different financial instruments used to effect leverage adjustments make it challenging to draw meaningful conclusions without a more refined view of the data.

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Most firms adjust leverage infrequently, consistent with the arguments of Leary and Roberts (2005) and Strebulaev and Whited (2012). Some firms adjust leverage very frequently, consistent with Welch's (2004), (2012) interpretation of the data. However, these firms do not use external financing to optimize capital structure but, rather, to fund short-term working capital or recurring R&D expenses. Although these firms are very active, their use of financing sources with low adjustment costs, such as bank lines of credit and private placements to familiar investors, is consistent with a model of capital structure involving fixed costs of issuance and periods of inactivity between financing events.

Our analysis of the adjustment sample suggests that many of the adjustment events in Compustat are driven by factors outside of the firm's control (e.g., option exercise) or incur negligible transaction costs (e.g., line-of-credit usage). This means that the overall frequency of proactive leverage adjustment in the population may be substantially lower than that suggested by prior research (e.g., Leary and Roberts (2005)). If the frequency of adjustment is interpreted as evidence regarding the costs and benefits of capital structure optimization, then the implied balance may change after omitting events that do not represent such optimization.

To quantify this potential bias, we estimate alternative frequencies of adjustment by excluding reasons and financial instruments that incur minimal transaction costs, such as option exercise and line-of-credit usage, from the set of adjustment events. The first step in this estimation is to regress adjustment reasons and instruments on adjustment frequency and firm characteristics in our adjustment sample. Table 9 reports the regression estimates, which are largely consistent with the patterns discussed earlier in the article.[16] Next, we use the regression coefficients to interpolate the reasons for adjustment and financial instruments used across all firms in the Compustat sample. Finally, we compute alternative measures of adjustment frequency, excluding the interpolated actions that do not represent the proactive long-term capital structure changes that the literature aims to study.[17]

Table 10 presents the results of this exercise. First, we consider the effect of excluding adjustments that are motivated by short-term operating needs and those that are passive, meaning initiated by outside parties or resulting from past actions. These exclusions, which result in a sample of leverage adjustments based only on long-term investment or capital structure motivations, dramatically reduce the heterogeneity in adjustment frequencies, with the difference between the 1st and 10th decile falling from 55.7% to 11.7%. The overall frequency of adjustment in the Compustat sample falls commensurately from 19% to 10.3%, a proportional reduction of 46%. We observe similar effects if we exclude line-of-credit usage and the exercise of executive stock options and warrants. When we omit these financial instruments from the sample of adjustments, the interdecile range of adjustment frequency is reduced to 18.6%, and the full sample adjustment frequency falls to 9.1%.

[16]In unreported results, we consider including asset market-to-book and the ratio of capital expenditures to assets in the set of control variables. The coefficients on these variables are statistically insignificant in all but the operating-losses and investment-reasons regressions, so we exclude them from the final set of variables to avoid overfitting.

[17]Note that this exercise relies on correlations in the data that should not be interpreted as causal relations.

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TABLE 9

Regressions of Adjustment Reasons and Financial Instruments Used

Table 9 reports regressions of adjustment reasons (Panel A) and financial instruments used (Panel B) on firm characteristics for the sample of adjustment events from quarterly U.S. Securities and Exchange Commission (SEC) filings. The dependent variable is an indicator (as a percentage, i.e., from 0 to 100) for a given category of adjustment reason (Panel A) or class of financial instruments issued or repurchased (Panel B). ADJUSTMENT_FREQUENCY is the ratio of the number of adjustment events to the number of observations for each firm. All other firm characteristics are observed at the end of the previous quarter. PROFITABILITY is the ratio of quarterly operating income before depreciation to book assets, expressed as a percentage. CASH is the ratio of cash to book assets. log(ASSETS) is the natural logarithm of book assets. MARKET_LEVERAGE is the ratio of book debt to book debt plus market capitalization. "Full-sample probability" is the rate at which each reason is reported in the regression sample containing 1,276 observations. *t*-statistics based on standard errors clustered by firm are in parentheses. *, **, and *** indicate that the corresponding *p*-values are less than 10%, 5%, and 1%, respectively.

Panel A. Adjustment Reasons

Frequency of Reason (%)	Losses	Operating	Investment	Financial	General	Passive
ADJUSTMENT_FREQUENCY	24.5***	65.1***	−11.6	−15.5**	−25.4***	14.8**
	(3.69)	(6.92)	(−1.28)	(−2.25)	(−5.52)	(2.39)
PROFITABILITY (%)	−2.61***	−1.66***	−0.37	0.95***	−0.18	0.06
	(−9.33)	(−5.78)	(−1.65)	(4.16)	(−1.09)	(0.21)
CASH	−5.10	−41.6***	−24.1***	16.8**	22.8***	29.7***
	(−0.70)	(−4.58)	(−3.39)	(2.31)	(3.40)	(3.59)
log(ASSETS)	−1.36	−0.62	3.66***	2.73**	0.24	−0.46
	(−1.52)	(−0.43)	(2.84)	(2.41)	(0.35)	(−0.59)
MARKET_LEVERAGE	2.28	10.1	−7.71	17.9**	−6.51	−18.2***
	(0.29)	(1.04)	(−0.85)	(2.08)	(−1.59)	(−3.72)
Constant	16.1**	23.3**	19.0**	20.4***	17.8***	7.84
	(2.46)	(2.46)	(2.21)	(2.74)	(3.75)	[1.33)
R^2	0.38	0.30	0.04	0.08	0.10	0.09
No. of obs.	1,276	1,276	1,276	1,276	1,276	1,276
Full-sample probability	23.1	45.0	26.1	33.4	11.1	13.3

Panel B. Financial Instruments Used to Adjust Capital Structure

Frequency of Usage (%)	Credit Line	Short-Term Debt	Long-Term Debt	Equity	Options
ADJUSTMENT_FREQUENCY	34.2***	30.7***	−22.9***	−10.6	−0.43
	(4.31)	(4.07)	(−3.13)	(−1.50)	(−0.15)
PROFITABILITY (%)	1.31***	1.02***	−0.91***	−0.94**	0.18
	(4.14)	(3.53)	(−3.30)	(−2.33)	(1.05)
CASH	−70.1***	−76.2***	−5.45	48.0***	11.2**
	(−7.50)	(−8.29)	(−0.58)	(4.65)	(2.22)
log(ASSETS)	−1.01	0.24	2.93**	2.54**	−1.66***
	(−0.74)	(0.18)	(2.14)	(2.28)	(−3.22)
MARKET_LEVERAGE	27.4***	21.5**	15.9*	−31.5***	−5.83*
	(3.20)	(2.51)	(1.79)	(−4.63)	(−1.68)
Constant	47.8***	47.7***	18.3**	19.4***	12.4***
	(5.82)	(5.92)	(2.22)	(2.67)	(3.18)
R^2	0.31	0.30	0.04	0.18	0.05
No. of obs.	1,276	1,276	1,276	1,276	1,276
Full-sample probability	48.7	51.3	26.8	30.5	4.62

The bottom line is that the measured level of adjustment frequency obtained by applying the Leary and Roberts (2005) approach to the Compustat data is driven heavily by short-term operating needs and line-of-credit borrowing that involves minimal adjustment costs. Ignoring leverage changes with minimal fixed costs of adjustment, the typical firm adjusts capital structure every 2.5 years, which is half as often as reported by Leary and Roberts (2005). If the frequency of proactive leverage adjustment is determined by the costs and benefits of capital structure optimization, then our results are consistent with adjustment costs being substantially higher, or the benefits of moving toward the optimal leverage ratio being lower, than what is suggested by the previous literature.

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TABLE 10

Recomputed Leverage-Adjustment Frequencies

Table 10 reports statistics on predicted adjustment statistics, sorting firms by adjustment frequency. ADJUSTMENT_FREQUENCY for each firm is the ratio of the number of capital structure changes to the total number of quarterly observations. The "Never" column contains firms that never adjust in our sample. The "Adj. Firms" column includes all firms that adjust at least once. "Decile adjustment frequency" is the ratio of the number of capital structure changes to the total number of observations in each decile. All ratios are presented as percentages. Adjustment reasons and financial instruments are predicted using the regressions in Table 9 and expressed as the fitted percentage of adjustment events for which the firm lists each reason or instrument out of all adjustment events in each decile. "Alternative adjustment frequencies" are the adjustment frequency minus the adjustment frequency multiplied by the fitted conditional probability of the respective reasons or financial instruments.

		Adjustment-Frequency Decile											
Group	Never	1	2	3	4	5	6	7	8	9	10	Adj. Firms	All Firms
Distribution of Adjustment Frequency													
Number of firms	372	183	220	186	141	182	182	183	182	181	180	1,820	2,192
Number of firm-quarters	5,134	5,306	4,950	3,504	3,417	4,070	4,066	3,112	3,707	3,179	2,782	38,093	43,227
Decile adjustment frequency	0	4.90	8.77	11.6	14.5	17.8	21.7	26.3	32.4	40.6	60.6	21.5	19.0
Adjustment Reasons Fitted by Firm Characteristics													
Any operating reason		11.2	13.1	17.2	18.4	21.5	24.3	28.3	34.3	41.1	60.5	34.2	34.2
Any investment reason		32.1	31.8	32.2	31.2	29.9	31.1	29.0	28.1	27.8	24.0	28.5	28.5
Any financial reason		44.6	44.0	43.0	42.7	41.7	41.6	40.3	37.5	36.3	29.7	38.0	38.0
General purposes		21.6	20.9	19.1	19.1	18.1	16.6	15.5	13.4	10.1	4.65	13.4	13.4
Passive adjustment		9.89	10.9	9.61	10.9	11.0	11.0	11.4	11.8	11.3	13.7	11.7	11.7
Alternative Adjustment Frequencies													
Refi. freq. excl. passive		4.42	7.81	10.4	12.9	15.9	19.4	23.3	28.5	36.0	52.2	19.0	16.8
Refi. freq. excl. operating		4.35	7.62	9.58	11.8	14.0	16.5	18.9	21.3	23.9	23.9	14.2	12.5
Refi. freq. excl. oper., pass.		3.86	6.67	8.46	10.2	12.0	14.1	15.9	17.4	19.3	15.6	11.6	10.3
Financial Instruments Fitted by Firm Characteristics													
Line of credit		35.4	35.7	40.1	38.5	40.2	43.0	44.4	47.7	54.8	60.6	48.0	48.0
Any short-term debt instrument		39.3	39.6	44.0	42.2	43.5	46.6	47.3	50.4	57.2	62.1	50.8	50.8
Any long-term debt instrument		33.4	32.3	32.3	31.8	31.0	30.7	29.7	27.9	26.3	22.9	28.2	28.2
Any equity security		37.2	37.7	34.7	36.1	34.6	33.9	32.5	30.6	26.4	23.8	30.6	30.6
Stock options/warrants		4.70	4.80	4.25	4.53	4.66	4.02	4.36	4.49	3.90	3.94	4.25	4.25
Alternative Adjustment Frequencies													
Refi. freq. excl. LoC		3.17	5.64	6.93	8.89	10.7	12.4	14.6	16.9	18.4	23.9	11.2	9.86
Refi. freq. excl. options		4.67	8.35	11.1	13.8	17.0	20.9	25.2	30.9	39.1	58.2	20.6	18.2
Refi. freq. excl. LoC, options		2.94	5.22	6.44	8.24	9.83	11.5	13.5	15.5	16.8	21.5	10.3	9.06

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VII. Conclusion

This article introduces novel hand-collected data to study the drivers of capital structure adjustment by firms. Our analysis paints a more detailed picture of the financial policies of firms than that provided by the existing literature. Past studies of corporate financial policy tend to focus on either the choice of leverage or the usage of specific types of financing. We tie these strands of literature together by showing that the dynamics of capital structure are connected to the instruments that firms use to raise capital.

We show that firms adjust their capital structures at vastly different rates, and we broadly categorize them into four types. Firms that never adjust leverage generate sufficient internal cash to fund their own needs. Infrequently adjusting firms primarily access capital markets to fund M&As, to implement payout policy through share repurchases, and to repay past borrowings. Frequently adjusting firms broadly fall into two buckets. One type uses credit lines to satisfy working capital needs and to make investments. The other type consists of small growth firms that make frequent private placements of equity and convertible bonds to cover operating losses and fund growth. Together, these two types represent a small share of public firms, but they are responsible for a large fraction of leverage adjustments.

Another important result is that many events that would be labeled as capital structure adjustments using standard accounting data are actually outside of the firm's control and unrelated to contemporaneous corporate actions. Examples of such events include the exercise of executive stock options and the conversion of convertible bonds. Taken together, our results imply that adjustment costs are larger, or the benefits of adjustment lower, than previously thought.

Although certain behaviors are in line with extant theory, others present challenges or are not well covered by the literature. Adjustments for operating reasons are very common in the data but not well captured by standard models that focus on new investments or pure capital structure rebalancing; small growth firms face high information-asymmetry costs but raise external financing frequently; infrequently financing firms should have low adjustment costs but do not readjust often; and firms often use credit lines to fund operating losses, whereas the literature tends to find a positive relation between credit-line usage and profitability.

Some of these challenging findings can be explained by taking a closer look at the financial instruments used. For example, the use of private placements (rather than public issuance) by small growth firms reduces adverse-selection costs. But many of the remaining issues call for deeper exploration and more flexible theories that account for the financing conditions faced by real firms. Although there is an abundance of theory on dynamic leverage optimization with adjustment costs, there is a relative dearth of theory describing the behavior of firms that adjust leverage frequently. Standard capital structure models usually assume the firm's operating cash flow is positive, counter to the results highlighted here. Under dynamic trade-off theories, debt issuance is assumed to incur a fixed cost, but we show that most debt financing is through bank lines of credit that incur negligible fixed costs of adjustment after origination. Finally, we hope that the findings presented in this article will motivate researchers to use the wealth of information in corporate filings rather than relying on standard accounting data in future studies of capital structure.

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Appendix: Classification Scheme

This Appendix describes the categories used for classifying the reasons associated with leverage adjustments and the financial instruments used. Section II.B in the article describes how we interpret the SEC filings associated with each adjustment event in our sample.

Adjustment Reasons

Operating Reasons

Funding operating losses: The firm issues securities to fund its operating losses.

GTx, Inc., 2007:Q4: "On December 18, 2007, we completed a private placement of 1,285,347 shares of common stock to Merck and received proceeds of approximately $30.0 million. Net cash used in operating activities was $37.6 million, $11.5 million and $34.8 million for the years ended December 31, 2007, 2006 and 2005, respectively. The use of cash in all periods resulted primarily from funding our net losses."

Seasonality: The firm uses external financing to meet seasonal working capital needs.

Sports Authority, Inc., 1998:Q3: "Financing activities are primarily related to the utilization of the Company's credit facility to meet day to day operating needs and increase its inventory levels in anticipation of the winter holiday selling season."

Change in inventory level: The firm uses external financing to fund inventory.

Harold's Stores, Inc., 2001:Q3: "The Company's primary needs for liquidity are to finance its inventories and revolving charge accounts and to invest in new stores, remodeling, fixtures and equipment. Cash flow from operations and proceeds from credit facilities represent the Company's principal sources of liquidity."

Change in accounts receivable: The firm uses external financing to fund accounts receivable.

Sensory Science Corp., 1997:Q3: "The Company's sales seasonality requires incremental working capital for investment primarily in inventories and receivables, which the Company currently funds through a line of credit with Congress Financial."

Change in accounts payable: The firm uses external financing to meet shortfalls in trade credit or uses trade credit to repay debt or repurchase equity.

Bindley Western Industries, 1995:Q4: "Net decrease in borrowings under the bank credit agreement was $62 million during 1995 ... The Company's operations provided $63 million in cash for the year ended December 31, 1995. The source of funds was primarily a result of a reduction in merchandise inventory and an increase in accounts payable."

Investment Reasons

Investment needs: The firm issues securities to fund capital expenditures.

Granite City Food & Brewery, 2003:Q4: "We have required capital principally for the development, construction and opening of new restaurants. To date, we have obtained gross proceeds aggregating approximately $11.0 million through the sales of our securities in our initial public offering and two private placements."

Asset divestiture: The firm sells assets and uses the proceeds to repay debt or repurchase equity.

Venture Stores, Inc., 1997:Q2: "During the second quarter of 1997, the company sold 20 stores to Kmart for a negotiated price of $38 million cash, before closing adjustments ... The decrease in long-term debt is due to the prepayment of approximately $5.8 million of mortgage notes from the proceeds of the sale of 20 stores to Kmart."

Mergers and acquisitions: The firm uses external financing to fund a merger or acquisition.

Big Lots, Inc., 1996:Q1: "At May 4, 1996, the Company borrowed $320 million under the Revolver to finance the acquisition of Kay-Bee Center, Inc. and repay certain existing indebtedness under the prior revolving credit agreement."

Financial Reasons

Equity repurchase: The firm repurchases shares under a program authorized by its board.

Ross Stores, Inc., 2000:Q1: "In January 2000, the company announced a $300.0 million common stock repurchase program to be completed over the next two years. In the three months ended April 29, 2000, the company repurchased approximately 5.9 million shares for an aggregate purchase price of approximately $99.4 million."

Capital structure rebalancing: The firm issues equity to repay debt or borrows to repurchase equity.

Matrixx Initiatives, Inc., 1999:Q3: "In September 1999, as permitted by the Citadel financing arrangement, Gum Tech issued 117,759 shares of common stock to Citadel Investment Group to repay $800,000 principal amount of Senior Secured Notes and $400,000 of Series A Preferred Stock, including a prepayment charge of $120,000."

Debt repayment: The firm fully or partially repays debt out of operating cash flows. We do not include repayment of debt through other financing sources in this category.

Netlist, Inc., 2007:Q1: "Net cash used in financing activities for the three months ended March 31, 2007 was $7.5 million primarily as a result of net repayments on our outstanding revolving line of credit of approximately $7.2 million."

Maturing debt: The firm allows debt to mature without issuing new debt to replace it.

Tekelec, Inc., 2008:Q2: "On June 15, 2008 we repaid our $125 million Convertible Debt instruments in accordance with their terms."

Forced conversion: The firm forces conversion of convertible debt or preferred shares.

Ag Services of America, 1996:Q3: "On June 7, 1996, the Company called for redemption or conversion all of its outstanding 7% Convertible Subordinated Debentures due 2003 (the 'Debentures'). From June 7, 1996 through July 10, 1996, the redemption date, the Company issued 1,483,345 shares of common stock upon conversion of $13,721,000 of Debentures and redeemed $39,000 of Debentures as full settlement of all $13,760,000 of the Debentures outstanding at May 31, 1996."

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Restructuring/reorganization: The firm reduced debt through renegotiation or bankruptcy.

MGC Diagnostics Corp., 2002:Q2: "On June 17, 2002, the Company announced an agreement with the noteholders under which the $20,198,000 in outstanding notes plus accrued interest of $1,017,000 would be converted into common stock of the Company through a Chapter 11 Bankruptcy proceeding and a Plan of Reorganization filed jointly between the Company and its noteholders."

Passive Reasons

Convertible-debt conversion: Bondholders convert convertible debentures, decreasing debt.

Millennium Cell, Inc., 2004:Q2: "During the second quarter, approximately $3 million of the 2004 Debentures were converted into 1,398,802 shares of the Company's common stock."

Executive compensation: Executives and employees exercise stock options, increasing equity.

VISX Inc., 1999:Q2: "Cash increased $72,823,000 due mainly to net income and the exercise of stock options. Approximately $9 million was generated from the exercise of stock options."

Related to neighboring quarter: The firm continues a financing activity that was initiated in a previous quarter.

Ansoft Corp., 2007:Q2: "Funds used for the repurchase of common stock were $24.3 million and $5.7 million in the three-month periods ended July 31, 2007 and 2006, respectively ... All repurchases were made pursuant to a share repurchase program publicly announced in 1998 and amended in 2002, 2004 and 2006."

Apparent Compustat error: Incorrect figures in Compustat trigger an adjustment flag.

Genitope Corp., 2005:Q2, 2005:Q4: Lease financing liability is added to long-term debt in Compustat in 2005:Q2 and removed in 2005:Q4, resulting in a net leverage increase then a net leverage decrease. However, the liability is reported as constant from before 2005:Q2 to after 2005:Q4 in the SEC filings.

Accounting change: One example of a company changing the accounting of convertible debt.

Microchip Technology, Inc., 2009:Q2: "As the debentures can be settled in cash upon conversion, for accounting purposes, the debentures were bifurcated into a liability component and an equity component, which are initially recorded at fair value."

Other Reasons

General purposes: The firm raises funding and holds the proceeds as cash without stating an explicit use of proceeds.

Sonic Solutions, 2009:Q4: "On December 17, 2009, the Company issued 3,450,000 shares of common stock in an underwritten offering at a per-share public offering price of $9.70. The Company received approximately $31.4 million in net cash proceeds after underwriting discounts and commissions and expenses, which will be used for working capital and general corporate purposes."

Lawsuit costs: The firm uses external financing to pay litigation costs or a legal settlement.

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McLaren Performance Technologies, Inc., 2000:Q4: "During the first quarter of fiscal 2001, the Company sold 347,826 of its shares to a director of the Company. Net proceeds after expenses totaled $391,400 ... Due to trial preparation and the settlement of litigation, litigation costs continued to be a major expense item for the Company in the quarter, increasing to $179,996 in the period compared to $146,777 for the same period in 1999."

Financial Instruments

Short-Term Debt

Line of credit: The firm draws down or repays borrowings under a revolving-credit facility.

Tuesday Morning Corp., 2005:Q3: "We have financed our operations with funds generated from operating activities and borrowings under our revolving credit facility ... We have a $210 million revolving credit facility that expires in December 2009. Any borrowing under the revolving credit facility will incur interest at LIBOR or the prime rate, depending on the type of borrowing, plus an applicable margin. We incur commitment fees of up to 0.25% on the unused portion of the revolving credit facility."

Commercial paper: The firm sells or retires promissory notes with maturity under 1 year.

Osiris Therapeutics, Inc., 2008:Q2: "During the six months ended June 30, 2008, we have issued $10.5 million in convertible promissory notes and an additional $5.5 million of short-term promissory notes, separate from this financing commitment."

Bridge loan: The firm borrows a fixed amount at maturity of under 1 year from an institution.

PEC Israel Economic Corp., 1999:Q1: "During the first quarter of 1999, PEC Israel Finance Corporation Ltd. ('PECFC'), a wholly owned subsidiary of PEC, borrowed $24.0 million from a bank to finance the purchase of a 0.63% ownership interest in United Pan-Europe Communication N.V., a cable television company ('UPC') whose shares are publicly traded on the NASDAQ National Market System under the trading symbol 'UPCOY'. This loan is unsecured, bears interest at a rate of 5.75% per annum, is guaranteed by PEC and matures on May 18, 1999."

Long-Term Debt

Term loan: The firm borrows a fixed amount at maturity of over 1 year from an institution.

Imagyn Medical Technologies, Inc., 1996:Q3: "To finance the cash portion of the Richard-Allan acquisition, the Company obtained a $35.0 million bank credit facility. The facility consists of a $20.0 million dollar term loan and a $15.0 million revolving line of credit."

Long-term note: The firm sells or retires straight debentures with maturity of over 1 year.

Hills Stores Co., 1996:Q1: "On April 19, 1996 the Company issued $195 million of unsecured 12 1/2% Senior Notes (the 'New Senior Notes') due 2003. The New

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Senior Notes are noncallable, guaranteed by all the subsidiaries of the Company, with interest payable semiannually."

Convertible debt: The firm sells or retires debentures that are convertible into equity.

Teraforce Technology Corp., 1996:Q2: "During the quarter ended June 30, 1996, the Company issued Convertible Debentures (the 'June Debentures') in the aggregate principal amount of $5,000,000 bearing interest at 7.5% payable quarterly in arrears. The June Debentures mature on June 7, 1998, are redeemable for cash at the Company's option at 117.5% of their face value and are convertible at the holder's option into common shares at 82.5% of the NASDAQ trading price on conversion."

Capital lease: The firm finances the purchase of long-term assets with a lease.

Pantry, Inc., 2007:Q2: "For the first nine months of fiscal 2007, net cash provided by financing activities was $346.3 million. We entered into new lease financing transactions with proceeds totaling $200.5 million, including $188.4 million related to acquisitions ... We finance substantially all capital expenditures and new store development through cash flows from operations, proceeds from lease financing transactions, asset dispositions and vendor reimbursements."

Debt to another firm: The firm borrows or repays debt from another nonfinancial corporation.

Omnipoint Corp., 1997:Q3: "On August 7, 1997, Omnipoint MB Holdings, Inc. ('OMB') entered into a credit facility agreement with Ericsson Inc. to provide financing to the Company for up to $352.5 million for the purpose of financing the buildout of networks in the Boston and Miami markets (the 'Ericsson B & M Facility'). The Ericsson B & M Facility provides the immediate availability of $202.5 million, of which $100.0 million was funded to OMB at closing."

Guarantee: One example of a company guaranteeing another company's debt.

Friedman's, Inc., 2001:Q3: "In connection with the credit facility, we agreed to provide certain credit enhancements, including the support of $60 million of our eligible receivables and inventories, and to guarantee the obligations of Crescent under its $112.5 million senior secured revolving credit facility. In consideration for this guaranty, Crescent makes quarterly payments to us in an amount equal to 2% per annum of the outstanding obligations of Crescent under its credit facility during the preceding fiscal quarter."

Equity

Public equity: The firm sells or repurchases common stock on the open market.

Weyerhaeuser Co., 2004:Q2: "On May 5, 2004, the company issued 16,675,000 common shares and received net proceeds from the offering, after deduction of the underwriting discount and other transaction costs, of $954 million."

Private equity: The firm sells or repurchases common stock in a private transaction.

Cytogen Corp., 2003:Q2: "In June 2003, we entered into a securities purchase agreement with certain institutional investors pursuant to which we issued and sold 1,052,632 shares of our common stock at $4.75 per share. In connection with such financing, we also issued warrants to such investors to purchase 315,790 shares of our common stock with an exercise price of $6.91 per share."

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Preferred stock: The firm sells or repurchases preferred stock.

Pharsight Corp., 2002:Q2: "Net cash provided by financing activities was $2.9 million for the three months ended June 30, 2002. Cash from financing activities was provided primarily as a result of proceeds from the issuance of Series A redeemable convertible preferred stock."

Funding from Previously Issued Securities

Stock options/warrants: Executives exercise stock options, or investors exercise warrants.

Discovery Laboratories, Inc., 2003:Q3: "Between the dates of June 1, 2003 and September 12, 2003, holders of warrants exercisable for approximately 3.6 million shares of common stock exercised such warrants, in accordance with their respective terms, either cashlessly or for cash, resulting in the issuance to the holders of approximately 3.3 million shares of common stock and our receipt of aggregate cash proceeds equal to approximately $6.1 million."

Supplementary Material

To view supplementary material for this article, please visit http://doi.org/10.1017/S0022109020000952.

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