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Firms' histories and their capital structures ☆

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Abstract

This paper examines how cash flows, investment expenditures, and stock price histories affect debt ratios. Consistent with earlier work, we find that these variables have a substantial influence on changes in capital structure. Specifically, stock price changes and financial deficits (i.e., the amount of external capital raised) have strong influences on capital structure changes, but in contrast to previous conclusions, we find that over long horizons their effects are partially reversed. These results indicate that although firms' histories strongly influence their capital structures, over time their capital structures tend to move towards target debt ratios that are consistent with the tradeoff theories of capital structure.

JEL classification: G3

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1. Introduction

Capital structure theory suggests that firms have what is often referred to as a target debt ratio, which is determined by various tradeoffs between the costs and benefits of debt versus

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equity. In a recent survey of CFOs, Graham and Harvey (2001) report that 37% of their respondents have a flexible target, 34% have a somewhat tight target or range, and 10% have a strict target. Consistent with the idea that targets can be flexible, capital structure theory provides arguments based on information asymmetries, market inefficiencies, and transaction costs that explain why firms' cash flows, investment expenditures, and stock price histories can lead them to deviate from the targets suggested by traditional tradeoff theories. Indeed, a substantial part of the recent literature on capital structure focuses on those forces that move firms away from their target ratios and often gives the impression that a firm's history is a more important determinant of capital structure than are firm characteristics that proxy for the costs and benefits of debt versus equity financing.

In theory, we expect that observed capital structures are influenced by the costs and benefits that determine firms' target debt ratios, as well as their cash flows, investment expenditures, and stock price histories that lead them to deviate from their targets. If we believe that firm values are highly sensitive to deviations from their target debt ratios, and if the cost of adjusting towards the target is relatively low, then these history variables should have only a fleeting influence on observed capital structures. In contrast, if the function mapping capital structure to firm value is very flat, and if adjustment costs are large, then these history variables will have a persistent effect that reverses quite slowly.

Although there is a growing empirical literature that addresses these issues, most of the existing studies focus on only one aspect of the capital structure problem. This paper provides a more comprehensive analysis of how cash flows, investment expenditures, and stock price histories affect capital structure choices and, in contrast to earlier work, more explicitly examines the extent to which the effect of these history variables are subsequently reversed. Our analysis confirms that history does in fact have a major influence on observed debt ratios, and that these effects at least partially persist for at least ten years. However, the long-term effects of a firm's history on its capital structure have been exaggerated in some of the recent literature. Our evidence indicates that a portion of these history effects are subsequently reversed, and that debt ratios tend to move towards target ratios based on traditional tradeoff variables.

Our analysis focuses on the following variables, which we describe and discuss in detail later in the paper:

(1) *Past profitability:* Titman and Wessels (1988) and others find that firms with higher past profits tend to have lower debt ratios. This evidence, which has been attributed to the Donaldson (1961) and Myers (1984) pecking order of financing preferences, is consistent with tax, transaction cost, and adverse selection arguments that imply that internally generated equity is less costly than equity capital that is raised externally.
(2) *Financial deficits:* Shyam-Sunder and Myers (1999) find that firms with higher financial deficits, i.e., firms that raise more external capital, tend to increase their leverage. This evidence is consistent with Myers and Majluf's (1984) adverse selection model.[1]
(3) *Past stock returns:* Graham and Harvey's (2001) survey evidence suggests that firms issue equity following stock price increases because CFOs believe that they can raise

[1] Frank and Goyal (2003) examine a larger sample of firms and also find a strong relation between financial deficits and changes in debt ratios. However, they note that the relation between financial deficits and changes in the debt ratio is stronger for larger and older firms. Since these firms might be expected to be less subject to asymmetric information problems, they argue that their evidence is inconsistent with Myers and Majluf (1984).

equity capital under more favorable terms in such situations. This observation is consistent with Hovakimian, Opler, and Titman (2001) and others who find that firms tend to issue equity following increases in their stock prices and tend to repurchase shares following stock price declines, which is the opposite of what one might expect if firms tended to rebalance their capital structures towards a static target.[2] The evidence that firms tend to issue (repurchase) equity following stock price increases (decreases) implies that leverage ratios are likely to be strongly negatively related to past stock returns, which was recently documented by Welch (2004).

(4) *Market timing:* Baker and Wurgler (2002) examine the tendency of managers to ''time the equity markets'' by interacting the market-to-book ratio with the amount of capital that a firm raises (i.e., its financial deficit). Their evidence suggests that firms tend to reduce their leverage ratios by raising substantial amounts of capital when the equity market is perceived to be more favorable, i.e., when market-to-book ratios are higher.

(5) *Leverage deficit:* Hovakimian, Opler, and Titman (2001) show that the leverage deficit, which is the difference between the observed debt ratio and a target ratio predicted by traditional tradeoff variables, predicts whether firms raise new capital with debt or equity. Fama and French (2002) construct a similar variable and provide evidence that debt ratios tend to move towards their targets, but at a relatively slow rate.[3]

(6) *Change in target:* Firms may be moving towards moving targets. If this is the case, then changes in the target will partially explain changes in the debt ratio.

To address the long-term effects of these variables, we examine changes in debt ratios by estimating what some have referred to as partial adjustment regressions.[4] Specifically, we regress changes in debt ratios on the above-mentioned variables that capture the firm's financing, earnings, investment, and stock returns history. However, in contrast to the existing literature, since our focus is on whether history has more than a fleeting effect on capital structure, we examine changes in capital structure over somewhat longer time periods (five and ten year changes rather than one-year changes). In addition, we consider how changes in capital structure that are generated from these history effects are subsequently reversed. These regressions provide additional insights on the extent to which deviations from a firm's target capital structure influences future financing choices and complement the partial adjustment regressions that attempt to estimate the speed with which deviations between actual and target debt ratios are subsequently closed.

[2]Taggart (1977), Marsh (1982), Asquith and Mullins (1986), Korajczyk, Lucas, and McDonald (1991), Jung, Kim, and Stulz (1996), and Hovakimian, Opler, and Titman (2001) find evidence of market timing with seasoned equity. Loughran and Ritter (1995) and Pagano, Panetta, and Zingales (1998) show that firms tend to initiate IPOs when they have high market valuations. Ikenberry, Lakonishok, and Vermaelen (1995) provide evidence of market timing with share repurchases. See Ritter (2003) for a detailed list of papers that provide evidence of market timing.

[3]In a recent paper, Flannery and Rangan (2006) offer a different specification that suggests that debt ratios tend to move towards their target ratios at a rate that is substantially faster than the rate estimated by Fama and French (2002). Leary and Roberts (2005) also examine this issue and show that firms tend to rebalance their debt ratios in ways that keep them within an optimal range.

[4]Jalilvand and Harris (1984) and Auerbach (1985) are among the early studies that use partial adjustment models. Recent studies by Shyam-Sunder and Myers (1999), Hovakimian, Opler, and Titman (2001), Fama and French (2002), and Frank and Goyal (2003) also examine changes in debt ratios.

Although our analysis of financial deficits is generally consistent with Shyam-Sunder and Myers (1999), there are some noteworthy differences in our conclusions. In particular, we find a somewhat weaker relation between leverage and the financial deficit and show that this relation is reduced (and can be reversed) for firms with sufficiently high market-to-book ratios.[5] In addition, we find that the financial deficit has a stronger effect on capital structure when it is positive (i.e., when firms are raising capital) than when it is negative (i.e., when firms are paying out capital).

In addition, although we take issue with the specific construction of the Baker and Wurgler (2002) timing measure,[6] we confirm that firms that happen to raise capital in years in which their stock prices are relatively high tend to reduce their debt ratios. However, our timing measure, which captures the spirit of the Baker and Wurgler intuition, has a relatively weak effect on observed debt ratios.[7] A second "timing" variable that interacts a firm's average financial deficit with its average market-to-book ratio is shown to be more strongly related to changes in the debt ratio and its effect is more long-lasting.

Our empirical results also confirm the Welch (2004) observation that stock price changes have a strong effect on market leverage ratios. In addition, we find that past stock returns influence the ratio of debt to book value of assets, which is consistent with the observation that firms are more likely to issue equity subsequent to stock price increases. However, in contrast to Welch's claim, the stock return effect partially reverses and does not subsume other determinants of capital structure. Indeed, our results indicate that after controlling for changes in stock prices and other timing and pecking order effects, changes in debt ratios are still explained by the leverage deficit and by changes in target debt ratios.

The remainder of the paper is organized as follows. Section 2 describes our methodology and presents the measures that we construct to proxy for timing and pecking order effects. Section 3 reports the data, followed by an analysis of the contemporaneous effects of financial deficits, market conditions, and profitability on debt ratios in Section 4. Section 5 investigates the persistence of the market timing and pecking order effects on capital structure and Section 6 analyzes the extent to which these effects reverse. In Section 7 we provide a number of extensions and Section 8 concludes the paper.

2. Methodology and variable construction

As we discuss in detail below, we examine how the debt ratios of firms change over time. Our empirical methodology is closely related to the partial adjustment models that have been examined in the literature. Following these models, we estimate the determinants of changes in the debt ratio in two steps. In the first step we construct a proxy for the target

[5] Lemmon and Zender (2004) make a similar observation and argue that the tendency of high market-to-book firms to fund their financial deficits by issuing equity rather than debt could be due to the fact that high market-to-book firms have a lower debt capacity. This possibility will be briefly discussed later.

[6] As it turns out, it is the persistence of the firm's average market-to-book ratio (which is captured in our second measure) rather than the covariance between market-to-book and the financial deficit (which is captured in our first measure) that drives the persistence result in Baker and Wurgler. In a recent study, Hovakimian (2006) finds support for the alternative hypothesis that the historical market-to-book ratio has a negative impact on leverage because it contains information about growth opportunities not captured by the current market-to-book ratio. Liu (2005) also examines this issue and provides further evidence that is consistent with Hovakimian's conclusion.

[7] Alti (2006), in a study of IPOs, measures timing relative to how hot on IPO market is and finds that firms that go public in hot IPO markets are initially less levered; however, whether or not the firm goes public in a hot IPO market does not have a significant lasting effect on capital structure.

leverage ratio, L^{T}, as the predicted value from a regression of debt ratios on tradeoff variables employed in prior cross-sectional studies.[8] Next, using this target leverage proxy, we construct a leverage deficit variable as the difference between the target leverage ratio and the leverage ratio at the beginning of the period ($L{-}L^{\mathrm{T}}$).

In the second step, we estimate a regression of changes in the debt ratio on this estimated leverage deficit, changes in the target debt ratio, and the history variables described below. The alternative to this two-stage estimation would be to use the target proxies directly in the change regressions (rather than using the predicted target leverage estimated from these proxies in the first stage) which would potentially reduce the estimation error due to imputed regressors (Hovakimian, 2004). Our results regarding the history variables remain robust to either specification.

2.1. The financial deficit variable

The financial deficit, or equivalently, the amount of external capital that is raised, plays a central role in both Myers' pecking order effect, as discussed in Shyam-Sunder and Myers (1999) and Frank and Goyal (2003), and the timing effect, as discussed by Baker and Wurgler (2002). Our definition of financial deficit, which is employed in the above studies, is simply the net amount of debt and equity the firm issues or repurchases in a given year. Specifically, the financial deficit (FD) is defined as the sum of investments (I), dividends (D), and changes in working capital (ΔWC), net of net cash flow (CF). This sum, described below, is identical to net debt issues (Δd) plus net equity issues (Δe):

$$\text{Financial deficit } (FD) = \Delta WC + I + D - CF \equiv \Delta e + \Delta d. \tag{1}$$

When this variable is positive the firm invests more than it internally generates. When it is negative, the firm generates more cash than it invests; in other words, the firm has positive free cash flow. The interpretation of the pecking order hypothesis, described in Shyam-Sunder and Myers (1999) and Frank and Goyal (2003), is that since debt is likely to be the marginal source of financing, firms with high financial deficits are likely to increase their debt ratios. One could argue that the financial deficit should be treated as an endogenous variable, which is determined by whether or not the firm is under- or overlevered. Specifically, firms that are temporarily overlevered might cut back their investment expenditures to reduce their financial deficit or equivalently increase the free cash flow available to pay down their debt. This can induce a positive relation between the financial deficit and changes in the leverage ratio for reasons that have nothing to do with the pecking order theory. We mitigate this problem by including a leverage deficit variable as the difference between the actual leverage ratio and the target, which we explain in more detail later in this section.

It is likely that a positive financial deficit and a negative financial deficit (i.e., positive free cash flow) affect debt ratios differently. For example, the information issues involved in a share repurchase might not be the same as those involved in a share issuance. For this reason we interact the financial deficit with a dummy variable that takes a value of one

[8] Shyam-Sunder and Myers (1999) use the average of the debt ratio over the sample period to proxy for the target debt ratio and Hovakimian, Opler, and Titman (2001) predict the target leverage using the variables that are suggested in the tradeoff theory.

when the financial deficit is positive, to separate the positive and negative values of the financial deficit variable.[9]

2.2. Timing measures

Baker and Wurgler (2002) develop a timing measure based on the idea that firms tend to raise funds with equity when their stock price is high and with debt when their stock price is low. Given this, firms are expected to have lower (higher) debt ratios if they happen to raise capital when their stock prices are high (low). In this subsection we present our own timing measures, which have properties that we think are preferable to the Baker and Wurgler measure. However, as we will show, these measures are closely related to the Baker and Wurgler measure.

Similar to Baker and Wurgler, the financial deficit, or equivalently, the amount of capital raised, plays a key role in the two timing measures that we describe below:

$$\begin{aligned}\text{Yearly timing } (YT) &= \left(\sum_{s=0}^{t-1} FD_s * (M/B)_s\right) \Big/ t - \overline{FD} * \overline{M/B} \\ &= \hat{\text{cov}}\,(FD, M/B). \end{aligned} \tag{2}$$

$$\begin{aligned}\text{Long-term timing } (LT) &= \left(\sum_{s=0}^{t-1} (M/B)_s/t\right) * \left(\sum_{s=0}^{t-1} FD_s/t\right) \\ &= \overline{M/B} * \overline{FD}, \end{aligned} \tag{3}$$

where the summations are taken for each firm-year observation over a five-year period.

The yearly timing measure (YT), i.e., the sample covariance between total external financing and the market-to-book ratio, captures the Baker and Wurgler (2002) idea that a firm that raises external capital when its stock price is relatively high is more likely to decrease its debt ratio. The logic here is that managers take advantage of short-term overvaluation to fund their capital needs by issuing equity. In this case, the notion of over- or undervaluation is determined by the firm's current market-to-book ratio relative to its market-to-book ratio in surrounding years.

One might also posit that managers form their beliefs about whether or not their stock is over- or undervalued based on how high their market-to-book ratios are relative to all firms in general. This is one interpretation of our long-term timing measure (LT). Put slightly differently, the long-term timing measure allows us to test whether managers act as though their cost of equity financing is inversely related to the market-to-book ratio (which some would argue is consistent with empirical observations), leading them to fund their financial deficit with equity rather than debt if their market-to-book ratio is sufficiently high.

The long-term timing measure can also be interpreted relative to the pecking order tests of Shyam-Sunder and Myers (1999) and Frank and Goyal (2003). Specifically, this variable allows us to estimate how the pecking order effect is related to market-to-book ratios. There are a variety of reasons why the pecking order effect may be related to the

[9] Shyam-Sunder and Myers (1999) acknowledge that this could be an issue but choose not to account for this lack of symmetry in their empirical analysis.

market-to-book ratio that have nothing to do with market timing. First, it is plausible that firms with high market-to-book ratios are more willing to issue equity because they are subject to fewer asymmetric information problems. Second, firms with higher market-to-book ratios could be more willing to be exposed to the increased scrutiny that occurs when their shares are issued on public markets.[10] Third, since firms with higher market-to-book ratios are likely to have higher growth opportunities, they might wish to finance their current financial deficit with equity because they want to reserve their borrowing capacity for the future.[11]

The two timing measures that we discuss in the preceding paragraphs are closely related to the timing measure considered by Baker and Wurgler (2002). Specifically, as we show in the following equation, the Baker and Wurgler (BW) timing measure, M/B_{efwa}, can be viewed as a linear combination of the yearly and long-term timing measures (see Appendix A for the derivation):

$$\begin{aligned} M/B_{\text{efwa},t-1} &= \left(\sum_{s=0}^{t-1} FD_s * (M/B)_s\right) \Big/ \sum_{r=0}^{t-1} FD_r \\ &= \frac{\widehat{\text{cov}}\,(FD, M/B)}{\overline{FD}} + \overline{(M/B)} \\ &= (YT + LT)/\overline{FD}. \end{aligned} \tag{4}$$

The first term in this decomposition, $\widehat{\text{cov}}\,(FD, M/B)$ divided by $\overline{FD}$, is the same as our yearly timing measure; however, this term is scaled by the average financial deficit, making it invariant to the amount of capital raised. In contrast, our yearly timing measure (YT) accounts for the fact that market timing (specifically, the tendency to raise funds with equity rather than debt when stock prices are high) is likely to affect a firm's capital structure to a greater degree if the firm raises more external capital.[12]

The second term in the decomposition, the average market-to-book ratio ($\overline{M/B}$), does not really capture the BW timing intuition. However, the presence of this term in their timing measure can induce a negative relation between the BW timing measure and changes in the debt ratio for reasons that have nothing to do with market timing incentives. Specifically, the market-to-book ratio is likely to proxy for a firm's investment opportunity set, which in theory should be negatively related to observed debt ratios, i.e., firms with better investment opportunities tend to avoid debt financing in order to keep their financial flexibility. Baker and Wurgler recognize this possibility and include

[10]A recent paper by Almazan, Suarez, and Titman (2006) develops a model that indicates that in some situations firms will choose not to issue equity because they do not want the scrutiny associated with an equity issue. It is plausible that these scrutiny costs are related to whether a firm is likely to be growing in the future. Scrutiny is likely to benefit growing firms, since with favorable attention they can more easily attract new customers and employees. In contrast, scrutiny can be costly to firms that are not likely to grow, since they could lose existing customers and employees if the scrutiny associated with an equity issue reveals negative information.

[11]This argument requires the market-to-book ratio times the financial deficit to provide information about the firm's target capital structure that is not contained in our estimate of the target debt ratio. Alternatively, firms with higher market-to-book ratios might have more serious borrowing constraints. Lemmon and Zender (2004) also argue that firms near their borrowing constraints behave in ways that are not consistent with the pecking order hypothesis; they find that the financial deficit has more of an influence on capital structure for firms without ratings.

[12]It should be noted that this decomposition applies only to the case where the Baker and Wurgler timing measure is positive. When it is negative they set it equal to zero.

a one-period lag of M/B to control for differences in investment opportunities. However, if leverage changes more slowly than investment opportunities, or alternatively if M/B is a very noisy proxy for investment opportunities, then the average market-to-book ratio, calculated over a number of prior years, might provide a better proxy for a firm's investment opportunities than does the one-year lagged M/B.[13]

In unreported regressions we find a strong relation between M/B_{efwa} and observed debt ratios, which is consistent with Baker and Wurgler (2002). However, the regressions that include the two components in place of M/B_{efwa} reveal that it is the second term ($\overline{M/B}$) that drives these results and that the covariance term scaled by the average financial deficit is not significantly related to observed leverage ratios.[14] However, as we show below, when the covariance term is not scaled by the average financial deficit it is in fact significantly related to the debt ratio.

2.3. Stock returns

To examine the direct effect of stock price changes on the debt ratio we include firms' stock returns (r), measured as the cumulative log return on the stock over the previous five years. This variable can also be interpreted as a proxy for the market timing effect we discussed before. However, it is not interacted with the financial deficit variable. As Welch (2004) emphasizes, stock returns will be negatively associated with debt ratios (measured with the market value of equity) if firms choose not to rebalance their debt ratios following periods of increasing and decreasing stock prices.[15] In addition, a negative relation between book leverage and the cumulative log stock return would provide further evidence that firms are more willing to issue equity when they experience relatively high market valuations.

2.4. Profitability

Profitability, which we define as the sum of earnings before interest, taxes, and depreciation over the previous five years, scaled by the beginning-period firm value, is related to the availability of internal funds.[16] Although the previously cited tests of the pecking order effect (Shyam-Sunder and Myers, 1999; Frank and Goyal, 2003) do not include profitability in their regressions, the pecking order suggests that profitability should have an independent effect on capital structure even after controlling for the financial deficit. To understand this, consider the extreme case of the pecking order where levered firms finance new projects with retained earnings but choose not to issue either new debt or new equity. In this case, the financial deficit will be exactly zero, but more profitable firms will reduce their leverage (relative to less profitable firms) through retained earnings.

[13] Hovakimian (2006) and Liu (2005) consider these possibilities in more detail.

[14] We later discuss that the average market-to-book variable is very persistent, which contributes to its persistent relation with leverage.

[15] This mechanical relation between stock returns and market leverage will clearly hold over sufficiently short intervals, although, over the five-year and ten-year intervals that we consider, firms should be able to make issuance/repurchase choices that offset their stock returns if adjustment costs are not too large and if firms have market value targets that are not strongly influenced by changes in their equity values.

[16] In book leverage regressions, the beginning-period firm value is the sum of book debt and book equity. In the market leverage regression the scaling factor is the sum of book debt and market equity.

It also should be noted that profitability could affect capital structure for tax reasons that Myers (1984). In particular, as Auerbach (1979) and others have noted, if distributions are taxed at the personal level, there will be a tax advantage associated with retaining equity that leads more profitable firms to reduce their debt ratios.[17] Given a tax effect, and the potential correlation between profitability and the financial deficit, it is possible that the observed relation between the financial deficit and changes in capital structure could also be driven by taxes. However, taxes should not induce a relation between the financial deficit and changes in the debt ratio after controlling for profitability.

2.5. *Leverage deficit and change in target*

If firms have a tendency to move towards their target debt ratios, then firms that have leverage ratios that are lower (higher) than their targets are likely to experience future increases (decreases) in their debt ratios.[18] In addition, we expect firms to increase or decrease their debt ratios as their target debt ratios change.

Our proxy for the target debt ratio is the predicted value from a Tobit regression of observed debt ratios on variables that have been suggested in the previous literature as proxies for the benefits (e.g., tax deductibility of interest and the reduction of free cash flow) and costs (e.g., potential financial distress and bankruptcy costs) of leverage. These variables are profitability (*EBITD*), asset tangibility (*PPE*), research and development expense (*R&D*), selling expense (*SE*), firm size (*SIZE*), and the market-to-book ratio (M/B).[19] In addition, we include industry dummies to capture the industry-specific determinants of leverage not captured by the above variables.[20] The motivation for selecting these target proxies is discussed in detail in Appendix B.

Given our estimate of the target debt ratio, we can estimate what we call the leverage deficit, which is the difference between the actual debt ratio and the target debt ratio. Similarly, our measure of the change in the target is the difference between the current target debt ratio and the target debt ratio measured at the beginning of the observation period.

3. Data

Our sample consists of firms listed in the Compustat Industrial Annual Files at any point between 1960 and 2003. Data on stock prices are obtained from the Center for Research in

[17]A recent paper by Hennessy and Whited (2005) examines this possibility in detail and provides simulations that indicate that the observed negative relation between debt ratios and past profitability can be generated entirely by taxes on distributions. In Titman and Tsyplakov (2005) and Strebulaev (2004), there is also discussion of the fact that profitability will lead to decreases in the debt ratio if more profitable firms become more valuable, which, holding their debt levels constant, results in lower debt ratios.

[18]We simplify the specification of adjustment costs by assuming that both leverage-increasing and leverage-decreasing adjustments are symmetric. In other words, we abstract from potential differences that can arise because of wealth transfers from equity holders to debt holders that keep firms from paying down their debt (Myers, 1977), or information asymmetries that make it more difficult to issue equity than debt. In Section 7 we discuss this potential asymmetry in firms' tendencies to move towards their targets in more detail.

[19]These variables were previously considered by Titman and Wessels (1988), Rajan and Zingales (1995), and others. As in Hovakimian, Opler, and Titman (2001), we also constructed the target proxy without the profitability and the market-to-book ratio in the Tobit regressions, since these variables are generally associated with changes in leverage. The unreported results based on this target proxy construction yield similar results.

[20]Specifically, we use the Fama and French (1997) industry classification (see Kenneth French's website).

Security Prices (CRSP) files. We exclude financial firms (SIC codes 6000–6999) and regulated utilities (SIC codes 4900–4999) from the sample. In addition, we restrict the sample to include firms with a book value of assets above $10 million.[21] Additional data restrictions are stated in the following discussion of our regression variables. Our sample is further restricted to include firms that have at least five years of data due to our long-horizon analysis.

Book leverage is defined as the ratio of book debt to total assets, where book debt is defined as total assets minus book equity, and book equity is equal to total assets less total liabilities and preferred stock plus deferred taxes and convertible debt.[22] We drop observations where this ratio is greater than one for individual firm-year observations. Market leverage is the ratio of the book value of debt to the sum of the book value of debt and the market value of equity.[23,24]

Net debt and net equity issues that are used both in market timing and financial deficit variables are calculated using balance sheet items. We define net equity issues as the change in the book value of equity minus the change in retained earnings; Baker and Wurgler (2002) also use this approach. Net debt issues are then defined as the change in total assets net of the change in retained earnings and net equity issues.[25]

A detailed discussion of the variable construction is presented in Table 1.

[21]As a robustness check, we exclude firms involved in large asset sales and big mergers (identified by Compustat footnote code AB). This does not have any material effect on our results.

[22]Our construction of book and market leverage follows Baker and Wurgler (2002), which is very similar to Fama and French (2002)'s definition of leverage. This broad definition of leverage is likely to overstate the financial leverage (as it includes non-debt liabilities like accounts payable and pension liabilities) and it may not provide a good indication of the near future default probability. However, for some firms these non-debt items are a very important part of the capital structure. Indeed, credit rating agencies state that traditional measures focusing on long-term debt have lost much of their significance and that non-interest-bearing liabilities like pension obligations should be considered as being similar to debt in many respects; see Standard & Poor's *Corporate Ratings Criteria* (2004, p. 22). Rajan and Zingales (1995, p. 1427) also provide a discussion on why considering the non-debt items might be necessary in defining leverage. Also note that, as in Baker and Wurgler (2002), we treat preferred stock as debt. The rationale for this is that for the purposes of considering timing and pecking order effects, preferred stock, being a fixed claim, more closely resembles debt than equity.

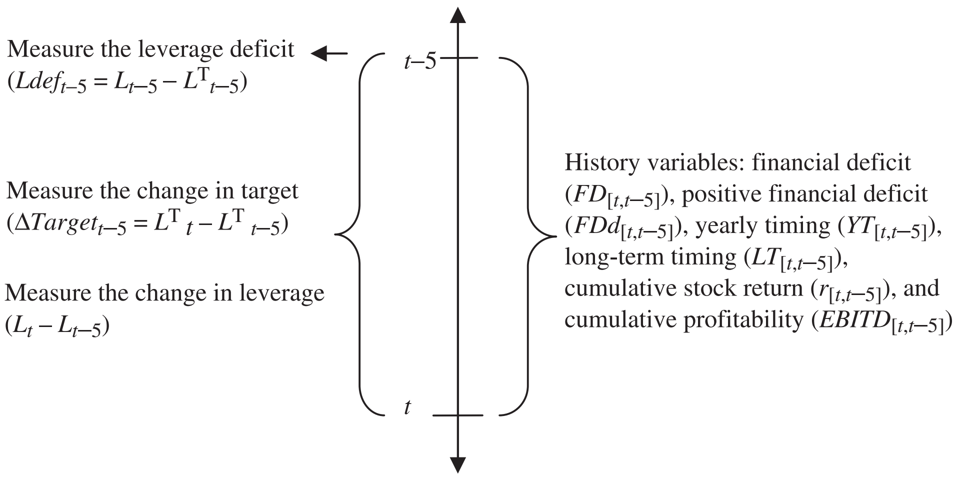
[23]Since our analysis is based on the changes in the leverage ratio, a potential problem arises from the fact that our measured debt ratios cannot be negative. We investigate this issue in more detail in Section 7.

[24]The literature is somewhat mixed about whether one should consider market or book leverage ratios. Welch (2004) argues that we should use market leverage ratios since our theories of target debt ratios are implicitly about market leverage ratios. However, one can argue that to test the pecking order theory one should focus on changes in book debt ratios, which are not influenced by changing stock prices. Because of these considerations, Shyam-Sunder and Myers (1999) and Frank and Goyal (2003) focus on book leverage ratios. Because we examine a broader literature that addresses issues relating to both target debt ratios and the pecking order theory, we consider both book and market debt ratios.

[25]Alternatively, these variables can be calculated from cash flow statements as in Frank and Goyal (2003) and Shyam-Sunder and Myers (1999). Specifically, net equity issues will equal the sale of common and preferred stock minus the purchase of common and preferred stock; and net debt issues will equal long-term debt issuance minus long-term debt reduction. While conceptually equivalent, the two methods differ on what is counted as a change in book value of equity (e.g., foreign currency translations, exercise of stock options, tax benefits from exercise of stock options, and issuance of employee stock purchase and executive retirement plans). This accounting treatment primarily influences our construct of the "amount of net equity issue" since it is defined as the difference between the change in the book value of equity and the change in retained earnings. In this sense, the balance sheet calculation reflects changes in account balances that do not necessarily have underlying cash components and hence leads to noise in our constructs. Even though cash flow accounts could yield less noisy constructs, we report our results using balance sheet constructs because cash flow accounts do not have comprehensive coverage in Compustat (U.S. firms were not required to submit the cash flow statement until 1988). When we redo our analysis using variables calculated from cash flow statements, we get qualitatively similar results.

4. Contemporaneous effects of financial deficits, market conditions, and profitability on debt ratios

This section examines how financial deficits, market conditions, and profitability variables relate to changes in leverage after controlling for the leverage deficit that is measured at the beginning of the period. The analysis in this section extends the work by Shyam-Sunder and Myers (1999) and Frank and Goyal (2003), who examine only the contemporaneous effect of the financial deficit on changes in leverage. The timeline of the observations and our two-stage regression specification is as follows:



Stage 1: Predict the target leverage

$$L_t = \alpha_0 + \beta_1 M/B_{t-1} + \beta_2 PPE_{t-1} + \beta_3 EBITD_{t-1} + \beta_4 R\&D_{t-1} + \beta_5 (R\&D\ dummy)_{t-1} + \beta_6 SE_{t-1} + \beta_7 SIZE_{t-1} + \beta_8\ Industry\ dummy + \varepsilon_t \tag{5}$$

and construct the leverage deficit ($Ldef_{t-5} = L_{t-5} - L^{T}_{t-5}$) and the target change ($\Delta Target_{t-5} = L^{T}_{t} - L^{T}_{t-5}$).

Stage 2: Estimate the regression model

$$L_t - L_{t-5} = \alpha_0 + \beta_1 FDd_{[t,t-5]} + \beta_2 FD_{[t,t-5]} + \beta_3 YT_{[t,t-5]} + \beta_4 LT_{[t,t-5]} + \beta_5 r_{[t,t-5]} + \beta_6 EBITD_{[t,t-5]} + \beta_7 Ldef_{t-5} + \beta_8 \Delta Target_{t-5} + \beta_9 Industry\ dummy + \varepsilon_t. \tag{6}$$

The first-stage regression is estimated using a Tobit specification where the predicted value of the leverage ratio is restricted to be between zero and 100.[26]

[26]We construct the target proxy using a Tobit model since by definition the debt ratio varies between zero and 100. In unreported results, we estimate this first-stage regression with OLS and eliminate the predicted values that are lower than 0 or greater than 100, with similar results. The first-stage regression that we use to construct the target proxy used in our analyses here is reported in Table B.1.

Table 1
Variable definitions

Variable	Data name	COMPUSTAT annual data item
Book debt	Total assets−book equity	Data6−book equity
Book equity	Total assets−[total liabilities + preferred stock] + deferred taxes + conv. debt	Data6−[data181 + data10] + data35 + data79
Market equity	Common shares outstanding*price	Data25*data199
Book leverage	Book debt/total assets	Book debt/data6
Market leverage	Book debt/(total assets−book equity + market equity)	
PPE (Asset tangibility)	Net property, plant, and equipment/total assets	Data8/data6
EBITD (Profitability)	Earnings before interest, tax, and depreciation/total assets	Data13/data6
R&D (Uniqueness)	Research and development expense/sales	Data46/data 12
SE (Uniqueness)	Selling expense/sales	Data181/data12
Ln(Sales) (Size)	Natural logarithm of net sales	Data12
Net equity issue ($\Delta\ e/A$)	(a) (Δ Book equity−Δ balance sheet retained earnings)/total assets	(Δ Book equity−Δ data36)/data6
	(b) Sale of common and preferred stock−purchase of common and preferred stock	Data108−data115
Net debt issues ($\Delta\ d/A$)	(a) (Δ total assets/total assets)−(e/A)−(Δ retained earnings/total assets)	
	(b) Long-term debt issuance−long-term debt reduction	Data111−data114
Newly retained earnings ($\Delta RE/A$)	Δ Retained earnings/total assets	Δ Data36/data6

In the second-stage regression we estimate the coefficients with standard OLS regressions, and because of the overlapping intervals we use a bootstrapping technique to determine the statistical significance of the estimated coefficients. Standard regression models are not appropriate to determine the significance of the parameter estimates since the standard errors violate the assumption that the errors are independently and identically distributed. Bootstrapping allows us to estimate standard errors that are robust to heteroskedasticity, correlation that arises as a result of multiple observations for each firm, and autocorrelation that we induce by including observations in overlapping periods.[27] A detailed explanation of the procedure we follow is provided in Appendix C.

4.1. Results

Table 2, Panel A, reports the coefficient estimates obtained from the regressions of changes in book leverage and market leverage on our proxies for market timing, pecking order, cumulative stock return, cumulative profitability, and the leverage deficit. To highlight the economic significance of our results, Panel B reports estimates of the magnitudes of the changes in capital structure generated by these same variables. Specifically, we examine the effect of a one standard deviation change in the independent variables on changes in the book and market debt ratios. The evidence indicates that the financial deficit, stock returns, and the leverage deficit have important effects on changes in the debt ratios, while the effects of the other variables are relatively minor. For example, a one standard deviation increase in stock returns decreases book leverage by 3.98% and market leverage by 14.29%.[28] In addition, a one standard deviation increase in the leverage deficit decreases book leverage by 7.26% and market leverage by 6.63%.

Firms are also responsive to changes in their target debt ratios; a 1% increase in the standard deviation of the change in the target leads to a 1.85% increase in the book debt ratio and a 3.33% increase in the market debt ratio. It is interesting that in the market leverage regressions the magnitude of the coefficient estimate for the change in target (β_8) is quite close to the magnitude of the coefficient estimate for the leverage deficit (β_7). By rearranging terms in Eq. (6), one can show that the equality of the magnitudes of β_7 and β_8

[27]An alternative approach for correcting the bias in OLS standard errors is to use what are known as cluster regressions, which relaxes the assumption that the residuals are independent over time. Petersen (2005) provides simulation analyses that suggest that cluster regressions provide appropriate standard errors when there is time-series correlation in the residuals. Although the current version of Petersen's paper does not consider the bootstrap technique, Mitchell Petersen has kindly provided additional simulations that suggest that bootstrapped standard errors are at least as large as errors from cluster regressions. Our own unreported cluster regressions also generate standard errors that are slightly smaller than the standard errors we generate with our bootstrap approach.

[28]One could argue that stock returns are endogenous. If the higher debt ratio increases the stock's systematic risk, highly levered firms will have high stock returns. In addition, if these risky firms tend to be overlevered, they might decrease their leverage to move towards their targets, inducing a correlation between returns and changes in leverage that have nothing to do with either market timing or the issues raised by Welch. We test the sensitivity of our analyses to this potential endogeneity problem by considering an asset return variable instead of our stock return variable. The comparison of the coefficients of the cumulative return variables across the two regressions suggests that asset returns have a stronger effect on changes in debt ratios than do stock returns. This result is the opposite of what we would expect if there were serious endogeneity problems. In any event, none of the other coefficients are materially affected by the alternative specification.

Table 2
Contemporaneous effects of financial deficits, market conditions, and profitability on debt ratios

The tables presents the regression results (Panel A) and the sensitivity analysis (Panel C) for the following model:

$$L_t - L_{t-5} = \alpha_0 + \beta_1 FDd_{[t,t-5]} + \beta_2 FD_{[t,t-5]} + \beta_3 YT_{[t,t-5]} + \beta_4 LT_{[t,t-5]} + \beta_5 r_{[t,t-5]} + \beta_6 EBITD_{[t,t-5]} + \beta_7 Ldef_{t-5} + \beta_8 \Delta Target_{t-5} + \beta_9 Ind.dum + \varepsilon_t.$$

The statistics are obtained from 500 bootstrap replications (each replication is a bootstrap sample of firm clusters) resampled from the actual dataset. Observations that belong to the same firm form a cluster. "Observed" is the coefficient estimate obtained by fitting the model using the original dataset. The standard error is the sample standard deviation of the 500 estimates. The 95% confidence interval is obtained from the sample of bootstrap coefficients. The dependent variable is the change in leverage (book leverage is book debt to book assets and market leverage is book debt to the sum of book debt and market equity) between year t and $t-5$. *Financial deficit* (*FD*) is total external financing between year t and $t-5$. *Positive financial deficit* (*FDd*) is the total financial deficit interacted with a dummy variable that takes the value one when *FD* is positive. *Yearly timing* (*YT*) is the covariance between the financial deficit and the market-to-book ratio from year t to $t-5$. *Long-term timing* (*LT*) is the product of the average market-to-book ratio and average external financing between year t and $t-5$. Five-*year cumulative stock return* (r) is the cumulative log return on stock between year t and $t-5$. Five-*year cumulative profitability* (*EBITD*) is the sum of earnings before interest, taxes, and depreciation between year t and $t-5$, scaled by the beginning-period firm value. In book leverage regressions, the beginning-period firm value is the sum of book debt and book equity. In the market leverage regression, the scaling factor is the sum of book debt and market equity. *Leverage deficit* (*Ldef*) is the difference between leverage and target leverage at $t-5$, where target leverage is proxied by the predicted value of the leverage ratio (details of this prediction regression are presented in Table B.1). *Change in Target* ($\Delta Target$) is the difference between target leverage at t and target leverage at $t-5$. All variables except the cumulative stock return and cumulative profitability are expressed in percentage terms. The statistics for the industry dummies are suppressed.

The statistics on sensitivity analysis (presented in Panel C) reflect the percentage change in leverage in response to a one standard deviation increase in the corresponding right-hand side variable. The sample standard deviation for each variable is presented in Panel B.

Panel A: Regression results

Book leverage (Number of obs. = 52,653/number of firm clusters = 5,584)

Variable	Observed	Std. err.	95% Conf. interval	
Financial deficit ($FD_{[t,t-5]}$)	0.11	0.01	0.09	0.13
Positive financial deficit ($FDd_{[t,t-5]}$)	0.15	0.01	0.14	0.17
Yearly timing ($YT_{[t,t-5]}$)	−0.46	0.04	−0.55	−0.38
Long-term timing ($LT_{[t,t-5]}$)	−0.26	0.02	−0.30	−0.23
Five-year cum. stock return ($r_{[t,t-5]}$)	−3.59	0.11	−3.81	−3.37
Five-year cum. profitability ($EBITD_{[t,t-5]}$)	−1.99	0.18	−2.33	−1.57
Leverage deficit ($L_{t-5} - L^{T}_{t-5}$)	−0.41	0.01	−0.42	−0.39
Change in target ($L^{T}_{t-5} - L^{T}_{t-5}$)	0.33	0.02	0.29	0.37

Market leverage (Number of obs. = 54,328/number of firm clusters = 5,708)

Variable	Observed	Std. err.	95% Conf. interval	
Financial deficit ($FD_{[t,t-5]}$)	0.20	0.01	0.19	0.21
Positive financial deficit ($FDd_{[t,t-5]}$)	0.05	0.01	0.03	0.06
Yearly timing ($YT_{[t,t-5]}$)	−0.35	0.03	−0.41	−0.27
Long-term timing ($LT_{[t,t-5]}$)	−0.30	0.02	−0.34	−0.27
Five-year cum. stock return ($r_{[t,t-5]}$)	−12.86	0.12	−13.08	−12.59
Five-year cum. profitability ($EBITD_{[t,t-5]}$)	1.28	0.20	0.92	1.68
Leverage deficit ($L_{t-5} - L^{T}_{t-5}$)	−0.35	0.01	−0.36	−0.34
Change in target ($L^{T}_{t-5} - L^{T}_{t-5}$)	0.38	0.01	0.36	0.40

Table 2 (*continued*)

Panel B: Standard deviation of the right-hand side variables

Variable ($[t,t-5]$):	Std. dev.
Financial deficit ($FD_{[t,t-5]}$)	51.96
Yearly timing ($YT_{[t,t-5]}$)	4.20
Long-term timing ($LT_{[t,t-5]}$)	20.42
Five-year cum. stock return ($r_{[t,t-5]}$)	1.11
Five-year cum. profitability ($EBITD_{[t,t-5]}$)	1.42
Book leverage deficit ($L_{t-5} - L^{\mathrm{T}}_{t-5}$)	17.63
Change in book target ($L^{\mathrm{T}}_{t-5} - L^{\mathrm{T}}_{t-5}$)	5.61
Market leverage deficit ($L_{t-5} - L^{\mathrm{T}}_{t-5}$)	18.95
Change in market target ($L^{\mathrm{T}}_{t-5} - L^{\mathrm{T}}_{t-5}$)	8.69

Panel C: Magnitude effect on the change in leverage

One standard deviation change in:	Percentage change in book			Percentage change in market		
Yearly timing ($YT_{[t,t-5]}$)		−1.93			−1.46	
Five-year cum. stock return ($r_{[t,t-5]}$)		−3.98			−14.29	
Five-year cum. profitability ($EBITD_{t,t-5]}$)		−2.83			0.97	
	$L-M/B$	$A-M/B$	$H-M/B$	$L-M/B$	$A-M/B$	$H-M/B$
Composite negative FD ($_{[t,t-5]}$)	3.64	2.38	−2.96	8.01	6.56	0.41
Composite positive FD ($_{[t,t-5]}$)	11.65	10.39	5.05	10.51	9.06	2.91
Leverage deficit ($L_{t-5} - L^{\mathrm{T}}_{t-5}$)		−7.26			−6.63	
Change in target ($L^{\mathrm{T}}_{t-5} - L^{\mathrm{T}}_{t-5}$)		1.85			3.33	

implies that after controlling for the ending-period target (L^{T}_t), the beginning-period target (L^{T}_{t-5}) does not have a significant effect on the ending-period debt ratio (L_t). However, in our book leverage regression we find that the magnitude of β_7 is larger than β_8, which implies that the lagged book target partially explains observed book debt ratios, even after controlling for the current book target.[29]

The effect of the financial deficit on capital structure depends on whether the financial deficit is positive or negative, and whether the market-to-book ratio is high or low. To capture these effects, we provide six numbers to describe how the financial deficit affects both the book and market debt ratios. As shown in the table, when the financial deficit is positive, a one standard deviation increase leads to an 11.65% increase in book leverage for low $\overline{M/B}$ firms. In contrast, when it is negative, a one standard deviation increase in the financial deficit leads to a 3.64 percent increase in book leverage for low $\overline{M/B}$ firms. For high $\overline{M/B}$ firms, the financial deficit has a much smaller effect on the debt ratio. Specifically, a one standard deviation change in the financial deficit results in a 5.05% change in the debt ratio when the financial deficit is positive, and a −2.96% change in the

[29]Note that the significance of β_8 in both the book and market regressions suggests that we should observe a faster speed of adjustment towards the new target than the existing target. In an unreported regression we examine this and find that the speed of adjustment is indeed faster when we use the current rather than the lagged target, but that the difference is not significant. We thank the anonymous referee for pointing this out.

debt ratio when the financial deficit is negative.[30] The financial deficit has a similar effect on market leverage ratios.[31]

Although we find that the financial deficit affects capital structure very differently for high and low market-to-book firms (i.e., there is a significant long-term timing effect), the yearly timing effect (YT) has a relatively weak effect on leverage. For example, book leverage decreases by 1.93% with a one standard deviation increase in YT.[32] The relation between five-year cumulative profitability and leverage is also relatively weak; for example, a one standard deviation increase in cumulative profitability decreases book leverage by 2.83%. Moreover, in market regressions cumulative profitability has a positive coefficient estimate, which is inconsistent with the idea that firms pay down their debt when they are more profitable. A possible explanation for this finding is that highly profitable firms also have high stock returns, and like other firms that experience high stock returns, their debt ratios tend to decline. However, the debt ratios of the more profitable firms decline less than other firms with high stock returns, since these firms tend to invest more and thus have less cash to pay down debt.

To examine how the stock return variable influences the coefficient on profitability, as well as our other coefficients, we re-estimate the regression model in Eq. (6) without the stock returns variable on the right-hand side. In unreported regressions we find that the presence of the cumulative stock return variable has almost no effect on the other coefficients in the book regressions. However, the market regressions are influenced by the inclusion of this variable. Indeed, the sign on the coefficient estimate of the cumulative profitability variable is negative in the market leverage regressions when we exclude the stock return variable from the model. In addition, the evidence indicates that the effect of the leverage deficit and the change in target on market leverage is at least twice as large when we exclude the cumulative stock return variable from the regression, which is consistent with the idea that stock returns, to some extent, capture information about firms' target debt ratios. The coefficient estimates of the positive financial deficit and the long-term timing variables in market regressions are also larger after excluding stock returns from the regression model.

5. Do the effects of history persist?

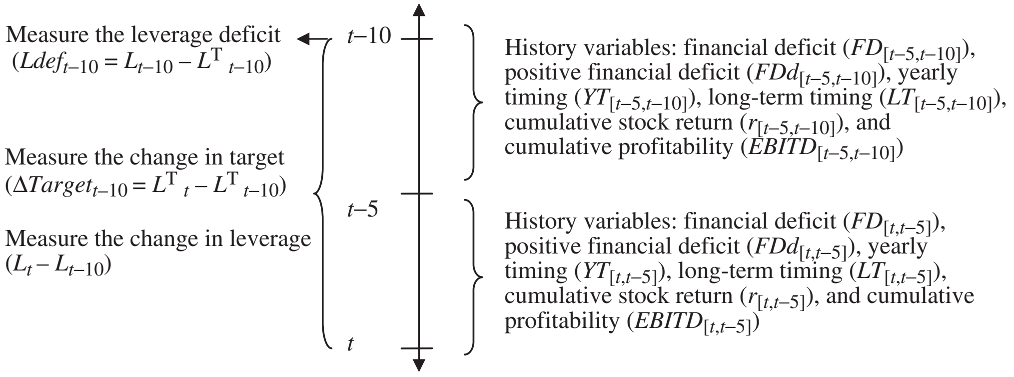
In the previous section we showed that financial deficits, market conditions, and profitability variables have significant effects on capital structures. In this section we examine the extent to

[30]The pecking order suggests that firms with a negative financial deficit (i.e., positive free cash flow) should reduce their leverage. However, this effect will be lower for firms with low market-to-book ratios since they are more likely to use their financial surplus to repurchase shares as well as to pay down debt. Since our specification does not specify separate M/B interaction effects for positive and negative financial deficits, we do not account for this possibility. Unreported regressions that include separate interaction variables for positive and negative financial deficits do not generate the expected effect. We conjecture that it is difficult to estimate the effect of M/B on firms with negative financial deficits because the sample firms with negative financial deficits is relatively small, and does not include a lot of dispersion in M/B, (high M/B firms generally do not have negative financial deficits).

[31]Note that the pecking order hypothesis suggests that the financial deficit variable influences the book leverage measure rather than the market leverage measure.

[32]Our regressions are estimated by eliminating the outliers at the highest and lowest one percentile; the yearly timing effect on changes in the debt ratio becomes less important if these observations are kept in the sample.

which these effects persist. Specifically, we test whether firms' cash flow, investment, and stock price histories measured in the first half of the ten-year period affect how leverage ratios change over an entire ten-year period. Since it is possible that the persistence of the relation between leverage and market timing, financial deficit, and profitability variables are due to the persistence of the variables themselves, we include history variables observed in the second (i.e., more recent) half of the ten-year period. Again, we estimate coefficients with OLS and bootstrap the standard errors as we did in the previous sections.



The following timeline describes the observation periods of the variables:

The regression results reported in Table 3, Panel A indicate that some of the effects of history at least partially persist. Panel C, which presents the magnitude effects of the history variables on debt ratios, indicates that stock returns and financial deficits have the most persistent effect on debt ratios over a 10-year period. For example, a one standard deviation increase in the cumulative stock return measured in the first half of the 10-year period leads to a 3.43% decrease in book leverage over the entire 10-year period, indicating that the effect of stock returns on book leverage observed in the first five years persists for at least five more years. Similarly, the financial deficit in the first half of the five-year period has a significant effect on the ten-year change in leverage. While history variables seem to have a persistent effect on debt ratios, the leverage deficit has the strongest economic impact on how debt ratios change over the ten year period; a one standard deviation change in the leverage deficit leads to a decrease in the debt ratio of a little more than 10%. In addition, we find that changes in the target influence the debt ratio. For example, in the book regression a one standard deviation increase in the change in the target leads to a 1.32% increase in the debt ratio. Overall, the evidence suggests that firms' tendencies to adjust towards a target is evident even when the target is measured in the distant past and even after controlling for all the cumulative effects of the cash flow and investment history variables as well as for changes in the target debt ratio.

6. Do the effects of history reverse?

The results in the previous section indicate that the cash flow, investment, and stock price histories of firms have a persistent effect on capital structure. However,

Table 3

Do the effects of history persist?

The tables presents the regression results (Panel A) and the sensitivity analysis (Panel C) for the following model:

$$\begin{aligned} L_t - L_{t-10} = {} & \alpha_0 + \beta_1 FDd_{[t-5,t-10]} + \beta_2 FD_{[t-5,t-10]} + \beta_3 YT_{[t-5,t-10]} + \beta_4 LT_{[t-5,t-10]} + \beta_5 r_{[t-5,t-10]} \\ & + \beta_6 EBITD_{[t-5,t-10]} + \beta_7 FDd_{[t,t-5]} + \beta_8 FD_{[t,t-5]} + \beta_9 YT_{[t,t-5]} + \beta_{10} LT_{[t,t-5]} + \beta_{11} r_{[t,t-5]} \\ & + \beta_{12} EBITD_{[t,t-5]} + \beta_{13} Ldef_{t-10} + \beta_{14} DTarget_{t-10} + \beta_{15} Ind.dum + \varepsilon_t. \end{aligned}$$

The statistics are obtained from 500 bootstrap replications (each replication is a bootstrap sample of firm clusters) resampled from the actual dataset. Observations that belong to the same firm form a cluster. "Observed" is the coefficient estimate obtained by fitting the model using the original dataset. The standard error is the sample standard deviation of the 500 estimates. The 95% confidence interval is obtained from the sample of bootstrap coefficients. The dependent variable is the change in leverage (book leverage is book debt to book assets and market leverage is book debt to the sum of book debt and market equity) between year t and $t-10$. *Financial deficit* (*FD*) is total external financing between year $t-5$ and $t-10$. *Positive financial deficit* (*FD∗d*) is the total financial deficit interacted with a dummy variable that takes the value one when FD is positive. *Yearly timing* (*YT*) is the covariance between the financial deficit and the market-to-book ratio from year $t-5$ to $t-10$. *Long-term timing* (*LT*) is the product of the average market-to-book ratio and average external financing between year $t-5$ and $t-10$. *Five-year cumulative stock return* (*r*) is the cumulative log return on stock between year $t-5$ and $t-10$. *Five-year cumulative profitability* (*EBITD*) is the sum of earnings before interest, taxes, and depreciation between year $t-5$ and $t-10$, scaled by the beginning-period firm value. In book leverage regressions, the beginning-period firm value is the sum of book debt and book equity. In the market leverage regression, the scaling factor is the sum of book debt and market equity. *Leverage deficit* (*Ldef*) is the difference between leverage and target leverage at $t-10$, where target leverage is proxied by the predicted value of the leverage ratio (details of this prediction regression are presented in Table B.1). *Change in target* (*ΔTarget*) is the difference between target leverage at t and target leverage at $t-10$. The regression model also includes realizations of the timing, financial deficit, stock return, and profitability variables between year t and $t-5$. All variables except the cumulative stock return and cumulative profitability are expressed in percentage terms. The statistics for the industry dummies are suppressed.

The statistics on sensitivity analysis (presented in Panel C) reflect the percentage change in leverage in response to a one standard deviation increase in the corresponding right-hand side variable. The sample standard deviation for each variable is presented in Panel B.

Panel A: Regression results

Book leverage (Number of obs. = 30,028/number of firm clusters = 3,068)

Variable	Observed	Std. err.	95% Conf. interval	
Financial deficit ($FD_{[t-5,t-10]}$)	0.10	0.01	0.07	0.13
Positive financial deficit ($FDd_{[t-5,t-10]}$)	0.06	0.02	0.03	0.09
Yearly timing ($YT_{[t-5,t-10]}$)	−0.47	0.07	−0.63	−0.35
Long-term timing ($LT_{[t-5,t-10]}$)	−0.16	0.03	−0.22	−0.10
Five-year cum. stock return ($r_{[t-5,t-10]}$)	−3.31	0.20	−3.73	−2.96
Five-year cum. profitability ($EBITD_{[t-5,t-10]}$)	−0.71	0.28	−1.22	−0.12
Financial deficit ($FD_{[t,t-5]}$)	0.04	0.01	0.02	0.06
Positive financial deficit ($FDd_{[t,t-5]}$)	0.21	0.01	0.18	0.23
Yearly timing ($YT_{[t,t-5]}$)	−0.50	0.07	−0.63	−0.38
Long-term timing ($LT_{[t,t-5]}$)	−0.18	0.03	−0.25	−0.11
Five-year cum. stock return ($r_{[t,t-5]}$)	−4.19	0.21	−4.60	−3.80
Five-year cum. profitability ($EBITD_{[t,t-5]}$)	−2.50	0.37	−3.32	−1.81
Leverage deficit ($L_{t-10} - \hat{L}_{t-10}$)	−0.62	0.01	−0.64	−0.60
Change in target ($L_t - \hat{L}_{t-10}$)	0.23	0.03	0.16	0.30

Table 3 (*continued*)

Market leverage (Number of obs. = 30,926/number of firm clusters = 3,106)

Variable	Observed	Std. err.	95% Conf. interval	
Financial deficit ($FD_{[t-5,t-10]}$)	0.19	0.01	0.17	0.22
Positive financial deficit ($FDd_{[t-5,t-10]}$)	−0.01	0.01	−0.03	0.02
Yearly timing ($YT_{[t-5,t-10]}$)	−0.40	0.06	−0.53	−0.27
Long-term timing ($LT_{[t-5,t-10]}$)	−0.25	0.03	−0.30	−0.20
Five-year cum. stock return ($r_{[t-5,t-10]}$)	−9.87	0.25	−10.37	−9.41
Five-year cum. profitability ($EBITD_{[t-5,t-10]}$)	0.34	0.27	−0.21	0.84
Financial deficit ($FD_{[t,t-5]}$)	0.15	0.01	0.13	0.18
Positive financial deficit ($FDd_{[t,t-5]}$)	0.07	0.01	0.04	0.09
Yearly timing ($YT_{[t,t-5]}$)	−0.35	0.06	−0.50	−0.25
Long-term timing ($LT_{[t,t-5]}$)	−0.26	0.03	−0.33	−0.20
Five-year cum. stock return ($r_{[t,t-5]}$)	−12.36	0.22	−12.76	−11.91
Five-year cum. profitability ($EBITD_{[t,t-5]}$)	2.65	0.33	2.01	3.27
Leverage deficit ($L_{t-10} - L^{\mathrm{T}}_{t-10}$)	−0.55	0.01	−0.56	−0.52
Change in target ($L^{\mathrm{T}}_{t-10} - L^{\mathrm{T}}_{t-10}$)	0.50	0.02	0.47	0.53

Panel B: Standard deviation of the right-hand-side variables

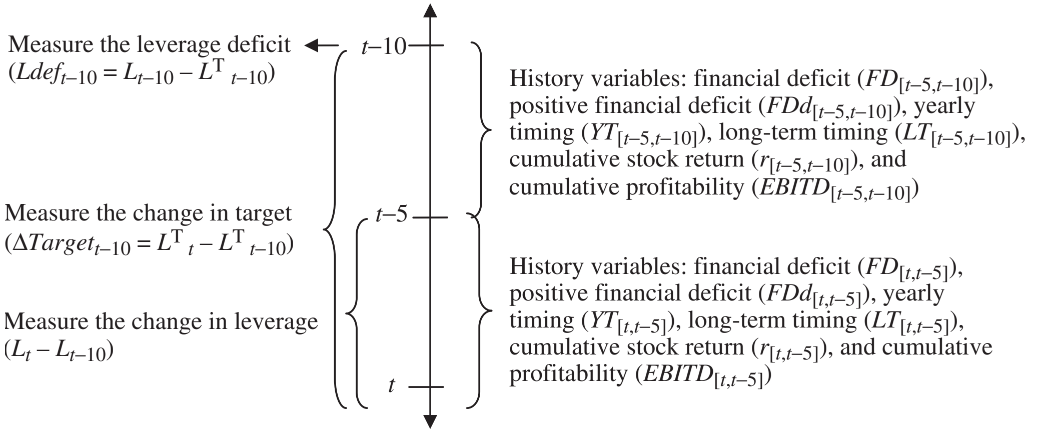
Variable ([t,$t-5$]):	Std. dev.	Variable ([$t-5$,$t-10$]):	Std. dev.
Financial deficit ($FD_{[t,t-5]}$)	51.96	Financial deficit ($FD_{[t-5,t-10]}$)	44.98
Yearly timing ($YT_{[t,t-5]}$)	4.20	Yearly timing ($YT_{[t-5,t-10]}$)	2.83
Long-term timing ($LT_{[t,t-5]}$)	20.42	Long-term timing ($LT_{[t-5,t-10]}$)	16.21
Five-year cum. stock return ($r_{[\ t,t-5]}$)	1.11	Five-year cum. stock return ($r_{[t-5,t-10]}$)	1.04
Five-year cum. profitability ($EBITD_{[t,t-5]}$)	1.42	Five-year cum. profitability ($EBITD_{[t-5,t-10]}$)	1.20
Book leverage deficit ($L_{t-10} - L^{\mathrm{T}}_{t-10}$)	17.63		
Change in book target ($L^{\mathrm{T}}_{t} - L^{\mathrm{T}}_{t-10}$)	5.61		
Market leverage deficit ($L_{t-10} - L^{\mathrm{T}}_{t-10}$)	18.95		
Change in market target ($L^{\mathrm{T}}_{t-10} - L^{\mathrm{T}}_{t-10}$)	8.69		

Panel C: Magnitude effect on the change in leverage

One standard deviation change in:	Percentage change in book			Percentage change in market		
Yearly timing ($YT_{[t-5,t-10]}$)		−1.34			−1.12	
5-year cum. stock return ($r_{[t-5,t-10]}$)		−3.43			−10.25	
5-year cum. profitability ($EBITD_{[t-5,t-10]}$)		−0.86			0.24	
	$L-M/B$	$A-M/B$	$H-M/B$	$L-M/B$	$A-M/B$	$H-M/B$
Composite negative FD ($_{[t-5,t-10]}$)	3.44	2.79	0.02	7.02	6.01	1.70
Composite positive FD ($_{[t-5,t-10]}$)	6.02	5.36	2.59	6.78	5.77	1.46
Yearly timing ($YT_{[t,t-5]}$)		−2.10			−1.48	
Five-year cum. stock return ($r_{[t,t-5]}$)		−4.66			−13.73	
Five-year cum. profitability ($EBITD_{[t,t-5]}$)		−3.55			−2.00	
	$L-M/B$	$A-M/B$	$H-M/B$	$L-M/B$	$A-M/B$	$H-M/B$
Composite negative FD ($_{[t,t-5]}$)	0.79	−0.06	−3.67	5.99	4.76	−0.47
Composite positive FD ($_{[t,t-5]}$)	11.49	10.64	7.04	9.43	8.19	2.96
Leverage deficit ($L_{t-10} - L^{\mathrm{T}}_{t-10}$)		−10.60			−10.22	
Change in target ($L^{\mathrm{T}}_{t-10} - L^{\mathrm{T}}_{t-10}$)		1.32			4.49	

the results indicate that a firm's more recent history influences its capital structure more than its more distant history. This suggests that part of the effect of firms' history subsequently reverses, which provides additional support for the idea that firms take actions that offset changes that move them away from their target debt ratios.[33]

In this section, we provide a more direct test of the extent to which the effects of these history variables are later reversed. Specifically, we estimate regressions that allow us to examine whether the firms' cash flow, investment, and stock price histories (from years $t-10$ to $t-5$) affect how leverage ratios change over the subsequent five-year period (from years $t-5$ to t). If the history effect reverses, we expect the coefficient on the lagged history variable to have the opposite sign as the corresponding contemporaneous history variable. The timeline for the regression that we estimate is described below:



Panel A of Table 4 reports the estimates of these regressions. The evidence reported in this table indicates that the financial deficit, profitability, and yearly timing effects each partially reverse.

The economic significance of these reversals is presented in Panel C of Table 4. The evidence indicates that the stock return effect reverses only slightly in the market leverage regression (23% of the stock return effect reverses in the subsequent period) but not at all in the book leverage regression. This observation is consistent with evidence that firms tend to issue equity subsequent to increases in their stock prices. The financial deficit effect shows relatively strong evidence of a reversal in both the market and book leverage regressions, and the magnitude is similar in both cases. The financial deficit effect reverses more when it is positive, and as a percentage of the original effect, the reversal is stronger for high M/B firms. For example, in book regressions, 74% of the financial deficit effect reverses in the subsequent period when it is positive and when M/B is high. Yearly timing and cumulative profitability effects show signs of reversal, although, these variables do not

[33] The history variables can be viewed as an additional proxy for the leverage deficit since they represent variables that lead firms to move away from their target debt ratios. For example, when the financial deficit is high, the leverage deficit is expected to be high, which implies that future changes in the debt ratio are likely to be negative.

Table 4
Do the effects of history reverse?

The tables presents the regression results (Panel A) and the sensitivity analysis (Panel C) for the following model:

$$\begin{aligned} L_t - L_{t-5} = \alpha_0 &+ \beta_1 FDd_{[t-5,t-10]} + \beta_2 FD_{[t-5,t-10]} + \beta_3 YT_{[t-5,t-10]} + \beta_4 LT_{[t-5,t-10]} + \beta_5 r_{[t-5,t-10]} \\ &+ \beta_6 EBITD_{[t-5,t-10]} + \beta_7 FDd_{[t,t-5]} + \beta_8 FD_{[t,t-5]} + \beta_9 YT_{[t,t-5]} + \beta_{10} LT_{[t,t-5]} + \beta_{11} r_{[t,t-5]} \\ &+ \beta_{12} EBITD_{[t,t-5]} + \beta_{13} Ldef_{t-10} + \beta_{14} DTarget_{t-10} + \beta_{15} Ind.dum + \varepsilon_t. \end{aligned}$$

The statistics are obtained from 500 bootstrap replications (each replication is a bootstrap sample of firm clusters) resampled from the actual dataset. Observations that belong to the same firm form a cluster. "Observed" is the coefficient estimate obtained by fitting the model using the original dataset. The standard error is the sample standard deviation of the 500 estimates. The 95% confidence interval is obtained from the sample of bootstrap coefficients. The dependent variable is the change in leverage (book leverage is book debt to book assets and market leverage is book debt to the sum of book debt and market equity) between year t and $t-5$. *Financial deficit* (*FD*) is total external financing between year $t-5$ and $t-10$. *Positive Financial Deficit* (*FD*d*) is the total financial deficit interacted with a dummy variable that takes the value one when FD is positive. *Yearly timing* (*YT*) is the covariance between the financial deficit and the market-to-book ratio from year $t-5$ to $t-10$. *Long-term timing* (*LT*) is the product of the average market-to-book ratio and average external financing between year $t-5$ and $t-10$. *Five-year cumulative stock return* (*r*) is the cumulative log return on stock between year $t-5$ and $t-10$. *Five-year cumulative profitability* (*EBITD*) is the sum of earnings before interest, taxes, and depreciation between year $t-5$ and $t-10$, scaled by the beginning-period firm value. In book leverage regressions, the beginning-period firm value is the sum of book debt and book equity. In the market leverage regression, the scaling factor is the sum of book debt and market equity. *Leverage deficit* (*Ldef*) is the difference between leverage and target leverage at $t-10$, where target leverage is proxied by the predicted value of the leverage ratio (details of this prediction regression are presented in Table B.1). *Change in target* ($\Delta Target$) is the difference between target leverage at t and target leverage at $t-10$. The regression model also includes realizations of the timing, financial deficit, stock return, and profitability variables between year t and $t-5$. All variables except the cumulative stock return and cumulative profitability are expressed in percentage terms. The statistics for the industry dummies are suppressed.

The statistics on sensitivity analysis (presented in Panel C) reflect the percentage change in leverage in response to a one standard deviation increase in the corresponding right-hand-side variable. The sample standard deviation for each variable is presented in Panel B.

Panel A: Regression results

Book Leverage (Number of obs. = 29,802/number of firm clusters = 3,059)

Variable	Observed	Std. err.	95% Conf. interval	
Financial deficit ($FD_{[t-5,t-10]}$)	0.01	0.01	−0.01	0.04
Positive financial deficit ($FDd_{[t-5,t-10]}$)	−0.15	0.01	−0.18	−0.12
Yearly timing ($YT_{[t-5,t-10]}$)	0.09	0.06	−0.03	0.21
Long-term timing ($LT_{[t-5,t-10]}$)	0.01	0.03	−0.05	0.07
Five-year cum. stock return ($r_{[t-5,t-10]}$)	−0.21	0.18	−0.54	0.17
Five-year cum. profitability ($EBITD_{[t-5,t-10]}$)	3.03	0.31	2.48	3.68
Financial deficit ($FD_{[t,t-5]}$)	0.14	0.01	0.12	0.17
Positive financial deficit ($FDd_{[t,t-5]}$)	0.16	0.01	0.13	0.19
Yearly timing ($YT_{[t,t-5]}$)	−0.56	0.06	−0.67	−0.43
Long-term timing ($LT_{[\ t,t-5]}$)	−0.24	0.04	−0.31	−0.17
Five-year cum. stock return ($r_{[\ t,t-5]}$)	−4.81	0.20	−5.26	−4.49
Five-year cum. profitability ($EBITD_{[t,t-5]}$)	−3.92	0.53	−4.82	−2.87
Leverage deficit ($L_{t-10} - L^{\mathrm{T}}_{t-10}$)	−0.18	0.01	−0.20	−0.17
Change in target ($L^{\mathrm{T}}_{t-10} - L^{\mathrm{T}}_{t-10}$)	0.16	0.03	0.11	0.21

Table 4 (*continued*)

Market leverage (Number of obs. = 30,926/number of firm clusters = 3,106)

Variable	Observed	Std. err.	95% Conf. interval	
Financial deficit ($FD_{[t-5,t-10]}$)	−0.04	0.01	−0.06	−0.02
Positive financial deficit ($FDd_{[t-5,t-10]}$)	−0.09	0.01	−0.12	−0.07
Yearly timing ($YT_{[t-5,t-10]}$)	0.14	0.05	0.03	0.23
Long-term timing ($LT_{[t-5,t-10]}$)	0.13	0.02	0.09	0.17
Five-year cum. stock return ($r_{[t-5,t-10]}$)	3.27	0.22	2.83	3.72
Five-year cum. profitability ($EBITD_{[t-5,t-10]}$)	1.52	0.25	1.04	2.00
Financial deficit ($FD_{[t,t-5]}$)	0.22	0.01	0.20	0.25
Positive financial deficit ($FDd_{[t,t-5]}$)	0.07	0.01	0.05	0.10
Yearly timing ($YT_{[t,t-5]}$)	−0.43	0.06	−0.54	−0.30
Long-term timing ($LT_{[t,t-5]}$)	−0.29	0.03	−0.34	−0.23
Five-year cum. stock return ($r_{[\ t,t-5]}$)	−14.53	0.21	−14.93	−14.14
Five-year cum. profitability ($EBITD_{[t,t-5]}$)	−0.46	0.31	−1.07	0.15
Leverage deficit ($L_{t-10} - L^{\mathrm{T}}_{t-10}$)	−0.21	0.01	−0.23	−0.20
Change in target ($L^{\mathrm{T}}_{t-10} - L^{\mathrm{T}}_{t-10}$)	0.25	0.01	0.22	0.28

Panel B: Standard deviation of the right-hand-side variables

Variable ([t,$t-5$]):	Std. dev.	Variable ([$t-5$,$t-10$]):	Std. dev.
Financial deficit ($FD_{[t,t-5]}$)	51.96	Financial deficit ($FD_{[t-5,t-10]}$)	44.98
Yearly timing ($YT_{[t,t-5]}$)	4.20	Yearly timing ($YT_{[t-5,t-10]}$)	2.83
Long-term timing ($LT_{[t,t-5]}$)	20.42	Long-term timing ($LT_{[t-5,t-10]}$)	16.21
Five-year cum. stock return ($r_{[\ t,t-5]}$)	1.11	Five-year cum. stock return ($r_{[t-5,t-10]}$)	1.04
Five-year cum. profitability ($EBITD_{[t,t-5]}$)	1.42	Five-year cum. profitability ($EBITD_{[t-5,t-10]}$)	1.20
Book leverage deficit ($L_{t-10} - L^{\mathrm{T}}_{t-10}$)	17.63		
Change in book target ($L^{\mathrm{T}}_{t-10} - L^{\mathrm{T}}_{t-10}$)	5.61		
Market leverage deficit ($L_{t-10} - L^{\mathrm{T}}_{t-10}$)	18.95		
Change in market target ($L^{\mathrm{T}}_{t-10} - L^{\mathrm{T}}_{t-10}$)	8.69		

Panel C: Magnitude effect on the change in leverage

One standard deviation change in:	Percentage change in book			Percentage change in market		
Yearly timing ($YT_{[t-5,t-10]}$)		0.25			0.40	
Five-year cum. stock return ($r_{[t-5,t-10]}$)		−0.22			3.39	
Five-year cum. profitability ($EBITD_{[t-5,t-10]}$)		3.64			1.08	
	$L-M/B$	$A-M/B$	$H-M/B$	$L-M/B$	$A-M/B$	$H-M/B$
Composite negative FD ($_{[t-5,t-10]}$)	0.65	0.70	0.92	−0.96	−0.43	1.79
Composite positive FD ($_{[t-5,t-10]}$)	−6.06	−6.01	−5.80	−5.17	−4.64	−2.41
Yearly timing ($YT_{[t,t-5]}$)		−2.34			−1.80	
Five-year cum. stock return ($r_{[t,t-5]}$)		−5.35			−16.14	
Five-year cum. profitability ($EBITD_{[t,t-5]}$)		−5.56			−0.34	
	$L-M/B$	$A-M/B$	$H-M/B$	$L-M/B$	$A-M/B$	$H-M/B$
Composite negative FD ($_{[t,t-5]}$)	5.51	4.36	-0.52	9.39	7.99	2.07
Composite positive FD ($_{[t,t-5]}$)	13.91	12.76	7.88	13.16	11.75	5.84
Leverage deficit ($L_{t-10} - L^{\mathrm{T}}_{t-10}$)		−3.15			−3.97	
Change in target ($L^{\mathrm{T}}_{t-10} - L^{\mathrm{T}}_{t-10}$)		0.92			2.26	

have an economically significant effect on capital structures and the magnitudes of the reversals are also fairly small.

Finally, it should be noted that the leverage deficit variable is highly significant in all of the regressions. Firms that are underlevered (overlevered) relative to our estimates of their target ratios tend to realize an increase (decrease) in their leverage ratios over the subsequent ten years. Furthermore, the change in the target has a significant impact on the change in the debt ratio. More specifically, when a firm experiences an increase in its target the debt ratio increases to reflect this change. These results are consistent with a significant, but relatively slow, movement towards firms' target debt ratios.

7. Extensions[34]

This section presents a number of alternative specifications and a discussion of the cross-sectional and time-series robustness of our results. We describe several regressions that are not included in the paper, but are available upon request.

7.1. Endogeneity of the financial deficit variable

The pecking order argument is based on the idea that firms make financing choices in response to exogenously generated cash flows and investment choices. In reality, however, the financial deficit is an endogenous variable that is likely to be influenced by conditions in the debt and equity markets. For example, firms might raise external capital, and thus generate a high financial deficit, because the external markets view the firm favorably. If firms tend to try to time equity markets more than debt markets, this behavior will induce a relation between changes in the debt ratio and the tendency of firms to raise capital when their market-to-book ratios are high.

In unreported regressions we address (but probably do not eliminate) this endogeneity problem by examining two alternative versions of the financial deficit variable. The first excludes changes in cash (Δcash) as part of the financial deficit, since it is a decision that management makes simultaneously with debt and equity issues. The necessity of this adjustment becomes clearer when we consider the possibility that firms sometimes issue equity only because their managers think that the firm's stock price is overvalued, and place the proceeds in cash. In this case, an increase in the financial deficit is associated with a decrease (rather than an increase) in leverage. The resulting reduction in the coefficient on the financial deficit variable arising from this activity is likely to be more significant for high market-to-book firms, if we believe that these firms are more likely to engage in this sort of timing activity. To explore the implications of this possibility we subtract changes in cash from the definition of the financial deficit.

$$FD \equiv \Delta e + \Delta d - \Delta \text{cash}. \tag{7}$$

For the second alternative we exclude dividends as well as changes in cash from the financial deficit. Again, if the manager raises equity because of favorable stock prices and distributes the proceeds as a dividend, the estimate of the financial deficit coefficient will be

[34]Some of the analysis in this section was suggested by participants at the April 9, 2004 NBER conference in Chicago and the 2004 WFA conference in Vancouver. We would like to especially thank Malcolm Baker, Gordon Phillips, and Jaime Zender.

reduced, i.e., an increase in the financial deficit will be associated with a decrease in leverage. To eliminate this effect on the coefficient of the financial deficit, we consider a third version of the financial deficit variable that takes the following form:

$$FD \equiv \Delta e + \Delta d - \Delta \text{cash} - D. \tag{8}$$

Our unreported regressions show that, with some exceptions, our findings are fairly robust with respect to the different measures of the financial deficit. First, we find that the differential effect of a positive financial deficit is lower when we use the financial deficit constructs that excludes the "changes in cash" and "dividends and changes in cash." Furthermore, our results suggest that when the financial deficit variable excludes the changes in cash balances, the yearly timing effect on the book leverage ratio is slightly lower. In other words, the decrease in the leverage ratio as a result of yearly timing tends to be lower when we exclude the timing activity that results in increases in cash balances.

7.2. How do our results vary cross-sectionally?

Existing research suggests that the relation between some of our independent variables and changes in leverage is likely to vary cross-sectionally. For example, Frank and Goyal (2003) find that the financial deficit has less of an effect on changes in capital structure for smaller and younger firms, and Lemmon and Zender (2004) find that the financial deficit has more of an influence on capital structure for firms without ratings.

We investigate the same cross-sectional characteristics within the context of our specification. Specifically, we estimate the regression model specified in Eq. (6) on different size, age, and credit rating subsamples.[35]

In contrast to the specifications tested in the above papers, our specification controls for the fact that capital structure changes are more sensitive to the financial deficit for firms with low market-to-book ratios. In addition, our specification considers capital structure changes over longer time periods and thus ignores the differences across characteristics that are generated because of temporary capital structure changes.

The unreported results suggest that the weaker pecking order effect for smaller and younger firms is partially generated by the same factors that dampen the pecking order effect for high market-to-book firms. Specifically, we find that after controlling for market-to-book ratios, the sensitivity of the changes in leverage to changes in financial deficits is similar across size groups. We do, however, find evidence that the financial deficit has less of an effect on capital structure for younger firms and firms without credit ratings. These results, while being consistent with the findings in Frank and Goyal and Lemmon and Zender, are somewhat weaker than what is reported in these papers.[36]

[35]The age and size subsamples are created in each year by segmenting the data in two stages. The first stage segments the data into 25 groups based on the firms' average market-to-book ratio. The second stage segments the firms in each of the 25 groups into three groups based on size rankings and three additional groups based on age rankings. Finally, we generate the three size and age subsamples used in our regressions by merging all the corresponding top, middle, and bottom size (and respectively age) segments from each of the 25 groups. The rating subsamples are created simply by splitting the sample into two based on the availability of a credit rating. The tests are conducted using both the Moody's and S&P credit ratings.

[36]We found no significant difference in the effect of the financial deficit on changes in book equity for the subsamples with and without credit ratings.

In addition to examining how these cross-sectional characteristics influence the financial deficit coefficients, our regressions also allow us to examine whether the rate at which firms move towards their target debt ratios differs cross-sectionally. Our regression results indicate that age, size, and whether or not firms have rated debt do not influence the rate at which underlevered firms (relative to their targets) increase their leverage. In addition, age and size do not seem to impact the rate at which overlevered firms decrease their debt. However, unrated firms that are overlevered tend to decrease their leverage twice as fast as rated firms. A possible explanation for this observation is that unrated firms are more dependent on banks, which are likely to have more influence on capital structure choices than public bondholders, and thus force the overlevered firm to take actions that reduce leverage.[37]

7.3. Including the average market-to-book ratio as a control variable

As we mentioned earlier, the explanatory power of the Baker and Wurgler (2002) timing measure is largely due to the fact that it contains the average market-to-book ratio. This makes it somewhat difficult to interpret the Baker and Wurgler results, since while the average market-to-book ratio can be viewed as a timing measure, it could also capture other determinants of the capital structure choice, such as growth opportunities.

To examine these issues in more detail, we estimate various specifications of our model that include the average market-to-book ratio as an independent variable. When we add the average market-to-book ratio to the book leverage regressions reported in Table 2, the variable is statistically insignificant and has only minor effects on the other coefficients. In the market leverage regression its effect is statistically significant but not particularly large (market leverage decreases by 1.76% with a one standard deviation increase in the average market-to-book ratio). Furthermore, our persistence regressions indicate that the average market-to-book ratio does not have a long-lasting effect on changes in leverage, and in fact its effect fully reverses in the subsequent five-year period.

To further examine the relevance of the average market-to-book ratio we compare the explanatory power of the firm's average market-to-book ratio and the industry mean of the average market-to-book ratio in explaining changes in the debt ratio. While the average industry market-to-book ratio can conceivably be interpreted as measuring timing incentives (i.e., firms like to issue equity when equity values in their industry are high relative to book values), it clearly provides a weaker measure of timing incentives than the firm's own average market-to-book ratio and could provide an equally good measure of a firm's growth opportunities.

A comparison of the results with the two versions of the average market-to-book ratio reveals that the industry measure explains changes in both book leverage and market leverage better than the firm's own market-to-book ratio. However, the changes in the debt ratios that are generated as a result of this industry measure are not very long-lasting. Reversal tests suggest that more than two-thirds of the effect of the industry average market-to-book ratio on the debt ratio reverses in the subsequent five-year period.

[37]Given the wealth transfer to debt holders, an equity-maximizing firm that is not under the influence of a bank has less incentive to take actions that reduce leverage. Titman and Tsyplakov (2005) examine the incentives of value-maximizing and equity-maximizing firms to reduce leverage when they are overlevered.

7.4. Is the relation between changes in the debt ratio and the leverage deficit spurious?

It is possible that the relation between changes in the debt ratio and the leverage deficit are spurious. For example, since our regressions track changes in capital structure for five and ten years, we require firms to survive over these periods. One might expect that those firms that are initially overlevered, and do not take steps to reduce their leverage, are less likely to survive, and hence will not be included in our sample. What this means is that within our sample of survivors, we are likely to see a negative relation between the leverage deficit and changes in leverage.

Even without survival bias we might expect to have a spurious relation between the leverage deficit and changes in leverage. Since the debt ratio must be between zero and one, there could be a mechanical relation between the leverage deficit and future changes in the debt ratio. To understand this, consider a firm that has no debt, and thus a debt ratio of zero, and presumably a negative leverage deficit (i.e., it is considered underlevered). Since such a firm cannot possibly reduce its leverage ratio, it must, on average, increase its leverage ratio and will thus contribute to a positive correlation between the leverage deficit and future changes in the debt ratio.

To explore whether these spurious relations could be driving the estimated relation between the leverage deficit and future changes in the debt ratio, we consider four changes to our estimated regressions. First, we estimate our regressions on a sample that excludes all firms with debt ratios under 10%, and find that our results do not change significantly. Second, we reexamine our regressions by including the beginning-period debt ratio in addition to the leverage deficit as independent variables. As one would expect, this additional variable is in fact negatively related to changes in the debt ratio, but its addition does not materially change our coefficient estimates other than for the leverage deficit variable. The significance of the leverage deficit in the market leverage regressions declines slightly, and we observe almost no effect on the coefficient estimate of the leverage deficit in the book leverage regressions.

Third, we reestimate our regressions with alternative debt ratios that subtract each firm's cash and short-term marketable assets from their debt levels (the idea is that cash is negative debt). One advantage of these alternative debt ratios is that they can be negative as well as positive, and are thus less subject to the above-mentioned mechanical relation. Our unreported results suggest that this adjustment has only a marginal effect on our results and the qualitative evidence on the changes in the debt ratio remains the same.

Finally, we examine whether the reversal towards a target debt ratio is different for firms with negative and positive leverage deficits. If our results are driven solely because of survival bias, we expect to see a relation only for firms with positive leverage deficits. We investigate this possibility by including an additional leverage deficit variable that is interacted with an indicator variable that takes a value of one when the leverage deficit is positive and zero otherwise. The results indicate that leverage deficits have a greater effect on changes in leverage for overlevered firms, which is consistent with survival bias. However, the evidence suggests that underlevered firms tend to increase their leverage, indicating that the leverage deficit effect is not driven purely by survival bias.[38]

[38]Even without survival bias we might expect to see asymmetry in the tendency of firms to respond to positive and negative leverage deficits. For example, the Myers (1977) debt overhang effect, which indicates that a reduction of debt might not be favored by equity holders because of a wealth transfer to debt holders, implies that

7.5. The Welch (2004) variable

Welch (2004) constructs a variable, which he calls the implied debt ratio (IDR), that might more explicitly measure the mechanical relation between market leverage ratios and stock returns. Consistent with our notation, the *IDR* at period *t* is:

$$IDR_t = \frac{D_{t-5}}{E_{t-5} * (1 + r_{[t,t-5]}) + D_{t-5}}, \tag{9}$$

where D, E, and r are, respectively, the book value of debt, the market value of equity, and the five-year cumulative stock return.

To measure the change in leverage that arises purely from stock returns, we construct a variable as the difference between the IDR and the lagged debt ratio. Our unreported regressions examine the extent to which this variable explains changes in the market leverage ratio. Consistent with Welch (2004), this variable is highly significant, but its level of significance is slightly less than what we find for the stock return variable in the regressions that we do report. In addition, the coefficients of the other variables in the regression are qualitatively unchanged.

8. Conclusion

There is considerable disagreement about the importance of the concept of a target debt ratio. On one hand, it is intuitive to think about how tradeoffs between the costs and benefits of debt financing lead to an optimal capital structure. On the other hand, it is also possible that at the optimum, the relation between the debt ratio and firm value is relatively weak, so that the cost of deviating from the optimum is quite small, making the idea of a target debt ratio much less important. When this is the case, capital structures are likely to be strongly influenced by transaction costs and market considerations that can temporarily affect the relative costs of debt versus equity financing.

The results in this paper support the view that firms behave as though they have target debt ratios, but their cash flows, investment needs, and stock price realizations lead to significant deviations from these targets. Our results indicate that the capital structures of firms move back towards their targets but at a slow rate. This result is consistent with with the dynamic capital structure models presented in Fischer, Heinkel, and Zechner (1989) and Titman and Tsyplakov (2005) who show that with reasonable levels of transaction costs along with the traditional costs and benefits of debt financing, debt ratios vary over a relatively large range.[39]

(*footnote continued*)
firms are less likely to respond to positive leverage deficits. However, if entrenched managers personally favor lower debt ratios, they could have greater incentives to move towards their targets when they are overlevered (e.g., Friend and Lang, 1988; Mehran, 1992; Kayhan 2005).

[39]Our estimate that debt ratios tend to increase or decrease by 40% of the gap between the observed debt ratio and the estimated target over a five-year period is also consistent with the yearly adjustment estimated by Fama and French (2002). Although Fama and French interpret their findings as evidence of a relatively slow rate of adjustment, the estimated speed of adjustment is not at all surprising given that the target debt ratio is estimated with considerable error and probably changes over time. In other words, we have an errors-in-variables problem that downwardly biases our estimate of the speed of adjustment. It should also be noted that this estimate of the tendency to move towards the target debt ratio does not include the movement towards the target that is associated with the reversal of the various history effects.

Consistent with Shyam-Sunder and Myers (1999) and Frank and Goyal (2003) we find that higher financial deficits are associated with increases in leverage. In addition, as in Welch (2004), stock returns have a very important effect on capital structure. However, although the variable motivated by the Baker and Wurgler (2002) intuition influences capital structure in the predicted direction, the magnitude of this effect is quite small relative to the stock price and financial deficit effects.

Our reversal tests provide further evidence that firms tend to move towards their target debt ratios. By looking at economic events, like the financial deficit and stock returns, that are likely to move a firm away from its target debt ratio, we can more explicitly examine whether there are forces that tend to move the debt ratios back. These tests provide relatively strong evidence that changes in leverage due to the financial deficit partially reverse. However, changes in leverage that are generated by stock returns reverse very little.

One interpretation of this evidence is that stock price changes are associated with changes in the target debt ratio that are not entirely accounted for in our target estimate.[40] For example, increased stock prices are likely to be associated with increased growth opportunities as well as other changes in the nature of the business that might be associated with lower target debt ratios. Furthermore, one could argue that managerial incentive issues can also play a role. If managers prefer conservative capital structures (because they personally suffer bankruptcy costs and have less discretion in more levered firms), one might not expect them to take actions that reverse the decrease in the debt ratio caused by an increase in their stock price.[41] Although we have ignored corporate governance/managerial incentive issues in this study, an evaluation of these issues is likely to enhance our understanding of what causes capital structures to change over time.

Appendix A. Decomposition of Baker and Wurgler market timing measure

Recall that the financial deficit is defined as

$$FD = \Delta e + \Delta d. \tag{A.1}$$

Then we can write the Baker and Wurgler (BW) measure as

$$BW = \sum_{s=0}^{t-1} \frac{FD_s}{\sum_{r=0}^{t-1} FD_r} (M/B)_s, \tag{A.2}$$

[40]We initially conjectured that because of an endogeneity problem, the evidence of the reversal of the financial deficit effect on leverage changes would be weak. Specifically, we argued that firms that tend to be underlevered (overlevered) are expected to have larger (smaller) financial deficits and experience increases (decreases) in leverage for this reason. Since movements towards the target ratio are not expected to be reversed, we do not expect to see the effects of financial deficits to fully reverse. In contrast, since stock returns should be affected very little by deviations from the target, we expect to observe a full reversal in the stock return effect if they are not associated with changes in the target.

[41]Berger, Ofek, and Yermack (1997) provide evidence that leverage ratios are lower in firms where managers have more control.

We can also rewrite Eq. (A.2) as

$$BW * \left(\sum_{s=0}^{t-1} FD_s\right) = \sum_{s=0}^{t-1} FD_s * (M/B)_s, \tag{A.3}$$

Let $\left(\sum_{s=0}^{t-1} FD_s\right) \Big/ t = \overline{FD}$ and $\left(\sum_{s=0}^{t-1} (M/B)_s\right) \Big/ t = \overline{M/B}$.

Scaling Eq. (A.3) by t and adding and subtracting $\overline{FD} * \overline{M/B}$ from it results in

$$BW * \overline{FD} = \left(\sum_{s=0}^{t-1} FD_s * (M/B)_s\right) \Big/ t - \overline{FD} * \overline{M/B} + \overline{FD} * \overline{M/B}, \tag{A.4}$$

which can also be represented as

$$BW * \overline{FD} = \hat{\text{cov}}(FD, M/B) + \overline{FD} * \overline{M/B}. \tag{A.5}$$

Appendix B. Predicting target leverage

In this appendix we briefly discuss the estimation of the target prediction model (Eq. (5)) that allows us to construct a proxy for the target debt ratio that we later use in our change regressions. We estimate a Tobit regression model that regresses the debt ratio on a set of variables that we use to proxy for firm characteristics.

The first variable, profitability (defined as earnings before interest, taxes, and depreciation), plays multiple roles in tradeoff models. First, more profitable firms are likely to be better positioned to take advantage of the debt tax shield and might be perceived as less risky, suggesting a positive relation between profitability and the debt ratio. In addition, a positive relation between profitability and leverage can arise as a mechanism to offset the tendency of managers of firms with significant free cash flows to overinvest; see for example, Jensen (1986) and Hart and Moore (1995). Finally, profitability can be an indication of market power. In contrast to other arguments, a negative relation between profitability and leverage is plausible if firms with market power prefer keeping their leverage at low levels to deter potential entrants into their lines of business; see, for example, Bolton and Scharfstein (1990), and others.

We also include the value of tangible assets (defined as net property, plant, and equipment), which can proxy for the collateral ability of the assets and can thus be associated with higher debt capacity. Size, defined as the natural logarithm of net sales, is likely to be positively correlated with leverage, since large firms are likely to be more diversified and have greater access to capital markets. Research and development expense and selling expense are included to proxy for the uniqueness of the firm's products as well as the uniqueness (and the lack of liquidity) of the firm's collateral. Both R&D and selling expenses are expected to decrease firms' target debt ratios. The R&D expense variable has a significant number of missing observations. Therefore, we set R&D to zero when R&D expense is not reported and include a dummy variable to differentiate these observations.[42] We eliminate the very high values of the selling expense variable (the ones in the 99th

[42] *R&D dummy* takes the value one if the firm does not report any R&D expense. Since not reporting does not always imply that there is no *R&D*, it is important to distinguish firms that do not report any R&D expense from those that report very small amounts.

Table B.1
Predicting leverage (Tobit regressions)

We use a tobit specification to predict the leverage ratio (both in book and market values) with market-to-book ratio (M/B), asset tangibility (*PPE,* net property, plant, and equipment scaled by total assets), profitability (*EBITD*, operating income before depreciation scaled by total assets), research and development expense (*R&D* scaled by net sales), *R&D dummy* (a dummy variable that is set to one if the firm has no R&D expense), selling expense (*SE*, selling expense scaled by net sales), and firm size (*SIZE*, logarithm of net sales), where the predicted value of the leverage ratio is restricted to be between 0 and 100. Panel A presents the coefficient estimates b and the corresponding t-statistics ($t(b)$) of the variables used in the regression. The statistics for the industry dummies are suppressed. The mean and standard deviation of the predicted target leverage, the leverage deficit, and the change in target are presented in Panel B.

Panel A

	Book Leverage		Market Leverage	
	b	$t(b)$	b	$t(b)$
Market-to-book$_{t-1}$	−1.85	−32.62	−7.97	−134.21
Prop., Plant & Equip.$_{t-1}$	0.05	13.66	0.06	17.15
Profitability$_{t-1}$	−0.47	−85.04	−0.57	−105.21
Selling Expense$_{t-1}$	−0.07	−20.77	−0.10	−32.63
Research & Dev.$_{t-1}$	−0.12	−19.08	−0.08	−13.24
R&D dummy$_{t-1}$	2.25	15.38	2.17	13.92
Size$_{t-1}$	2.39	68.84	1.03	27.97
Number of observations	109283		112978	
Prob. $>\chi^2$	0		0	
Pseudo R^2	0.02		0.05	
LR χ^2 (48)	23302.74		49607.54	

Panel B

	Mean	St. dev.	Mean	St. dev.
Predicted target leverage$_t$	48.85	8.47	44.86	11.34
Leverage deficit$_{t-5}$	−0.24	17.63	−2.04	18.95
Change in target$_{t-5}$	1.83	5.61	1.87	8.69

percentile) to reduce the impact of outliers on the target debt ratio. We include the market-to-book ratio (M/B) to proxy for the investment opportunity sets that firms face. Following Baker and Wurgler (2002), we drop observations that have a market-to-book ratio greater than 10. Selling expense and R&D expense are scaled by net sales, and total assets are used to scale the other target proxies. All of the scaled variables are expressed in percentage terms.

The results for our estimation are reported in Table B.1.

Appendix C. Bootstrapping

Bootstrapping allows us to obtain consistent standard errors from our regression model by resampling the original data. Although there are several variants, the procedure first proposed by Efron (1979) is a nonparametric randomization technique that draws from the observed distribution of the data to model the distribution of a test statistic of interest. Given the panel structure of the data, the sample we draw during each replication is a bootstrap sample of firm clusters. Drawing firm clusters instead of individual firm-year observations is necessary since we want to protect the time-series structure of the data.

The following procedure is designed to construct the correct standard errors from the sample of coefficient estimates that are obtained by bootstrapping the sample of observations. Specifically, we start by drawing N clusters of observations (clusters of dependent and independent variables) from the dataset with N firm clusters. In this random drawing, some of the firm clusters will appear once, some more than once, and some not at all. In the second step, we apply the regression model and obtain the coefficient estimates using this new dataset. Eventually, we build a sample of estimated coefficients by repeating this procedure k times.[43] From this bootstrap sample of coefficient estimates we calculate the correct standard errors of regression variables as $\left\{\sum(\theta_i^* - \bar{\theta}^*)^2/(k-1)\right\}^{1/2}$, where $\bar{\theta}^*$ is the average of the bootstrap statistic and θ_i^* is the statistic calculated the using the ith bootstrap sample and k is the number of replications. The point estimates of our regression variables are obtained from the regression on the original sample with N firm clusters.

The main advantage of this procedure is that it allows us to control for the presence of potentially biasing factors such as the overlapping leverage change intervals, the lagged correlation between independent and dependent regression variables, and the hetero-skedasticity problem in the residuals.

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[43]It is generally believed that for estimates of standard error only 50–200 replications are needed (Efron and Tibshirani, 1986).

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