Firms' Capital Structure Choices and Endogenous Dividend Policies*

Hursit Selcuk Celil†
Peking University
HSBC Business School

Mengyang Chi‡
Virginia Tech
Pamplin College of Business

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†*Corresponding author. Address: Peking University HSBC Business School, University Town, Nanshan District, Shenzhen, 518055, P.R.China. E-mail address: hscelil@phbs.pku.edu.cn.*

‡Address: Virginia Tech Pamplin College of Business, Blacksburg, VA, 24061, U.S.. E-mail address: mychi@vt.edu.

ABSTRACT

We analyze capital structure dynamics of publicly held firms within the context of endogenously determined payout policies. Firms tend to smooth their dividend payments and often alter their capital structures accordingly. Our empirical methodology assumes that firms are inclined to satisfy the cash flow identity and in turn provides a more precise way of explaining corporate financing decisions cross-sectionally and across time. This framework captures more than 50% variation of capital structure decisions while avoiding some of the concerns associated with standard empirical models, i.e. omitted variable bias. Our findings are robust for a variety of model specifications.

Keywords: Cash flow identity; Capital structure; Dividend policy.

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I. Introduction

One of the primary interests of corporate financial economists is analyzing the dynamics of firms' capital structure decisions. Understanding this phenomenon is crucial because firms' financing choices are typically associated with benefits and costs which determine the firm value. Starting from Modigliani and Miller's (1958; 1961) irrelevance proposition, the vast majority of the literature recognizes this fundamental idea and agrees that economic entities can create value through their policy choices only if there are imperfections in the capital markets. Consequently, it is rational to assume that these entities consider the excess value of additional units of external and internal capital to operate efficiently. If this concept is fundamentally accepted across all firms, then target debt-to-equity ratios and the associated firm behaviors should be linked to certain factors that drive expectations about the companies' future prospects in the capital markets.

Although there is much empirical evidence supporting this view, a common consensus in the empirical literature is that deviations from these targets occur quite often and persist across time [Leary and Roberts (2005); Flannery and Rangan (2006); Lemmon, Roberts and Zender (2008); Frank and Goyal (2009)]. Hence, both the implications of economic theories to explain firm behaviors as well as the accuracy of empirical specifications to test them are at the center of academic scrutiny. For instance, empirical models are modified to minimize the suspicion of biased speed of adjustment estimates by including more explanatory variables to address the omitted variable bias and modifying autoregressive models to capture the dynamic nature of firm level data [Flannery and Rangan (2006); Faulkender, Flannery, Hankings and Smith (2012)]. Along this line of research, our paper is designed to contribute to the existing literature by underlining another important managerial decision, i.e. dividend payout policies, which is endogenous to firms' financing decisions.

As in Tobin (1969), our empirical approach assumes the separation of source of funds and their allocation so that the investment decision of a firm is exogenous.[1] However, we also assume that firms' financing and payout decisions are reconcilable as in Lambrecht and Myers (2012) who argue, "First, there are many separate theories of payout, debt, and investment. But there can be no more than two independent theories" (p. 1762). We believe this is one of the key ingredients of corporate finance research, and it is often ignored or not explicitly stated by prior empirical studies.

Specifically, adopted empirical design relies on the implications of the cash flow identity of firms' capital budget constraints which link their financing decisions to their payout decisions [Frank and Goyal (2003); Byoun (2008)]. Although these decisions are linked to each other, they are often considered as mutually exclusive events in the standard empirical literature.[2] However, as is documented in this paper, an exogeneity assumption is restrictive, and disregarding the violation of this property may lead to potentially biased results and spurious regression estimates in classical models in both strands of empirical research.

If firms trade off the costs and benefits of adjusting leverage, then the asymmetric cost and benefit of increasing and decreasing dividend payments as another crucial corporate policy must as well be considered. After all, these decisions affect the level of capital inflows

[1]Whited (1992), Hennessy and Whited (2005), and DeAngelo, DeAngelo, and Whited (2011) show the effect of endogenous investment decisions on firms' financing choices.

[2]Empirical literature on firm's dividend payout policies are interested in explaining the determinants of firm's dividend smoothing behavior [Farre-Mensa, Michaely, and Scmalz (2014)]. On the other hand there is a significant amount of literature on the determinants of firms' capital structure decisions [Rajan and Zingales (1995); Frank and Goyal (2003); Fama and French (2002); Frank and Goyal (2009); Faulkender, Flannery, Hankings and Smith (2012)].

and outflows. Even though these payouts are often treated as the residual claims on excess cash holdings of a company, capital markets form their beliefs on the basis of the information that dividends carry about a firm's future operating performance. Imagine a case with two similar firms facing investment projects. One of these firms does not issue any dividends and may have a sufficient level of internal funds to finance this investment project. Another firm with high levels of dividend yield might need to raise debt or costly equity after using up all internal funds in order to pursue a given investment project while trying to keep its dividend payout ratio at historical levels.[3] As in DeAngelo and DeAngelo (2006), for a latter type of firm the irrelevance of dividend payments is no longer irrelevant to its capital structure choices. Therefore, it is natural to assume that these firms have different capital targets and respond differently to their financial needs. In turn, dividend payout policies provide valuable information about a firm's financial status. In this paper we propose an iterative technique to capture firms' motives and analyze a firm's responsiveness to the changes in financing and dividend policies.

Conditional on a firm's capital budget constraint and adopting partial adjustment models of dividend and leverage, we derive two equalities restricting the variations of adjustment speed parameters to their corresponding optimal targets. These four equations are estimated iteratively until we reach an equilibrium. Conventional firm characteristics that are documented to be related to a firm's financing choices such as growth opportunities, asset tangibility, and size are also controlled in the estimation procedure. Specifically, firms' time-variant characteristics are incorporated to obtain a more accurate starting point in our estimation procedure. In the sample of US firms where the cash flow identity is weakly sat-

[3] Lintner (1956) is among the first papers which studies a sample of firms concerned with stability of dividends. Leary and Michaely (2011) interprets Lintner's concept as "firms first consider whether they need to make any changes from the existing rate" (p. 3197).

isfied, time-variant firm characteristics only manage to capture a 5.18% variation of changes in book leverage with standard ordinary least square (OLS) regression. However, by adding the iteratively estimated target leverage as an additional explanatory variable we manage to significantly increase the explanatory power of the model and capture 52.4% of the book leverage dynamic. This modification yields an adjustment speed around 20% on average. Our framework also increases the quality of a fixed effect regression model, which is usually modified to control for the unobserved time invariant heterogeneity across firms. Although the speed of adjustment does not alter dramatically with the fixed effect model specification, we still observe that a significant amount of variation in changes in book leverage is explained by the iteratively estimated target measure, i.e. goodness of fit of the model is about 71%.

The explanatory power of our leverage target is robust when we use alternative estimation models, i.e. Fama-Macbeth demeaned regression, dynamic generalized method of moments (GMM) or instrument variables (IV) approaches. Except for the GMM model, the variation of speed of adjustment estimates for different regression specifications is much smaller once we control for the iteratively estimated leverage target. These findings show that it is not only sufficient but also necessary to control for our target leverage estimates. In fact, a Shapley-Owen R-square decomposition shows that 45% of the total variation of changes in book leverage is solely explained by our proposed measure. Overall, firms tend to close half the gap between target leverage and its actual levels within two to four years once we address the dynamic nature of panel data and misspecification issues in our iterative procedure.

Although in this paper our main focus is to fill in the gap in the capital structure literature by calibrating target measures with both leverage and dividend policies, we also observe that our empirical methodology has some implications on the dividend policy literature. For instance, we find that in general firms intend to keep their existing rates and only make an adjustment to their policies when it is necessary. We confirm the findings of previous literature and document that dividend smoothing is more pronounced in the sample of older, larger, and higher levels of asset tangibility [Leary and Michaely (2011); Michaely and Roberts (2012)]. Consistent with the intuition of cash flow identity in which either debt or dividend has to absorb the shock to a firm's future prospects, over-leveraged firms smooth more on their dividend policies and make more adjustment on their leverage decisions. These findings can also help us interpret the economic meaning in the context of agency conflicts due to capital market imperfections as in Easterbrook (1984), Allen, Bernerdo and Welch (2000), and DeAngelo and DeAngelo (2007). These agency-based models not only provide promising revisions for future theoretical development in the dividend literature, but are also useful in developing more comprehensive models to explain a firm's capital structure decisions.

Our findings contribute to empirical capital structure literature in several ways. Since DeAngelo and DeAngelo (2006) suggest that an equality in a firm's budget constraint is necessary in order to find a better estimate for the unobservable target. Our results show that without this equality condition the associated adjustment speeds are generally biased. This issue has been raised in a different way by Flannery and Rangan (2006) and Lemmon, Roberts and Zender (2008) who suggest that incorporating unobserved firm specific effects into the standard model is important in obtaining parameter estimates. Although many empirical works choose to control these unobserved characteristics through "within" transformation such as fixed effect regressions, these models are not well specified under a partial adjustment framework due to the dynamic structure of panel data which requires us to control lagged dependent variable as an additional explanatory variable [Baltagi (2008);

Woolridge (2010); and Hsiao (2014)]. Specifically, transformed error terms will be correlated with the transformed lagged dependent variable, and omitting iterative target from the regression model will increase the degree of biased estimators.

The rest of the paper proceeds as follows. In Section II we explain the empirical framework and describe the iterative estimation procedure in obtaining target leverage and dividend payout. Section III explains data sample and empirical results. In the Appendix A & B, we also provide more details on variable construction and data sample selection criteria. Section IV shows average sample dynamics of leverage and dividend policy choices. Section V examines the robustness of our framework and provides economic interpretations of our findings. We conclude the paper with Section VI.

II. Modeling Optimal Targeting Behavior

Our empirical methodology is designed to reconcile two types of partial adjustment models from the literature: One is related to dividend payout policy initiated by Lintner (1956), and the other is from capital structure literature as in Flannery and Rangan (2006) who suggested that firms gradually adjust towards target leverage. In this section we first explain how these two policy choices are linked to each other, and then claim that reconciling these two frameworks is crucial in capturing the dynamics of the main variable of interest in standard models. Lintner (1956) propose a partial adjustment model for dividend with the form:

$$\Delta\text{Dividend}_t = \kappa + \lambda_1(\text{Target Dividend}_t - \text{Dividend}_{t-1}) + \varepsilon_t \tag{1}$$

and Flannery and Rangan's (2006) partial adjustment model of leverage can be written as follows,

$$\Delta L_t = L_t - L_{t-1} = \lambda_2 (L_t^* - L_{t-1}) + u_t \tag{2}$$

where L_t is firm's leverage ratio. Typically, equations (1) and (2) are considered separately when analyzing a firm's targeting behaviors in the corresponding literature.[4] This estimation form of testing the implications of underlying theory is commonly accepted among scholars and is designed to capture the dynamic nature of sample data.[5]

We can write a firm's capital budget constraint as in Lambrecht and Myers (2012),

$$\Delta \text{Debt} + \text{Net Income} = \text{CAPEX} + \text{Payout}. \tag{3}$$

In fact, equation (3) links equations (1) and (2), which in turn relates two speeds of adjustment parameters, λ_1 and λ_2. Ignoring the structure of a firm's budget constraint is contingent on the assumption that dividend policy is exogenous and independent of the financing decision as addressed by Byoun (2008). Many scholarly works mention the importance of the potential link between firms' payout policies and financing decisions, however only some of them manage to account for their joint behavior empirically.[6] Our framework is designed to relax the exogeneity assumption between dividend and leverage decisions while still assume that firms' investment decisions are exogenous, as in Tobin (1969). In the remaining parts

[4] Flannery and Rangan (2006) estimate a speed of adjustment of 34.4% for market leverage. Faulkender et al. (2012) estimates speed of adjustment for book leverage and market leverage of 21.9% and 22.3%, respectively. Fama and Babiak (1968) find a very small adjustment speed for dividends. Skinner (2008) presents a 18% and 29% adjustment speed for firms often pay dividends and make repurchases across different time periods.

[5] Debate still exists with the specification of partial adjustment model, for example Chang and Dasgupta (2009) consider the mean-reverting property of leverage adjustment process.

[6] Fama and French (2002) address this issue and it is one of the few papers which considers the relationship between leverage and dividends.

of this paper we rely on these assumptions and argue that the cash flow identity equation (3) provides important implications in explaining the variations of firms' policy choices.

A. Basic Model

Denote a typical firm's total asset value as A, the firm's debt level as D, and d as dollar value of its dividend. The budget constraint equation (3) can be rewritten as equation (4), where all exogenous variables are suppressed into variable X. Equation (5) is the Lintner's dividend adjustment model and equation (6) is the leverage adjustment model, where $L_t = \frac{D_t}{A_t}$ is book leverage.

$$D_t = D_{t-1} + d_t + X_t \tag{4}$$

$$d_t - d_{t-1} = \lambda_1(d_t^* - d_{t-1}) + \varepsilon_{1t} \tag{5}$$

$$L_t - L_{t-1} = \lambda_2(L_t^* - L_{t-1}) + \varepsilon_{2t} \tag{6}$$

Parameters λ_1 and λ_2 are known as speed of adjustment parameters and they are linked to each other if we first rewrite equation (6) as follows,

$$\frac{D_t}{A_t} - \frac{D_{t-1}}{A_{t-1}} = \lambda_2(L_t^* - \frac{D_{t-1}}{A_{t-1}}) + \varepsilon_{2t} \tag{7}$$

then plug equation (4) along with its lagged expression into equation (7) and obtain

$$\begin{aligned}
\frac{A_{t-1}}{A_t}(d_t - d_{t-1}) = & - \frac{A_{t-1}}{A_t}(D_{t-1} + X_t) + (D_{t-2} + X_{t-1}) \\
& + \lambda_2(A_{t-1}L_t^* - D_{t-2} - X_{t-1}) \\
& - (\lambda_2 + \frac{A_{t-1}}{A_t} - 1)d_{t-1} + A_{t-1}\varepsilon_{2t}
\end{aligned}$$

Hence by comparing with equation (5) we have the equalities as follows,[7]

$$\lambda_1 = \frac{A_t}{A_{t-1}}\lambda_2 + 1 - \frac{A_t}{A_{t-1}} \tag{9}$$

$$\lambda_1 d_t^* = \lambda_2 A_t L_t^* + \frac{A_t}{A_{t-1}}(1 - \lambda_2)(D_{t-2} + X_{t-1}) - (D_{t-1} + X_t). \tag{10}$$

Equation (9) can also be written in a different form,

$$\lambda_2 = \frac{A_{t-1}}{A_t}\lambda_1 + 1 - \frac{A_{t-1}}{A_t} \tag{11}$$

According to equation (11), when the adjustment speed for dividends $\lambda_1 = 0$, the adjustment speed for leverage $\lambda_2 = \frac{A_t - A_{t-1}}{A_t}$. This can also be interpreted as the asset growth rate of a typical firm. On the other hand if $\lambda_1 = 1$ in equation (11), then $\lambda_2 = 1$, which implies that if there is no transaction cost then both leverage and dividend can be immediately adjusted to their optima.

[7] We omit one equality condition as the following,

$$\frac{\varepsilon_{1t}}{A_t} = \varepsilon_{2t} \tag{8}$$

However, this equation (8) is redundant given the implications of equations (4), (5), (6), (9) and (10). Thus, we can also interpret constraint on optimal targets as constraint on error terms.

In the standard capital structure literature, adjustment speed λ_2 stands for how qucikly a firm adjusts its equity-debt ratio to the optimal level. Corresponding literature on dividends generally considers dividend policies as sticky in the short-run (Fama and French (2002); Brav et al. (2005)), and in equation (11) we show that λ_2 can be partially explained as a result of a firm's dividend smoothing preferences. Ignoring this endogenous relationship between dividend and leverage choices may lead to biased empirical estimators. Hence, in the remaining parts of the paper our estimation technique relies on this argument and provide a potential solution to the regarding endogeneity problem.

B. Estimation of Target Level

Our estimation procedure requires using all the available information provided by equations (5), (6), (9) and (10). First we rewrite partial adjustment models of dividends and leverage, equations (5) and (6), as the following augmented forms,

$$d_t - d_{t-1} = \gamma_1 d_t^* + \beta_1 Z_{t-1}^1 - \lambda_1 d_{t-1} + \varepsilon_{1t} \tag{12}$$

$$L_t - L_{t-1} = \gamma_2 L_t^* + \beta_2 Z_{t-1}^2 - \lambda_2 L_{t-1} + \varepsilon_{2t} \tag{13}$$

where we denote conventional regressors from prior literature as Z^1 and Z^2 in each equation respectively. Equations (12) and (13) are designed to provide starting values of our iterative procedure. The steps of calibrating targets can be summarized as follows,[8]

Step I: Starting from the standard regression model of equation (12) without d_t^*, where we can estimate $\hat{\lambda}_1^{(1)}$ and subsequently estimate $\hat{d}_t^{*(1)}$ based on equation (5);

[8]In the main context, we start from dividend regression. However, the results remain the same when we start from leverage regression. This technique is not subject to the starting point.

Step II: **i.** Estimating $\hat{\lambda_2}^{(1)}$ by using the estimate of $\hat{\lambda_1}^{(1)}$ and equation (9); and **ii.** Calculating $\hat{L_t^*}^{(1)}$ by using $\hat{\lambda_1}^{(1)}$, $\hat{\lambda_2}^{(1)}$, $\hat{d_t^*}^{(1)}$ and equation (10) for each observation;

Step III: Plug $\hat{L_t^*}^{(1)}$ into equation (13) in a standard regression model and estimate a new speed of adjustment parameter $\hat{\lambda_2}^{(2)}$. Afterwards estimating $\hat{L_t^*}^{(2)}$ as in the form of equation (6) by using this new parameter estimate;

Step IV: **i.** With $\hat{\lambda_2}^{(2)}$ and equation (9), estimate $\hat{\lambda_1}^{(2)}$; and **ii.** $\hat{\lambda_1}^{(2)}$, $\hat{\lambda_2}^{(2)}$, $\hat{L_t^*}^{(2)}$ and equation (10), can be used to calculate $\hat{d_t^*}^{(2)}$;

Step V: **i.** Including $\hat{d_t^*}^{(2)}$ in equation (12) and estimate the next round $\hat{\lambda_1}^{(1)}$, then estimate $\hat{d_t^*}^{(1)}$ based on equation (5); and **ii.** Going back to Step II and continuing these procedures iteratively until the parameter estimates converge, i.e. difference in adjacent $\hat{\lambda_2}^{(2)}$ and $\hat{\lambda_1}^{(1)}$ is less than 10^{-3}.

In our analyses $\hat{L_t^*}^{(1)}$ and $\hat{d_t^*}^{(2)}$ are the controls for the firm's leverage and dividend target obtained from this iteration procedure, which are denoted as *Lstar* and *dstar*, respectively. Further we refer to the estimated parameters $\hat{\lambda_1}^{(1)}$ and $\hat{\lambda_2}^{(2)}$ as the estimated speed of adjustment parameters in our empirical results.[9]

Our iteration framework can be an alternative to many other commonly used models that are employed by standard corporate finance literature. We argue that some of these models suffer from inaccurate measurement of target leverage ratio, i.e. model specifications in equation (2). Several recent papers are concerned with this issue and are designed to circumvent relevant problems in estimation techniques. For instance, Flannery and Rangan

[9] We note that the relationship between (9) and (10) incur some inequalities in real data due to the information content of a firm's funds flow and balance sheet statement, which we address with our data sampling criteria in the next section.

(2006) use several regression specifications to estimate the speed of leverage adjustment, i.e. the fixed effects model and the instrument variables approach. In this regard, Flannery and Hankins (2013) argue that fixed effects and lagged dependent variables introduce serious economic biases in estimated parameters, and instead, they introduce a system of GMM estimators to measure a firm's optimal capital structure. While our framework manages to explain the dynamic of corporate policy choices, it is relatively straightforward comparing to the existing empirical models, e.g. instrument variables approach or system GMM in which the identifications of high quality instrument variables are necessary.

III. Data Sample and Variable Construction

We start our analyses with the data from merged Compustat and CRSP files from 1971 to 2014. We start constructing our sample from 1971 because a funds flow statement is required in our analyses and it is only available after this date. Following Frank and Goyal (2003) and Flannery and Rangan (2006) we exclude financial firms (SIC codes in between 6000 and 6999) and utilities (SIC codes between 4900 and 4999) since these firms are typically treated separately in the standard literature due to various regulatory reasons. Firms with a cash format code that equals 4, 5, and 6 are excluded as in Frank and Goyal (2003) because Compustat does not define format codes 4 and 5, and format code 6 belongs to non-US firms. Firms are required to have non-missing information for the main variables we use in our regressions, such as a firm's total asset, book leverage and market-to-book ratio. In order to jointly study the behaviors of leverage and dividend adjustment models, we disregard firms that have never issued dividends in their lifetime. As in Leary and Michaely (2011) we also remove from our sample those firm-year observations before the first time a firm issues dividends and after its last dividend payment. Finally, we require each firm to have at least five years of firm-year observations in order to be included in the initial sample. These filters yield us 60,267 firm-year observations.

In order to examine implications of our framework more accurately, it is crucial to construct a proxy for control variables incorporated into X_t in equation (5). Hence, we follow the cash flow identity introduced by Frank and Goyal (2003) and Byoun (2008) as follows,

$$OCF_t - I_t - \Delta W_t = -\Delta D_t + DIV_t - \Delta E_t \tag{14}$$

Therefore exogenous variables denoted by X_t satisfy the equality,

$$X_t = I_t + \Delta W_t - OCF_t - \Delta E_t \tag{15}$$

We provide more details on variable construction in the Appendix. In general, accounting information from balance sheets and funds flow statements are not always matched directly with each other due to reporting rules of a firm's financing and operating activities. For example, debt changes in balance sheets include changes in long term debt (DLTT) and debt in current liabilities (DLC). Corresponding measures in funds flow statements can be calculated as long term debt issuance (DLTIS) minus long term debt reduction (DLTR). However, some firms choose to record the changes in current debt (DLCCH) as a part of changes in working capital and do not record this item separately.[10] In order to keep as many observations as possible in our final sample, we reclassify the changes in current debt from balance sheet records to debt changes from funds flow statements if the necessary information is missing.

[10]This reporting concept can be identified by observing the Compustat item DLCCH_DC.

Iteration methodology depends strictly on cash flow identity. Therefore, we add two more filters in our final sample construction to select observations such that they satisfy the equality of equation (14) as well as the equality of changes in debt from the balance sheet and funds flow statements.[11] We include more details on our sample selection criteria and definitions of traditional variables included in the leverage and dividend regression in the Appendix.

Our final sample data consists of 29,143 firm-year observations. This dataset has 3,458 firms with an average of 8.43 observations for each firm.[12] Variable characteristics are slightly different in terms of firm characteristics than the original sample before the two additional restrictions, however overall findings remain qualitatively unaltered if we relax our filters, and hence, in the remaining of the paper we use this sample to conduct our empirical analyses.

[Table I is about here.]

We provide the descriptive statistics of firm characteristics in Table I, where we denote a firm's leverage and dividend iterative targets as *Lstar* and *dstar*, respectively.[13] Although our sample only includes the dividend-paying firms, overall sample characteristics indicate that our sample is fairly similar to other related studies. For instance Flannery and Rangan (2006) study leverage choices of sample US firms from 1965 to 2001 which do not impose any restriction of cash flow identity equality. On average traditional factors such as firm

[11] We relax this strict equality requirement slightly by allowing up to 2% errors from funds flow statement equalities and up to 20% deviation in debt values from balance sheet and funds flow statement. In the robustness section we report the difference between sample characteristics between the firms which are included and excluded in this study, and we confirm our results are not driven by these requirements.

[12] The median number of observations per firm is 7 years with a standard deviation of 6.17.

[13] *Lstar* (*dstar*) refers to an estimated value for leverage (dividend) from equation (10). The negative value of these estimated targets reflect the latent property of targets as in the spirit of Tobit model settings. Thus although in reality we do not observe any negative targets, the latent variables being negative are not out of the norm. Moreover, in untabulated tests, our results remain robust when dropping the negative or extreme values.

size, asset tangibility, industry median and non-debt tax assets are fairly comparable to the characteristics of our sample. Mean (median) log firm size in our sample is 19.6 (19.46). Approximately 30% of a firm's total asset is tangible in our sample. Most firms are low in growth opportunities such that mean (median) market-to-book ratio is 1.18 (0.88). We also observe that most firms have low levels of non-debt tax shield, since mean (median) depreciation-to-asset ratio is 4.17% (3.73%). Our iterative leverage target measures indicate that an average firm should have 34% to 42% of its capital structure as straight debt.

[Table II is about here.]

In Table II, we present the main results of leverage regressions. Each regression model is specified in the context of partial adjustment and includes the lagged realization of book value of leverage as an additional explanatory variable. Each model is represented by two specifications, as one model is with and the other is without the target leverage measure from an iterative procedure. The dependent variable in all models is the change in book leverage. The models include all the time variant variables as controls that are commonly used by the prior literature. Time variant factors are all lagged by one year. Depending on the purpose of the regression model we include time invariant firm specific characteristics, i.e. firm fixed effects as additional control variables. We choose not to include the year fixed effect in our models since they are observed not to carry statistically significant explanatory power in our analyses, which is also consistent with the findings of Lemmon et al. (2008).[14] Except dynamic GMM, we also report adjusted R-square for each model in order to understand the goodness-of-fit of a specific model conditional on their degrees of freedom.

[14]Regressions with year fixed effects are not tabulated but are available upon request. In these regressions results are qualitatively similar to the ones we report.

Model (1) and (2) are classical OLS regressions. We include firm fixed effects to the same specification in Model (3) and (4). We provide the results of Fama-Macbeth (FM) demeaned regressions in Model (5) and (6) to confirm the economic value of unobserved time invariant firm characteristics in our empirical design. We use Blundell and Bond's (1998) system GMM regressions to obtain the results in Model (7) and (8), where we follow the specification of Faulkender et al. (2012) and Flannery and Hankins (2013). For these results we also provide corresponding test statistics to check the accuracy of model specification, i.e. p-values of AR (1), AR (2) tests and Sargan J-test are reported. Finally we provide the instrument variable (IV) regressions in Model (9) and (10) which use market debt ratio as an instrument for book debt ratio as in Flannery and Rangan (2006).

Results in Table II indicate that the inclusion of *Lstar* is necessary in standard models given the fact that it yields higher levels of goodness-of-fit in all regressions. For instance, in Model (1) and (3) simple OLS regression yields a slightly more than 5% adjusted R-square, while the inclusion of firm fixed effects only increases the within R-square to 14.8%. However, once we also include *Lstar* measure in Model (2) the adjusted R-square increases to 52.4%. Unobserved firm specific characteristics only capture 20% more variation in dependent variables once we compare Model (2) to Model (4). FM regression results also confirm these findings. Estimated speed of adjustment in these models are somewhere between 20% to 30% depending on the model specification.

Dynamic GMM results in Models (7) and (8) confirm these findings as well, which provided 12% and 23% faster speed of adjustment towards target leverage than OLS models, and the corresponding specification tests indicate that our results are statistically and economically meaningful. We observe that the instrument variables approach by Flannery and

Rangan (2006) does not alter the results of simple OLS regressions. *Lstar* is statistically significant and economically meaningful while adjusted R-square jumps to 52.4% in Model (10). Although we observe the loss of statistical significance of some traditional factors, in general they are consistent with the findings in prior research, i.e. firm size positively related to change in book leverage at 1% statistical level. Depending on the regression model specifications, these traditional factors are sometimes significantly associated with dependent variables with market-to-book as an exception. We also observe that the profitability proxy (EBIT_TA) has an insignificant but positive coefficient which is not consistent with majority of prior capital structure literature, e.g. Fama and French (2002), which generally finds a negative relationship between profitability and leverage. In untabulated test, we run regression with the universal sample without restricting firms to have dividend payment and find that this coefficient becomes negative. Thus, the positive profitability could be explained by firms in our sample tend to have higher and more stable earnings.

[Table III is about here]

In Table III, we provide the Shapley-Owen R-square decomposition for the fixed effect model where we pool all the traditional variables that are reported in Table II as a single variable. We use the same regression model specification of Model (3) and (4) in Table II to determine the amount of variation being captured by the explanatory variables. Due to the high computational costs of the decomposition procedure, we randomly sample all firms into 30 groups and decompose R-square for each regression. Comparing Model (3) and (4) we can see that *Lstar* contributes around 60% of the total explanatory power of the fixed effect regression, while the fixed effect itself captures only 22% of the total explained variation in changes in book leverage. On the contrary the conventional factors, i.e. market-to-book

(MB) and asset tangibility (FA_TA), only explain 4.69% of adjusted R-square in Model (2) after controlling *Lstar*. We also find that the explanatory power of traditional variables of the total variation in the dependent variable increased from 1% (8% multiplied by 14%) to 4% (5% multiplied by 74%) while the time invariant firm characteristics increased from 8% to 16%.

IV. Capital Structure and Dividend Policy Dynamics

Similar to Lambrecht and Myers (2012), and Farre-Mensa, Michaely and Schmalz (2014) our results so far indicate that financing decisions and dividend policies should not be separated from each other, and it is necessary to consider their interrelationship. In the remaining part of this paper, we explore this intuition in more detail by analyzing dynamics of firm choices given the estimated targets from proposed methodology in prior parts. In Figure 1 we plot the time-series sample average of target and actual leverage. In the long-run both measures appear to be mean reverting, however, on average a firm can sometimes be above and below the target level as in DeAngelo and Roll (2015).

[Figure 1 is about here.]

We also confirm this finding in Figure 2 in which we plot the time series average of deviations between target and actual level of leverage. In fact, these deviations appear to be cyclical. In absolute terms, minimum deviation is lower than 1% whereas it may reach up to 8%.

[Figure 2 is about here.]

In Figure 3 we plot the time-series average of actual dividend payouts to target levels from the iterative procedure. Results indicate that except for the time period after the 2007 financial crisis the actual level of dividend is always below the target levels. This finding indicates that firms are reluctant to increase dividend payouts historically and would rather smooth their policies on average. A potential explanation of this finding is that capital markets usually react negatively if firms cut dividends [Brav et al. (2005); Leary and Michaely (2011)].[15] Another finding in this graph is that on average both target and actual dividend payments decrease relatively from 1990 until 2005 comparing to other time periods. Further, the increase of dividends in recent years confirms the findings of resilient dividends as in Floyd, Li, and Skinner (2015).

[Figure 3 is about here.]

In Figure 4 we plot time series estimates of adjustment speed parameters of leverage and dividend from yearly regressions. As in Fama and French (2002), we scale the dividend regression by total assets and winsorized variables at 1th and 99th percentiles.[16] The sample estimates of dividend speed of adjustment is at the left axis, and leverage speed of adjustment is at the right axis. In this graph we also highlight NBER recessions in order to understand the adjustment dynamics in the context of the economic cycles given their significance in overall financial prospects of a typical firm.

We observe that firms have positive leverage adjustment speeds which are greater than 10% on average. Estimated adjustment speeds of leverage is lower than the sample average

[15] In Leary and Michaely (2011) authors claim that "Managers appear to believe strongly that the market puts a premium on firms with a stable dividend policy" (p. 3197)

[16] Leverage regression results remain qualitatively unchanged whether we winsorize or not and thus the main results are based on unwinsorized sample. However, we provide the winsorized results at the end of Section V.

from 1990s to early 2000s. Adjustment behaviors become slower before the recent recession and then increases quickly from 16% to 20% during the zero interest time period when the debt is relatively cheaper. It also reaches to its historically highest level, around 25%, during the Dot.com crash. These findings reveal that adjustment behavior varies depending on the state of the economy. For instance, during the high inflation time period in 1970s we observe relatively slower speed of adjustment.

[Figure 4 is about here.]

On the other hand the speed of adjustment parameters of dividend also show some time varying features. Although the majority of our sample is positive, there are a few years where it drops to near zero values. This shows that firms are on average reluctant to adjust their dividend levels. Comparing to the leverage adjustment, dividend shows a slower adjustment speed, which confirms the findings in Brav et al. (2005) that managers tend to smooth their dividends.

V. Discussion & Robustness

In this section we further analyze the empirical performance of our approach in explaining capital structure and dividend policy dynamics of different types of firms which are differentiated by firm specific characteristics, i.e. over-leveraged and under-leveraged. We perform this set of exercises in order to determine whether firms respond asymmetrically to the deviations from debt-to-equity and dividend targets. We also test the robustness of our findings.

A. Over-leveraged and Under-leveraged Firms

We start by dividing the whole sample into two groups as over-leveraged and under-leveraged firms as in Faulkender et al. (2012) and report the speed of adjustment parameters of leverage and dividend. According to Flannery and Hankins (2013), a combination of fixed effects and lagged dependent variables may lead to biased results, and hence we only control for time variant firm characteristics in this set of analyses. We report the results in Table IV.

[Table IV is about here.]

We find that there is a significant asymmetry in adjustment speed estimates across different subgroups of firms. Over-leveraged firms appear to adjust towards leverage targets significantly quicker than under-leveraged firms, 22% and 10% respectively. Over-leveraged firms are also observed to smooth their dividends more than under-leveraged firms. In fact, estimated speed of adjustment parameter is insignificant in the over-leveraged sample, which indicates on average these firms make no adjustment in their dividend policies at conventional significance levels.

In Figure 5 we observe that the significant difference between leverage adjustment speeds for under and over-leveraged firms mainly comes from the earlier half of our sample. Specifically before the 1990s, estimated leverage speed of adjustment of under-leveraged (over-leveraged) firms is less (more) than 10% (20%). This difference between two subgroups has become smaller in recent years. Over-leveraged firms adjust towards target with an average speed of 20% until the 2008 financial crisis. On the other hand, we observe the speed of adjustment of under-leveraged firms seems indifferent comparing to over-leveraged firms after the 1990s. After the 2008 financial crisis, under-leveraged firms tend to have a slightly higher adjustment speed than over-leveraged firms, reflecting the fact that debt has become a relatively cheaper way of financing during this time period.

[Figure 5 is about here.]

In Figure 6 we provide the time series average of two subgroups' dividend adjustment speeds. We find that on average under-leveraged firms have higher dividend adjustment speed than over-leveraged firms. In some years the adjustment speed for over-leveraged firms even becomes negative which reflects that these firms are deviating more from their dividend target. Overall we believe these findings also confirm the result in Table IV and our initial motivation by supporting the fact that financing decisions and dividend decisions are interrelated to each other.

[Figure 6 is about here.]

B. Active leverage adjustment

We also perform a similar analysis as in Table II by incorporating firms' motives to enter into capital markets as in Faulkender et al. (2012). In their paper, the authors notice the difference between a firm's active and passive adjustment towards optimal leverage by revising equation (6) as

$$L_t - L_{t-1}^P = \lambda_2'(L_t^* - L_{t-1}^P) + \varepsilon_t' \tag{16}$$

where $L_{t-1}^P = \frac{D_{t-1}}{A_{t-1}+NI_t}$, and NI is the firm's net income. In this context we modify the book leverage ratio by including each firm's net income value in the denominator of our prior ratio.[17] In the absence of active leverage adjustments, original leverage will be automatically

[17]Our derivations in Section II remain same as before if we simply substitute A_{t-1} with $(A_{t-1} + NI_t)$.

transformed from L_{t-1} to L^P_{t-1}. By controlling for the firms' motives to participate in the capital markets, Faulkender et al. (2012) present a speed of adjustment higher than prior estimates. In our framework, the relation (11) can be modified as follows,

$$\lambda_2' = \frac{A_{t-1} + NI_t}{A_t}\lambda_1 + 1 - \frac{A_{t-1} + NI_t}{A_t} \tag{17}$$

Let us consider the case where $\lambda_1 = 0$, then $\lambda_2' = 1 - \frac{A_{t-1}+NI_t}{A_t}$. Thus, if $NI_t > 0$ then $\lambda_2' < \lambda_2$, and vice versa. This implies that controlling for the dividend adjustment, the active adjustment factor λ_2' will differ from the original λ_2 according to the sign of net income. If net income is positive (negative), then a firm adjusts less (more) rapidly to its target.

We present the results in Table V, in which we use the same regression models as in Table II. Our findings are not qualitatively altered, however, we obtain a slower speed of adjustment in all regression specifications, which are significantly slower then 30% per year on average. This implies that firms adjust less rapidly once we account for passive leverage adjustment behavior. Our results contradict with Faulkender et al. (2012) probably due to different sample characteristics since the sign of average net income plays a central role in determining the result. The improvement of the adjusted R-square is similar in magnitude as the results in Table II. Overall, the economic meaning and statistical significance of iterative target measures do not change significantly from previous findings, which indicate the robustness of our framework.

[Table V is about here.]

C. Initial leverage

We analyze the effect of a firm's initial leverage on changes in book leverage in our regression models as in Lemmon et al. (2008). In their paper, the authors posit that leverage ratio is driven by unobserved time-invariant firm characteristics, which is proxied by a firm's initial leverage. We analyze whether the constructed variable plays an important role in our regression design and present the results in Table VI.

[Table VI is about here.]

Comparing the results with Table II, we observe that the inclusion of initial leverage increases the adjusted R-square of the original model, and the variable is statistically significant other than the dynamic GMM model. While a firm's initial leverage may be an important determinant of its capital structure, we find a small increase in the model's explanatory power and conclude that it is economically modest in explaining leverage dynamics, specifically in a dynamic estimation framework. On the other hand, the economic value and statistical significance of the *Lstar* measure is still intact in this alternative specification.

D. Sample filters

Our results are so far constrained by sample filters. Specifically we can estimate optimal target levels of dividend and leverage with our iteration procedure only in the sample of firms which satisfy equation (14) as well as the changes in debt in balance sheet equal to funds flow statements. Hence, our findings may be sample specific. In this subset of analysis we run regression analyses with observations that are excluded by our filters. We use similar empirical model specifications as in Table II, however we exclude the regression models that control the estimated target leverage, $Lstar$, since we cannot derive the corresponding values for these firms.

[Table VII is about here.]

We present the results in Table VII and confirm that our findings in prior sections are not sample specific. Estimated adjustment speed parameters in all of the regression specifications are qualitatively and quantitatively similar to our findings in Table II with only minor differences, approximately around a 1% point difference. Market-to-book is still an insignificant factor and other conventional factors are significantly associated with changes of book leverage depending on the estimation model. Similar to our findings in Table II, we find firm tangibility is positively associated with the dependent variable at the significance level of 1% level.

All of these models yield similar adjusted R-square measures as in models in Table II. Furthermore dynamic GMM estimation satisfies sufficiency conditions for autoregression and exogeneity of instrument variables, given that the test statistics of AR(2) and Sargan are at satisfactory levels. These results suggest that if we could obtain the target leverage and dividend measures for the firms that do not satisfy an equality of changes in debt from balance sheet and funds flow statements within our framework then we would expect to have similar findings as in previous sections.

E. Sample Outliers

In the previous sections we provide our findings of leverage regressions with unwinsorized sample variables. Although the descriptive statistics of our sample in Table I give us an assurance that we are dealing with a representative sample of firms in related literature, to alleviate outlier concerns we check the robustness of our findings with winsorized variables at 0.1^{th} and 99.9^{th} percentiles in order to yield a quantitatively similar sample characteristics comparing with Flannery and Rangan (2006). On the other hand, results are also robust when we winsorize at different percentiles, e.g. 1^{th} and 99^{th} or 0.5^{th} and 99.5^{th} percentiles. We use the same regression models as in Table II with each model with and without estimated target leverage level, *Lstar*.

[Table VIII is about here.]

We present our findings in Table VIII. Our findings do not change qualitatively from the findings in Table II and Table VII. However, we find that the sensitivity of dependent variables on *Lstar* increases from 11% to 15% in simple OLS regression and 14% to 20% in the fixed effect regression models. We observe similar changes in the estimated slope coefficient for our main variable of interest, *Lstar*, in all the other regressions including FM, dynamic GMM and IV regressions.

In each model the corresponding goodness of fit measure is significantly better with the winsorized sample than before. For instance, the explanatory power of the fixed effect regression model is close to 76%. We also find that the estimated speed of adjustment is close to 40% with the dynamic GMM estimation along with satisfactory sufficiency conditions. Furthermore, most of the time-variant firm characteristics are associated with the changes in book leverage as predicted by the prior literature [Flannery and Rangan (2006)]. Overall, our main results are not driven by sample outliers. These findings underline the importance of accounting the endogenous relationship between dividend and leverage policy choices in obtaining target estimates in empirical analyses.

F. Zero-leverage firms

Strebulaev and Yang (2013) document the puzzling evidence of zero-leverage firms. Similarly, we also find that in our final sample approximately 10% firms have zero-leverage and 16% firms have leverage less than 5%. Thus in Table IX we rerun our iteration procedure without these firms. In Panel A we exclude zero-leverage firms and in Panel B we exclude firms with less than 5% book leverage. The results show that the speeds of adjustment are slightly higher comparing with previous results but the magnitudes are modest after controlling for the iterative targets. On the other hand, we observe that without the iterative targets, the adjustment speed parameter estimates tend to fluctuate heavily depending on model specifications. Thus we conclude that our proposed methodology manages to generate a relatively more stable parameter estimates as well as higher explanatory power.

[Table IX is about here.]

VI. Conclusion

Firms trade off the benefit and the cost of policy choices to maximize their enterprise value. Corresponding valuation mechanisms link in between a firm's multiple policy choices which are then determined endogenously and may not be separable from each other. Our paper relies on this fundamental principle and tries to reconcile two of the most important features of corporate behaviors: capital structure decisions and dividend policy choices. Specifically, we examine firms' capital structure dynamics cross-sectionally and across time by incorporating dividend payout decisions of a firm, and *vice versa*. Our empirical framework provides a complementary perspective on circumventing the omitted variable bias and model misspecification in relevant literature. However, these are not only limited to one field of empirical finance but also to other strands, i.e. asset valuation, investment policy and firm performance.

Overall findings confirm our motivation in this paper. They suggest that firms try to close half the gap between endogenously determined targets and actual level of debt-to-equity ratios within 2 to 4 years on average. Our approach also underlines the importance of a firm's cash balances and its identity in order to test the implications of underlying theory related to both dividend payouts and capital structure. Our findings confirm the idea that financing and dividend decisions are the two sides of the same coin. In order to understand firms' behaviors in one aspect, we might have to consider the dynamics of all choice variables that are potentially linked to one another. We hope future studies will help us understand these dynamics in more detail.

A. Appendix: Sample Selection

The dataset starts with the merged Compustat-CRSP sample. After constructing all variables, the following filters are applied: financial firms and utility firms are excluded (SIC codes 6000-6999 & 4900-4999, respectively). Cash format code equaling 4, 5, and 6 are excluded. Observations require non-missing value in Compustat item total assets (at), fiscal year close price (prcc_f), common shares outstanding (csho), net property plant and equipment (ppent), depreciation and amortisation (dp), debt in current liabilities (dlc), total long term debt (dltt), income before extraordinary items (ib), stockholders' equity (seq), interest expense (xint), total income taxes (txt), total current liabilities (lct), total liabilities (lt), and common dividends (dvc). Negative dividends are removed. An observation must have validated data in all variables used in the regression analysis. Firms that never paid dividends are dropped. Observations before first and after last dividend payment are deleted. Finally, a firm must have no fewer than five years of observations.

In order to consider cash flow identity, we further restrict the sample with two additional filters: observations that satisfy the equality of equation (14) and the equality of change in debt from balance sheet and funds flow statement, where 2% and 20% inequality errors are allowed respectively to include more observations.

B. Appendix: Variable definitions

In this appendix, variable definitions related to Compustat items are shown first, while an item-name translation table is provided at the end.

i. Variables constructed as in Flannery and Rangan (2006):

BDR: sum of (dlc) and (dltt) divided by (at).

MDR: sum of (dlc) and (dltt) divided by sum of (dlc), (dltt) and (prcc_f) times (csho).

EBIT_TA: sum of lag (ib), lag (xint) and (txt), divided by lag of (at).

MB: sum of lag (dlc), lag (dltt), lag (pstkl), and lag (prcc_f) times (csho), scaled by lag of (at).

DEP_TA: lag (dp) divided by lag (at).

LnTA: log of (at) in 2000 constant US dollars.

FA_TA: lag (ppent) scaled by lag (at).

R&D_DUM: if lag (xrd) missing then equals to one, otherwise equals zero.

R&D_TA: lag (xrd) scaled by lag (at), set zero if lag (xrd) missing.

IND_median: industry median of book leverage for Fama-French 48 industry classification.

ii. Variables constructed as in Faulkender et al. (2012):

lag(BDRp): sum of lag (dlc) and lag (dltt) divided by sum of lag (at) and (ni).

iii. Variables constructed as in Skinner (2008):

EARN: (ib) minus 0.6 times (spi).

iv. Variables constructed as in Lemmon, Roberts and Zender (2008):

L_initial: first non-missing book leverage for a firm.

v. Variables constructed similar as in Frank and Goyal (2003) and Byoun (2008):

DIV: (dv).

OCF_t: for cash format code 1 to 3, OCF_t equals sum of (ibc), (xidoc), (dpc), (txdc), (esubc), (sppiv), (fopo), and (fsrco). For format code 7, OCF_t equals sum of (oancf), negative (recch), negative (invch), negative (apalch), negative (txach), and (exre).

I_t: for cash format code 1 to 3, I_t equals sum of (capx), (ivch), (aqc), (fuseo), negative (sppe), and negative (siv). For format code 7, I_t equals sum of (capx), (ivch), (aqc), negative (sppe), negative (siv), negative (ivstch), and negative (ivaco).

ΔW_t: for format code 1, ΔW_t equals to sum of (wcapc) and (chech). For format code 2 and 3, ΔW_t equals sum of negative (wcapc) and (chech). For format code 7, ΔW_t equals sum of negative (recch), negative (invch), negative (apalch), negative (txach), (chech), and negative (fiao).

ΔD_t: In balance sheet, this item equals change in sum of (dlc) and (dltt) from year t-1 to year t. In funds flow statement, this item equals sum of (dltis), negative (dltr), and negative (dlcch) for format code 1, otherwise equals sum of (dltis), negative (dltr), and (dlcch).

ΔE_t: In the dividend adjustment model, this item equals sum of (sstk) and negative (prstkc).

Table A.I
Item Name translation table

item	name	item	name
dlc	Debt in Current Liabilities	dltt	Long Term Debt Total
at	Assets Total	prcc_f	Price Fiscal Year Close
csho	Common Shares Outstanding	ib	Income Before Extraordinary Items
xint	Interest Expense	txt	Income Taxes Total
pstkl	Preferred Stock Liquidating Value	dp	Depreciation and Amortization
ppent	Net Property, Plant and Equipment	xrd	Research and Development Expense
ni	Net Income (Loss)	dv	Cash Dividends
spi	Special Items	tstkc	Treasury Stock Common
prstkc	Purchase of Common and Preferred Stocks	sstk	Sale of Common and Preferred Stock
ibc	Income Before Extra Items	xidoc	Extraordinary Items and Discontinued Operations
dpc	Depreciation and Amortization	txdc	Deferred Taxes
esubc	Equity in Net Loss (Earnings)	sppiv	Sale of PPE and Investments, Gain (Loss)
fopo	Funds From Operations Other	fsrco	Sources of Funds Other
oancf	Operating Activities Net Cash Flow	recch	Accounts Receivable Decrease (Increase)

invch	Inventory Decrease (Increase)	apalch	Accounts Payable and Accrued Liabilities Inc./(Dec.)
txach	Income Taxes Accrued Inc./(Dec.)	exre	Exchange Rate Effect
capx	Capital Expenditures	ivch	Increase in Investments
aqc	Acquisitions	fuseo	Uses of Funds Other
sppe	Sale of Property, Plant and Equipment	siv	Sale of Investments
ivstch	Short Term Investments Change	ivaco	Investing Activities Other
wcapc	Working Capital Change Other Inc./(Dec.)	chech	Cash and Cash Equivalents Inc./(Dec.)
fiao	Financing Activities Other	dltis	Long Term Debt Issuance
dltr	Long Term Debt Reduction	dlcch	Current Debt Changes

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Table I
Descriptive Statistics

	N.Obs	Mean	Median	Std.Dev.	Min	Max
lag(BDR)	29143	0.2101	0.2036	0.1549	0.0000	0.9993
lag(MDR)	29143	0.2619	0.2227	0.2199	0.0000	1.0000
lag(BDRp)	29143	0.1999	0.1906	0.1511	0.0000	1.1070
EBIT_TA	29143	0.1323	0.1251	0.1034	-1.2998	4.8747
MB	29143	1.1838	0.8843	1.2259	0.0018	111.3415
DEP_TA	29143	0.0417	0.0373	0.0239	0.0000	0.4414
LnTA	29143	19.6096	19.4696	1.7615	14.9508	26.3051
FA_TA	29143	0.3451	0.3049	0.2002	0.0000	0.9936
R&D_DUM	29143	0.4657	0.0000	0.4988	0.0000	1.0000
R&D_TA	29143	0.0151	0.0000	0.0320	0.0000	1.7219
IND_Median	29143	0.2192	0.2238	0.0589	0.0000	0.5490
Lstar	29143	0.3427	0.2799	0.3838	-6.0054	4.3327
Lstar_p	29143	0.4159	0.3381	0.4818	-7.4103	5.3614
L_initial	29143	0.1888	0.1618	0.1705	0.0000	2.7100
lag(DIV)	29143	44.80	2.33	326.49	0.00	10875.00
EARN	29143	113.20	8.38	777.28	-4363.80	32520.00
dstar	29143	614.40	3.01	6482.44	-30531.21	290050.05
dstar_p	29143	555.78	3.29	5872.04	-28631.93	262052.96
OCF_t	29143	213.08	17.45	1336.45	-1915.00	46821.45
I_t	29143	150.60	10.48	1019.63	-6742.00	53325.95
ΔW_t	29143	23.08	1.68	454.41	-12306.00	58704.00
ΔE_t	29143	-19.53	0.00	363.67	-20793.00	8631.23
NI	29143	106.71	7.98	768.46	-6647.57	32520.00

Sample data includes Compustat-CRSP firms with complete data for five or more years during 1971 to 2014. Sample selection is explained in Section III and Appendix A. Lstar and dstar are from the iterative procedure described in Section II, which solves the following equations:

$$d_t - d_{t-1} = \gamma_1 d_t^* + \beta_1 Z_{t-1}^1 - \lambda_1 d_{t-1} + \varepsilon_{1t}$$

$$L_t - L_{t-1} = \gamma_2 L_t^* + \beta_2 Z_{t-1}^2 - \lambda_2 L_{t-1} + \varepsilon_{2t}$$

Z_{t-1}^1 stands for earnings (EARN) and Z_{t-1}^2 stands for profitability (EBIT_TA), market-to-book (MB), depreciation (DEP_TA), size (LnTA), asset tangibility (FA_TA), R&D dummy (R&D_DUM), R&D expenses (R&D_TA) and industry median leverage (IND_Median). Operating cash flows (OCF_t), investment (I_t), change in working capital (ΔW_t) and change in equity (ΔE_t) are from cash flow identity. Lstar_p (dstar_p) represents active leverage adjustment which reflects firm's net income level (NI). Variable definitions are provided in Appendix B.

Table II
Leverage partial adjustment model regression results: Book leverage

	Dependent variable ΔBDR									
	OLS		FE		FM demeaned		BB GMM		IV	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Lstar		0.142**		0.185**		0.180**		0.190**		0.140**
		(41.79)		(25.71)		(29.07)		(34.23)		(41.02)
lag(BDR)	-0.110**	-0.196**	-0.317**	-0.309**	-0.305**	-0.302**	-0.233**	-0.427**	-0.0786**	-0.180**
	(-30.93)	(-59.47)	(-36.59)	(-45.65)	(-33.53)	(-48.50)	(-14.07)	(-32.38)	(-22.03)	(-48.91)
EBIT_TA	0.00744	0.00764	0.00788	0.00770	0.00261	0.00605	0.0436**	0.0306*	0.0186**	0.0130*
	(1.38)	(1.36)	(1.06)	(1.04)	(0.32)	(0.71)	(3.88)	(2.57)	(3.11)	(2.25)
MB	0.0000430	0.000776	0.000794	0.000521	0.000461	0.00129	0.000680	-0.000426	0.000195	0.000841
	(0.13)	(1.80)	(1.59)	(1.05)	(0.62)	(1.59)	(0.65)	(-0.54)	(0.54)	(1.89)
DEP_TA	-0.0934**	-0.0198	-0.0606	-0.0328	-0.0819	-0.0721*	-0.360**	0.0201	-0.0743**	-0.0114
	(-3.73)	(-1.05)	(-1.18)	(-0.94)	(-1.92)	(-2.64)	(-4.37)	(0.29)	(-2.95)	(-0.60)
LnTA	0.00150**	0.0142**	0.0111**	0.0228**	0.00938**	0.0197**	0.00260	0.0295**	0.00108**	0.0138**
	(6.26)	(47.74)	(8.44)	(19.72)	(6.42)	(13.29)	(1.73)	(14.85)	(4.50)	(45.38)
FA_TA	0.0279**	0.0127**	0.0460**	0.0101	0.0409**	0.00219	0.118**	0.00592	0.0234**	0.0107**
	(8.80)	(5.94)	(4.60)	(1.35)	(4.17)	(0.39)	(9.35)	(0.39)	(7.36)	(5.02)
R&D_DUM	0.00331**	0.00540**	0.000637	-0.000807	0.00171	-0.00247	0.0157**	0.0217**	0.00335**	0.00540**
	(3.31)	(7.81)	(0.26)	(-0.48)	(0.50)	(-1.06)	(3.69)	(5.64)	(3.33)	(7.85)
R&D_TA	-0.0131	-0.0645**	0.0112	0.0210	0.0571	0.00992	-0.00666	-0.0502	-0.00444	-0.0599**
	(-0.60)	(-4.19)	(0.25)	(0.80)	(1.09)	(0.30)	(-0.22)	(-1.14)	(-0.20)	(-3.98)
IND_Median	0.000480	-0.00920	0.0141	-0.0562**	0.0468*	-0.0148	-0.0505	-0.0430*	-0.0153	-0.0166**
	(0.06)	(-1.54)	(0.82)	(-4.62)	(2.19)	(-1.40)	(-1.63)	(-2.18)	(-1.80)	(-2.77)
N.Obs	29143	29143	29143	29143	29143	29143	21830	21830	29143	29143
R-square	0.0518	0.524	0.148	0.711	0.165	0.704			0.0485	0.524
AR(1) p-value							0.0000	0.0000		
AR(2) p-value							0.5090	0.6962		
Sargan p-value							0.5519	0.9494		

Model (1) and (2) present ordinary least square regression (OLS) estimates. Model (3) and (4) present the fixed effects regression estimates (FE). Model (5) and (6) present Fama-Macbeth demeaned regression estimates. Model (7) and (8) present Blundell and Bond's system GMM regressions (BB GMM). Model (9) and (10) present IV regression estimates where firm dummies are included as instruments. Dependent variable in each regression model is changes in book leverage. *Lstar* is from the iterative procedure described in Section II. Other variable definitions are provided in the Appendix B. Reported *R-square* numbers for OLS models are adjusted R^2, and for fixed effects models are "within" R^2 statistics; ** and * indicates statistical significance at 1% and 5% levels, respectively. Constant terms are not reported and robust t-statistics are reported in the parentheses. AR(1) and AR(2) are tests for first-order and second-order serial correlation, under the null of no serial correlation. The Sargan test of over-identification is under the null that all instruments are valid.

Table III
Shapley-Owen R-square decomposition

	(1)	(2)
Lstar		60.34
lag(BDR)	35.37	12.60
Tradional variables	8.02	4.69
Fixed effect	56.61	22.36
Average Adjusted R-square	0.1352	0.7435

The sample data consists of Compustat-CRSP firms with non-missing observations for five or more years from 1971 to 2014. Table presents Shapley-Owen R-square decomposition for fixed effects regression estimates. Due to computer memory limitations we randomly allocate all firms into 30 groups and decompose R-square for each group. Average Adjusted R-squares are reported at the bottom. Sample selection is explained in Section III and Appendix A. *Lstar* is from the iterative procedure described in Section II. *Traditional variables* stands for the combination of profitability (EBIT_TA), market-to-book (MB), depreciation (DEP_TA), size (LnTA), asset tangibility (FA_TA), R&D dummy (R&D_DUM), R&D expenses (R&D_TA) and industry median leverage (IND_Median). Variable definitions are provided in the Appendix B.

Table IV
Adjustment speeds for under- and over-leveraged firms

	Under lev.		Over lev.	
	Book Leverage	Dividends	Book Leverage	Dividends
SOA	0.0998**	0.149**	0.221**	0.0104
	(11.01)	(22.02)	(35.75)	(1.50)
N.Obs	13466	13466	15677	15677
R-square	0.477	0.259	0.645	0.180

Table IV presents speed of adjustment estimates (SOA) from OLS regression after the iterative procedure described in Section II. Dependent variables are changes in book leverage and changes in dividends scaled by total assets, respectively. Columns 1 and 2 represent firm-years with leverage below target leverage while columns 3 and 4 represent firm-years with leverage above target.

Table V
Leverage partial adjustment model regression results: Active book leverage

	Dependent variable ΔBDR									
	OLS		FE		FM demeaned		BB GMM		IV	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Lstar_p		0.107**		0.142**		0.139**		0.149**		0.107**
		(38.45)		(23.89)		(28.13)		(38.82)		(38.09)
lag(BDRp)	-0.0719**	-0.145**	-0.275**	-0.254**	-0.262**	-0.248**	-0.199**	-0.345**	-0.0492**	-0.132**
	(-17.52)	(-39.73)	(-28.79)	(-34.95)	(-30.48)	(-39.73)	(-8.36)	(-32.29)	(-13.22)	(-34.69)
EBIT_TA	0.0560**	0.0430**	0.0374**	0.0316*	0.0331**	0.0296**	0.0982**	0.0584**	0.0650**	0.0478**
	(6.61)	(5.36)	(4.09)	(2.33)	(3.69)	(3.49)	(8.63)	(6.85)	(7.01)	(5.75)
MB	0.000357	0.00131*	0.00123	0.00113	0.00167	0.00252**	0.000713	0.00169*	0.000470	0.00137*
	(0.81)	(2.23)	(1.84)	(1.63)	(1.92)	(3.14)	(0.66)	(2.40)	(1.00)	(2.26)
DEP_TA	-0.0987**	-0.0169	-0.0700	-0.00650	-0.0880*	-0.0513	-0.412**	0.0910	-0.0856**	-0.0106
	(-3.98)	(-0.90)	(-1.34)	(-0.16)	(-2.05)	(-1.75)	(-4.85)	(1.38)	(-3.43)	(-0.56)
LnTA	0.00176**	0.0137**	0.00741**	0.0212**	0.00543**	0.0183**	0.00420**	0.0283**	0.00147**	0.0135**
	(7.44)	(43.72)	(5.87)	(18.95)	(3.95)	(12.65)	(2.92)	(19.66)	(6.30)	(42.52)
FA_TA	0.0308**	0.0138**	0.0409**	0.00680	0.0384**	-0.000844	0.107**	-0.00431	0.0278**	0.0123**
	(10.00)	(6.47)	(4.22)	(0.86)	(4.35)	(-0.17)	(8.43)	(-0.39)	(9.06)	(5.79)
R&D_DUM	0.00291**	0.00531**	0.000391	-0.000798	0.00232	-0.00183	0.0151**	0.0228**	0.00293**	0.00530**
	(3.04)	(7.82)	(0.16)	(-0.48)	(0.64)	(-0.74)	(3.56)	(6.95)	(3.04)	(7.85)
R&D_TA	-0.00260	-0.0575**	0.0208	0.0290	0.0673	0.0183	-0.00645	-0.0456	0.00363	-0.0538**
	(-0.13)	(-3.83)	(0.45)	(1.04)	(1.37)	(0.55)	(-0.23)	(-1.07)	(0.18)	(-3.66)
IND_Median	-0.00148	-0.00813	0.00944	-0.0582**	0.0411	-0.0180	-0.0558*	-0.0455**	-0.0124	-0.0138*
	(-0.18)	(-1.38)	(0.53)	(-4.84)	(2.00)	(-1.77)	(-1.97)	(-2.65)	(-1.50)	(-2.33)
N.Obs	29143	29143	29143	29143	29143	29143	21830	21830	29143	29143
R-square	0.0391	0.505	0.128	0.694	0.146	0.689			0.0375	0.504
AR(1) p-value							0.0000	0.0000		
AR(2) p-value							0.1487	0.8212		
Sargan p-value							0.4988	0.9755		

Model (1) and (2) present ordinary least square regression (OLS) estimates. Model (3) and (4) present the fixed effects regression estimates (FE). Model (5) and (6) present Fama-Macbeth demeaned regression estimates. Model (7) and (8) present Blundell and Bond's system GMM regressions (BB GMM). Model (9) and (10) present IV regression estimates where firm dummies are included as instruments. The dependent variables are changes in book leverage. *Lstar_p* is from the iterative procedure described in Section II. Other variable definitions are provided in the Appendix B. Reported *R-square* numbers for OLS models are adjusted R^2 and for fixed effects models are "within" R^2 statistics; ** and * indicates statistical significance at 1% and 5% levels, respectively. Constant terms are not reported and robust t-statistics are reported in parentheses. AR(1) and AR(2) are tests for first-order and second-order serial correlation, under the null of no serial correlation. The Sargan test of over-identification is under the null that all instruments are valid.

Table VI
Leverage partial adjustment model regression results: Initial leverage

	Dependent variable ΔBDR					
	OLS		BB GMM		IV	
	(1)	(2)	(3)	(4)	(5)	(6)
Lstar		0.142**		0.190**		0.141**
		(41.88)		(42.51)		(41.10)
L_initial	0.0191**	0.0192**	0.0447*	-0.00812	0.00638*	0.0135**
	(6.10)	(9.12)	(2.23)	(-0.43)	(1.98)	(6.32)
lag(BDR)	-0.119**	-0.206**	-0.234**	-0.427**	-0.0823**	-0.188**
	(-30.52)	(-59.05)	(-14.23)	(-38.62)	(-20.40)	(-47.43)
EBIT_TA	0.00629	0.00648	0.0420**	0.0309**	0.0180**	0.0117*
	(1.18)	(1.16)	(3.61)	(8.70)	(3.03)	(2.03)
MB	0.000116	0.000849	0.000767	-0.000442	0.000217	0.000888*
	(0.34)	(1.92)	(0.74)	(-0.81)	(0.60)	(1.97)
DEP_TA	-0.0957**	-0.0221	-0.357**	0.0191	-0.0754**	-0.0137
	(-3.82)	(-1.17)	(-4.21)	(0.37)	(-2.99)	(-0.72)
LnTA	0.00167**	0.0143**	0.00282*	0.0294**	0.00114**	0.0140**
	(6.91)	(48.28)	(1.96)	(13.96)	(4.73)	(45.59)
FA_TA	0.0273**	0.0121**	0.114**	0.00666	0.0233**	0.0105**
	(8.60)	(5.67)	(8.64)	(0.55)	(7.32)	(4.91)
R&D_DUM	0.00272**	0.00481**	0.0134**	0.0222**	0.00315**	0.00498**
	(2.71)	(6.93)	(3.11)	(6.11)	(3.11)	(7.19)
R&D_TA	-0.0111	-0.0626**	-0.000773	-0.0512	-0.00395	-0.0589**
	(-0.51)	(-4.08)	(-0.02)	(-0.77)	(-0.18)	(-3.92)
IND_Median	-0.000514	-0.0102	-0.0488	-0.0433**	-0.0153	-0.0167**
	(-0.06)	(-1.71)	(-1.54)	(-2.60)	(-1.81)	(-2.78)
N.Obs	29143	29143	21830	21830	29143	29143
R-square	0.0534	0.526			0.0495	0.525
AR(1) p-value			0.0000	0.0000		
AR(2) p-value			0.4080	0.7046		
Sargan J test			0.5255	0.9415		

Model (1) and (2) present ordinary least square regression (OLS) estimates. Model (3) and (4) present Blundell and Bond's system GMM regressions (BB GMM). Model (5) and (6) present IV regression estimates where firm dummies are included as instruments. The dependent variables are changes in book leverage. *Lstar* is from the iterative procedure described in Section II. Initial leverage (*L_initial*) is constructed as in Lemmon, Roberts and Zender (2008). Other variable definitions are provided in Appendix B. Reported *R-square* numbers for OLS models are adjusted R^2; ** and * indicates statistical significance at 1% and 5% levels, respectively. Constant terms are not reported and robust t-statistics are provided in parentheses. AR(1) and AR(2) are tests for first-order and second-order serial correlation, under the null of no serial correlation. The Sargan test of over-identification is under the null that all instruments are valid.

Table VII
Leverage partial adjustment model regressions for out of sample observations

	Dependent variable ΔBDR				
	OLS	FE	FM demeaned	BB GMM	IV
	(1)	(2)	(3)	(4)	(5)
lag(BDR)	-0.118**	-0.295**	-0.293**	-0.230**	-0.0779**
	(-31.88)	(-34.94)	(-24.99)	(-11.12)	(-20.61)
EBIT_TA	0.0212*	0.000177	-0.0168	0.0193	0.0356**
	(2.24)	(0.02)	(-1.78)	(0.84)	(3.64)
MB	-0.00118	-0.000263	-0.000738	-0.000562	-0.00108
	(-1.55)	(-0.24)	(-0.72)	(-0.32)	(-1.39)
DEP_TA	-0.0495*	-0.0585	-0.141**	-0.223**	-0.0364
	(-2.22)	(-1.17)	(-2.84)	(-2.69)	(-1.63)
LnTA	0.000649**	0.00525**	0.00537**	0.00139	0.000348
	(2.95)	(4.74)	(5.73)	(1.10)	(1.58)
FA_TA	0.0131**	0.0179	0.0212**	0.0382**	0.00925**
	(4.89)	(1.86)	(2.85)	(2.69)	(3.42)
R&D_DUM	0.00261**	0.00325	0.00232	0.0108	0.00182
	(2.76)	(1.31)	(1.22)	(1.69)	(1.92)
R&D_TA	-0.0226	0.0706	0.0440	-0.0792	-0.00957
	(-1.30)	(1.77)	(1.06)	(-1.52)	(-0.55)
IND_Median	0.0498**	0.0542**	0.0497**	0.0636*	0.0243**
	(6.93)	(3.75)	(3.33)	(2.45)	(3.39)
N.Obs	31124	31124	31124	23130	31124
R-square	0.0569	0.146	0.165		0.0513
AR(1) p-value				0.0000	
AR(2) p-value				0.7629	
Sargan test p-value				0.3317	

Table VII presents regression estimates for out of sample observations. This sample consists of observations that either do not satisfy the cash flow identity within 2% errors, or do not satisfy changes in debt in balance sheet equal to funds flow statements within 20% errors. Model (1) presents ordinary least square regression (OLS) estimates. Model (2) presents the fixed effects regression estimates (FE). Model (3) presents Fama-Macbeth demeaned regression estimates. Model (4) presents Blundell and Bond's system GMM regressions (BB GMM). Model (5) presents IV regression estimates where firm dummies are included as instruments. The dependent variable in each regression model is changes in book leverage. Variable definitions are provided in Appendix B. Reported *R-square* numbers for OLS models are adjusted R^2, and for fixed effects models are "within" R^2 statistics; ** and * indicates statistical significance at 1% and 5% levels, respectively. Constant terms are not reported and robust t-statistics are reported in parentheses. AR(1) and AR(2) are tests for first-order and second-order serial correlation, under the null of no serial correlation. The Sargan test of over-identification is under the null that all instruments are valid.

Table VIII
Leverage partial adjustment model regression results, winsorized variable

	Dependent variable ΔBDR									
	OLS		FE		FM demeaned		BB GMM		IV	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Lstar		0.149**		0.196**		0.190**		0.209**		0.147**
		(56.54)		(40.45)		(37.88)		(59.38)		(55.43)
lag(BDR)	-0.107**	-0.198**	-0.311**	-0.303**	-0.299**	-0.297**	-0.235**	-0.381**	-0.0774**	-0.185**
	(-32.05)	(-70.02)	(-37.43)	(-53.47)	(-33.62)	(-53.54)	(-13.18)	(-34.86)	(-22.85)	(-58.47)
EBIT_TA	0.00935	0.00212	0.00950	0.00366	0.00335	0.00665	0.0488**	0.0282**	0.0214**	0.00727
	(1.66)	(0.40)	(1.25)	(0.47)	(0.36)	(0.92)	(4.14)	(3.21)	(3.76)	(1.35)
MB	0.0000895	0.00140**	0.00123	0.000846	0.000510	0.000630	0.000120	-0.0000666	0.000241	0.00145**
	(0.18)	(2.83)	(1.48)	(0.98)	(0.61)	(0.61)	(0.10)	(-0.04)	(0.49)	(2.95)
DEP_TA	-0.0981**	-0.0198	-0.0732	-0.0346	-0.0817	-0.0715**	-0.405**	0.0329	-0.0796**	-0.0127
	(-3.97)	(-1.15)	(-1.42)	(-1.01)	(-1.91)	(-2.71)	(-4.13)	(0.42)	(-3.21)	(-0.73)
LnTA	0.00143**	0.0146**	0.0110**	0.0230**	0.00935**	0.0195**	0.00273	0.0281**	0.00104**	0.0144**
	(6.08)	(66.40)	(8.46)	(20.64)	(6.59)	(13.32)	(1.84)	(15.82)	(4.40)	(63.46)
FA_TA	0.0280**	0.0119**	0.0476**	0.0119	0.0417**	0.00375	0.121**	-0.00130	0.0238**	0.0103**
	(9.10)	(6.04)	(4.81)	(1.81)	(4.29)	(0.76)	(8.71)	(-0.12)	(7.72)	(5.21)
R&D_DUM	0.00331**	0.00490**	0.00148	0.0000734	0.00213	-0.00168	0.0133**	0.0217**	0.00342**	0.00494**
	(3.55)	(7.68)	(0.62)	(0.04)	(0.65)	(-0.86)	(2.89)	(5.53)	(3.66)	(7.73)
R&D_TA	-0.0106	-0.0916**	0.0635	0.0583	0.0553	0.00719	-0.0350	-0.0895	-0.0000592	-0.0865**
	(-0.59)	(-6.57)	(1.32)	(1.23)	(1.09)	(0.25)	(-0.42)	(-0.98)	(-0.00)	(-6.18)
IND_Median	0.000403	-0.0113*	0.0138	-0.0604**	0.0453*	-0.0215*	-0.0503	-0.0470*	-0.0143	-0.0174**
	(0.05)	(-2.03)	(0.81)	(-5.38)	(2.13)	(-2.19)	(-1.46)	(-2.52)	(-1.75)	(-3.11)
N.Obs	29143	29143	29143	29143	29143	29143	21830	21830	29143	29143
R-square	0.0513	0.556	0.148	0.757	0.165	0.744			0.0483	0.555
AR(1) p-value							0.0000	0.0000		
AR(2) p-value							0.4625	0.1282		
Sargan p-value							0.5961	0.9624		

Variables are winsorized at 0.1^{th} and 99.9^{th} percentiles which yield quantitatively similar sample characteristics as in Flannery and Rangan (2006). Model (1) and (2) present ordinary least square regression (OLS) estimates. Model (3) and (4) present the fixed effects regression estimates (FE). Model (5) and (6) present Fama-Macbeth demeaned regression estimates. Model (7) and (8) presents Blundell and Bond's system GMM regressions (BB GMM). Model (9) and (10) presents IV regression estimates where firm dummies are included as instruments. The dependent variable in each regression model is changes in book leverage. Variable definitions are provided in Appendix B. Reported *R-square* numbers for OLS models are adjusted R^2, and for fixed effects models are "within" R^2 statistics; ** and * indicates statistical significance at 1% and 5% levels, respectively. Constant terms are not reported and robust t-statistics are reported in the parentheses. AR(1) and AR(2) are tests for first-order and second-order serial correlation, under the null of no serial correlation. The Sargan test of over-identification is under the null that all instruments are valid.

Table IX
Leverage partial adjustment model regression results: Book leverage

	Dependent variable ΔBDR							
	Panel A. Book Leverage > 0				Panel B. Book Leverage > 0.05			
	OLS		FE		OLS		FE	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lstar		0.163**		0.207**		0.168**		0.210**
		(45.19)		(32.57)		(43.86)		(32.21)
lag(BDR)	-0.134**	-0.217**	-0.344**	-0.310**	-0.164**	-0.229**	-0.391**	-0.317**
	(-32.52)	(-64.32)	(-36.24)	(-37.45)	(-34.44)	(-63.01)	(-38.16)	(-31.96)
EBIT_TA	0.00511	0.0110	0.00526	0.00554	0.00541	0.0142*	0.00416	0.00711
	(0.72)	(1.79)	(0.57)	(0.70)	(0.68)	(2.00)	(0.42)	(0.87)
MB	0.00288**	0.00142	0.00369**	0.00163	0.00464**	0.00153	0.00505**	0.00196
	(3.92)	(1.90)	(3.11)	(1.61)	(5.31)	(1.75)	(3.50)	(1.69)
DEP_TA	-0.124**	-0.0384*	-0.141*	-0.00813	-0.143**	-0.0524**	-0.187**	-0.0184
	(-4.33)	(-2.06)	(-2.55)	(-0.22)	(-4.71)	(-2.67)	(-3.30)	(-0.48)
LnTA	0.000854**	0.0149**	0.0116**	0.0215**	0.000405	0.0152**	0.0126**	0.0220**
	(3.21)	(48.93)	(7.81)	(18.54)	(1.43)	(47.10)	(7.89)	(18.04)
FA_TA	0.0286**	0.0116**	0.0431**	0.0164*	0.0291**	0.0115**	0.0433**	0.0188**
	(8.16)	(5.23)	(3.87)	(2.40)	(7.91)	(4.95)	(3.82)	(2.71)
R&D_DUM	0.00465**	0.00558**	0.00239	0.000242	0.00544**	0.00603**	0.00293	0.000452
	(4.18)	(7.23)	(0.91)	(0.15)	(4.59)	(7.39)	(1.05)	(0.28)
R&D_TA	-0.0249	-0.0998**	0.00953	0.0164	-0.0372	-0.105**	-0.00506	0.0197
	(-0.93)	(-4.54)	(0.19)	(0.68)	(-1.29)	(-4.28)	(-0.12)	(0.80)
IND_Median	0.00661	-0.00358	0.0293	-0.0425**	0.0138	0.000428	0.0405	-0.0373**
	(0.68)	(-0.56)	(1.50)	(-3.81)	(1.31)	(0.06)	(1.92)	(-3.06)
N.Obs	26271	26271	26271	26271	24342	24342	24342	24342
R-square	0.0657	0.601	0.165	0.786	0.0824	0.624	0.191	0.803

Panel A requires firms have non-zero book leverage and Panel B requires firms have book leverage more than 5 percent. Model (1), (2), (5) and (6) present ordinary least square regression (OLS) estimates. Model (3), (4), (7) and (8) present the fixed effects regression estimates (FE). Dependent variable in each regression model is changes in book leverage. *Lstar* is from the iterative procedure described in Section II. Other variable definitions are provided in the Appendix B. Reported *R-square* numbers for OLS models are adjusted R^2, and for fixed effects models are "within" R^2 statistics; ** and * indicates statistical significance at 1% and 5% levels, respectively. Constant terms are not reported and robust t-statistics are reported in the parentheses.

Figure 1. Book leverage vs. Target leverage

This figure shows the time series trend of average book leverage (BDR) and the overall estimated target after iterative procedure. The final stage leverage regression specification is:

$$L_t - L_{t-1} = \gamma_2 L_t^* + \beta_2 Z_{t-1}^2 - \lambda_2 L_{t-1} + \varepsilon_{2t}$$

where L_t is book leverage (BDR), L_t^* is the estimated *Lstar* from the iterative procedure described in Section II, and Z_{t-1}^2 stands for conventional factors: profitability (EBIT_TA), market-to-book (MB), depreciation (DEP_TA), size (LnTA), asset tangibility (FA_TA), R&D dummy (R&D_DUM), R&D expenses (R&D_TA) and industry median leverage (IND_Median). Target leverage equals $\frac{\hat{\gamma_2} L_t^* + \hat{\beta_2} Z_{t-1}^2}{\hat{\lambda_2}}$.

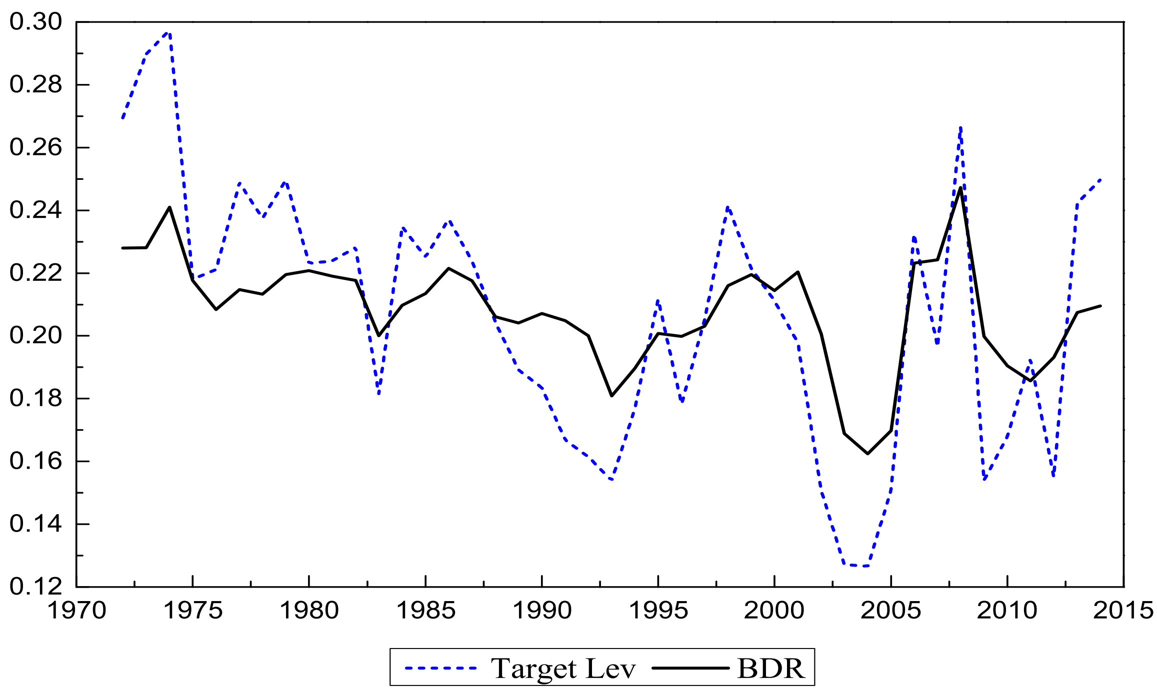

Figure 2. Deviations between book leverage and its target

This figure presents time series deviations between average book leverage (BDR) and its target. The final stage leverage regression specification is:

$$L_t - L_{t-1} = \gamma_2 L_t^* + \beta_2 Z_{t-1}^2 - \lambda_2 L_{t-1} + \varepsilon_{2t}$$

where L_t is book leverage (BDR), L_t^* is the estimated *Lstar* from the iterative procedure described in Section II, and Z_{t-1}^2 stands for conventional factors: profitability (EBIT_TA), market-to-book (MB), depreciation (DEP_TA), size (LnTA), asset tangibility (FA_TA), R&D dummy (R&D_DUM), R&D expenses (R&D_TA) and industry median leverage (IND_Median). Target leverage equals $\frac{\hat{\gamma_2} L_t^* + \hat{\beta_2} Z_{t-1}^2}{\hat{\lambda_2}}$.

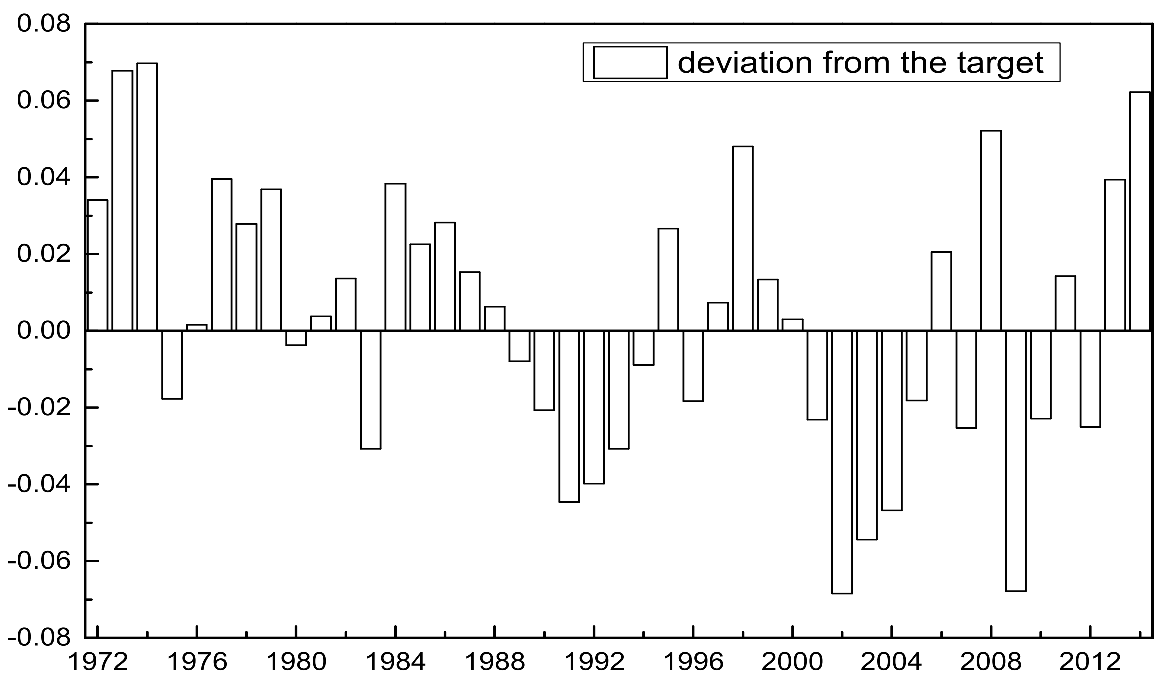

Figure 3. Dividend vs. Target dividends

This figure shows the time series trend of aggregate dividend and the estimated target (both scaled by aggregate number of shares outstanding) after iterative procedure. The final stage of iterative procedure for dividend regression specification is:

$$d_t - d_{t-1} = \gamma_1 d_t^* + \beta_1 Z_{t-1}^1 - \lambda_1 d_{t-1} + \varepsilon_{1t}$$

where d_t is dividend (DIV), d_t^* is the estimated *dstar* from the iterative procedure described in Section II, and Z_{t-1}^1 stands for earnings (EARN). Variable definitions are provided in the Appendix. Target dividend equals $\frac{\hat{\gamma_1} d_t^* + \hat{\beta_1} Z_{t-1}^1}{\hat{\lambda_1}}$.

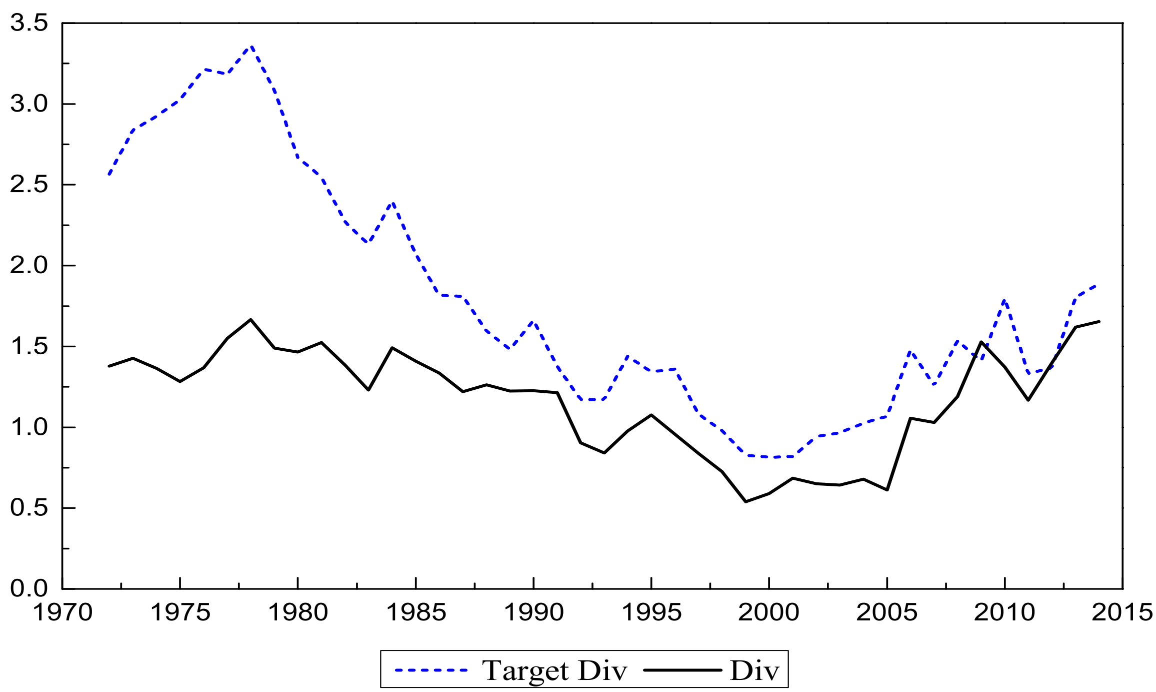

Figure 4. Leverage and dividend speed of adjustment

This figure shows the yearly estimates of speed of adjustment parameters (SOA) from leverage and dividend partial adjustment models. DivSOA and LevSOA represent regression coefficients λ_1 and λ_2 respectively. Regression specifications are the following:

$$\frac{d_t - d_{t-1}}{A_t} = \gamma_1 \frac{d_t^*}{A_t} + \beta_1 \frac{Z_{t-1}^1}{A_t} - \lambda_1 \frac{d_{t-1}}{A_t} + \varepsilon_{1t}$$

$$L_t - L_{t-1} = \gamma_2 L_t^* + \beta_2 Z_{t-1}^2 - \lambda_2 L_{t-1} + \varepsilon_{2t}$$

where d_t is dividend (DIV) and L_t is book leverage (BDR). d_t^* and L_t^* are estimated *dstar* and *Lstar* from the iterative procedure described in Section II. Z_{t-1}^1 stands for earnings (EARN) and Z_{t-1}^2 stands for conventional factors: profitability (EBIT_TA), market-to-book (MB), depreciation (DEP_TA), size (LnTA), asset tangibility (FA_TA), R&D dummy (R&D_DUM), R&D expenses (R&D_TA) and industry median leverage (IND_Median). Variable definitions are provided in the Appendix. Shaded areas are NBER recessions.

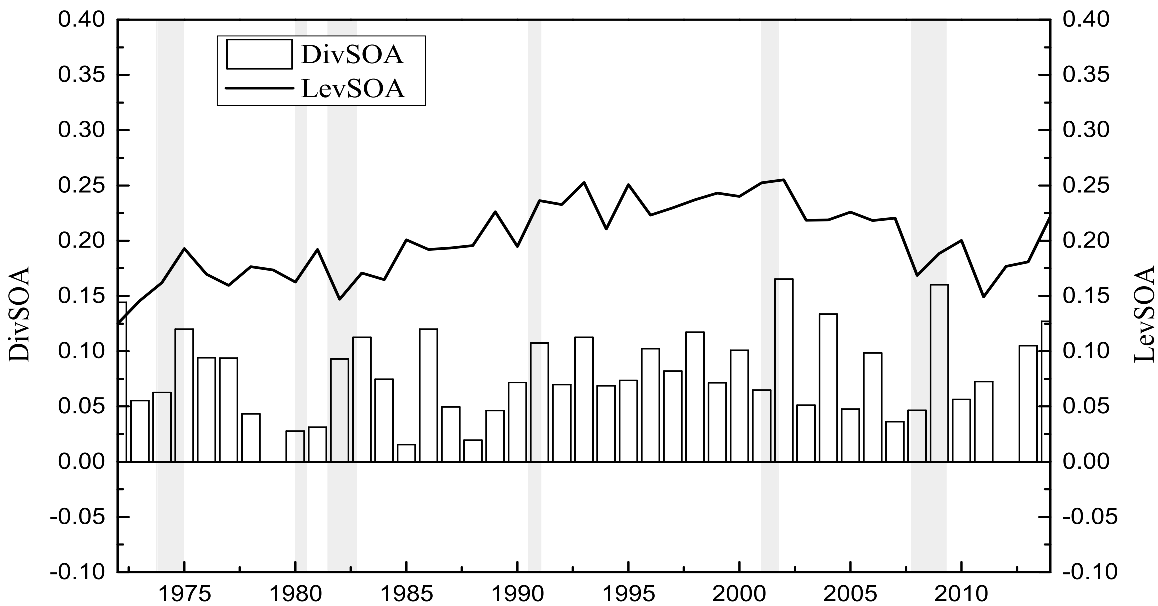

Figure 5. Leverage Speed of adjustment for under- and over-leveraged firms

This figure shows the yearly estimates of leverage speed of adjustment parameters (LevSOA) for under- and over-leveraged firms. Firms are identified as under-leveraged if their leverage targets are greater than the lag book leverage. Leverage targets are estimated from the iterative procedure described in Section II.

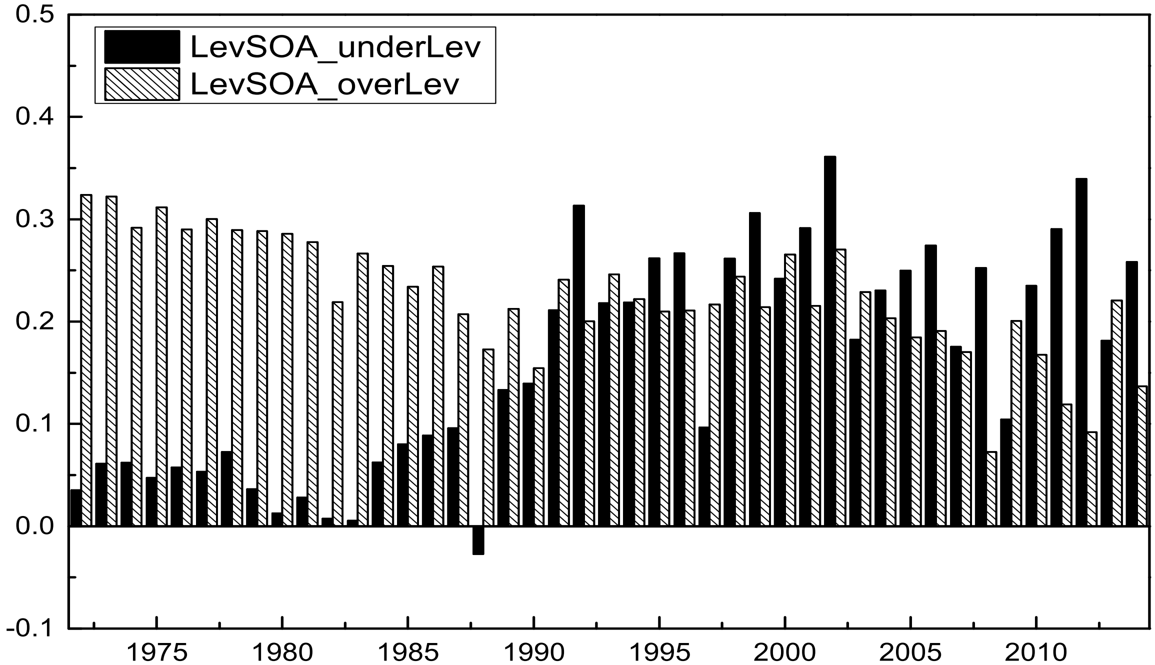

Figure 6. Dividend Speed of adjustment for under- and over-leveraged firms

This figure shows the yearly estimates of dividends speed of adjustment parameters (DivSOA) for under- and over-leveraged firms. Firms are identified as under-leveraged if their leverage targets are greater than the lag book leverage. Leverage targets are estimated from the iterative procedure described in Section II.