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Large dividend increases and leverage*

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Abstract

This study documents the fact that large dividend increases are followed by a significant increase in leverage, consistent with management increasing the dividend to use up excess debt capacity. However, the leverage increase is not captured by a standard partial adjustment model of leverage. Nor does it reflect variables known to be related to dividend increases, such as firm maturity, investment, and risk. Instead, the dividend increase signals a complex change in the way firms adjust to their leverage target, but it does not signal a change in the target.

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Since the work of Benartzi, Michaely, and Thaler (1997) and Grullon, Michaely, and Swaminathan (2002) (GMS), there has been a puzzle as to the signal being given by dividend increases. Although dividend *decreases* signal lower future profits, dividend *increases* do not signal an increase in future profits. Rather, GMS find evidence that dividend increases are followed by a move to a more mature phase of the firm: lower growth, declining reinvestment, and declining risk. This raises another important question: Why is this a signal? The age and growth stage of the firm are largely public information. Therefore, the dividend increase must signal private information regarding either exactly how mature the firm is or the intention of changed management behavior that the market does not anticipate.

The signal from a dividend increase comes from the intention to increase payout, and the increase predicts a change in future investment strategy. The sources and uses of funds' identity mean that payout and investment strategy are linked with financing. Therefore, we hypothesize that the signal should also contain information about future financing policy. In this study, we examine leverage changes subsequent to large dividend increases and show that a part of the signal given by a dividend increase is a change in leverage policy.

Using a sample of 4,374 firms making large dividend increases, we show that (1) large dividend increases are followed by a significant increase in leverage; (2) although the leverage increase is consistent with these firms having excess debt capacity prior to the dividend increase, the increase in leverage after the dividend increase is not captured by a partial adjustment model of leverage or by a response of leverage to firm maturity, investment, and risk; (3) the change in leverage policy is a change in the *conditional* response to a future financing surplus; and (4) this change does not happen for dividend decreases. Thus, the change in leverage behavior we

find is not subsumed by the effects found by GMS. Further, the effect is asymmetric between dividend increases and decreases just as they find. We hypothesize that this asymmetry is primarily because large dividend increases are voluntary, whereas large dividend decreases are not. We therefore interpret the dividend increase as a signal of the change in leverage policy.

To ensure that the dividend increase we study is voluntary, we use firms making large dividend increases. We investigate three possible causes of the leverage increase following a dividend increase. The first is that the dividend signals a change in the leverage target itself, which we do not find. We then include various controls that have been shown to be related to dividend changes and/or leverage policy and find that these controls do not explain the change. Finally, we measure the change in the conditional response to deficits and surpluses and find that a dividend increase (or initiation) signals a change in leverage policy whereby the response of leverage changes to financial deficits and surpluses become considerably more convex.

In the first step of the analysis, to investigate whether a change in the target leverage explains the leverage increase, we examine the deviation from target leverage before and after the dividend change using a procedure similar to that of Harford et al. (2009). We find that dividend-increasing firms are underleveraged at the time of the dividend increase. Firms initiating dividends and decreasing dividends by large amounts are also underleveraged. On average, the subsequent increase in book value leverage equals the leverage deficit at the time of the dividend increase for all three of these groups. Thus, these firms appear to behave on average as though they have leverage targets. We then examine the change in the leverage target after the dividend increase and find no change on average. Thus, the increased leverage is

related to a leverage deficit at the time of the dividend change, but not to an increase in target leverage.

To control for standard explanations of leverage changes we then measure leverage changes as deviations from a standard empirical model of leverage targets with partial adjustment (Kayhan and Titman 2007, KT). We find that this model does not explain the leverage change.

To control for the possibility that the leverage change is simply a by-product of other changes that have been shown to be related to dividend changes, we control for the variables that GMS and others have found to be related to dividend increases. We do this by augmenting the KT procedure with variables measuring risk, firm maturity, cash flow (CF), losses, tax, market timing, and debt rating (Brook et al., 1998, Faulkender and Wang 2006, Skinner and Soltjes, 2011, Koch and Sun, 2004, DeAngelo et al., 1992, Baker and Wurgler, 2002, Graham, 2000, Hennessy and Whited, 2005, Charitou et al., 2011). We also allow the rate of adjustment to change subsequent to the dividend change and for a change in the response to CF, to capture the change in investment behavior found by GMS. We find that this augmented procedure does not explain the leverage increase following large dividend increases or dividend initiations. It does, however, explain the leverage increase following large dividend decreases.

Given that none of these controls explains the leverage change for the dividend increase and initiation groups, we then investigate whether a large dividend increase signals a discretionary change in the way the firm manages its leverage. Specifically, we test whether the dividend increase signals a change in leverage policy conditional on future financing deficits and surpluses. Our main contribution is that we add to the description of the signal from dividend increases.

We find that dividend-increase and initiation firms differ from other firms in the way their leverage responds to financial surpluses and deficits. Their leverage change is a considerably more convex function of the financing deficit, raising the average level of the change and accounting for the leverage increase on average. In particular, when they have surpluses they do not use them to pay down debt in contrast to the average firm. Thus, the shift in leverage policy is a change in pecking order behavior *conditional on whether there is a surplus or deficit*. The dividend increase signals a change in leverage policy that is not predictable on the basis of either standard leverage models or the variables found by GMS to be related to dividend increases. This is consistent with the evidence in the study of Harford et al. (2009), which shows that firms move towards leverage targets after mergers, albeit in a somewhat complex way, and the evidence of Denis and McKeon (2012), that the evolution of a firm's leverage ratio depends primarily on whether or not the firm produces a financial surplus. For a sample of firms that initiate dividends we find similar but larger effects, confirming the results of other studies that dividend initiations are a stronger signal than increases (Officer, 2011, Lee and Mauck, 2016).

Finally, we investigate whether the change in leverage behavior is related to agency problems. We find some tentative indications that this is the case, although the sample for which we can measure agency effects is limited.

Our results are related to the literature on whether the relationship between dividends and leverage is negative (Fama and French, 2002, Frank and Goyal, 2009) or positive (Ravid and Sarig, 1991). Consistent with the total distribution idea of Ravid and Sarig, we find a conditionally positive relationship between dividend changes and leverage changes for the sample of firms with a large dividend increase.

Thus our results are consistent with dividends and leverage being complements in this situation, rather than substitutes.

Our work is also related to the extensive literature on leverage policy. The study falls into the category of leverage tests that focus on firms making active financial choices (Marsh, 1982, Hovakimian and Li, 2010). By focusing on large dividend increases it is likely that the leverage changes we observe occur at times of discretionary financial choices, avoiding the difficult issue of how to deal with firms whose leverage policy is passive (Frank and Goyal, 2015, Hennessy and Whited, 2005, Hovakimian and Li, 2010, Leary and Roberts, 2005, Strebulaev, 2007, Strebulaev and Whited, 2012). Our results are consistent with the fact that partial adjustment models explain only a small amount of actual leverage behavior (Frank and Goyal, 2009, Lemmon et al., 2008, DeAngelo and Roll, 2015). They are also consistent with the idea of a broad range of acceptable leverage ratios around the target (DeAngelo and Roll, 2015)

The article proceeds as follows. Section I develops the hypotheses. Section II describes the empirical methodology and variable construction, and section III the data. Section IV gives the empirical results. Section V discusses robustness tests, and section VI gives the conclusions and implications.

I. Hypothesis development

Firms that make large dividend increases do so voluntarily. Models of dividend signaling suggest that this should be a signal of quality, implying increased future profits (Bhattacharya 1979; Miller and Rock 1985). However, the work of GMS fails to find the hypothesized increase in profits. Instead, they find a change in firm maturity and related variables. But a large part of firm maturity is predictable and

so need not be signaled. The behavior they find which cannot be predicted before the dividend change includes declining reinvestment, so the dividend increase could be a signal of an unanticipated change in investment policy. Since investment policy and financing policy are closely linked through the pecking order view of financing, we hypothesize that the unanticipated change being signaled by a large dividend increase could include a change in financing policy.

Specifically, we hypothesize that large dividend increases or dividend initiations signal a change in leverage policy of a type that could not be forecasted based on standard models of leverage. To be consistent with the move towards a more mature type of firm that is related to dividend increases, we hypothesize that the change is an increase in leverage. We require that the change is not related to predictable firm maturity variables, so that the dividend increase is a genuine signal:

Hypothesis 1A: Firms making large dividend increases subsequently increase leverage in a way not predicted by standard models and not related to predictable firm maturity variables.

The null hypothesis against which we test is that any change in leverage policy subsequent to a large dividend increase either is explained by standard models of leverage (trade-off, partial adjustment, or standard pecking order) or reflects the predictable maturing of the firm.

In contrast to large dividend increases, large dividend decreases have a large non-discretionary component and do signal a fall in profit. Therefore, we do not expect them to have signaling content about leverage policy. Specifically, we expect any change in leverage subsequent to a large dividend decrease to be consistent with standard theories:

Hypothesis 1B: Firms making large dividend cuts will have a subsequent change in leverage that is explained by standard theories.

As a robustness check, we also examine a sample of dividend-initiating firms. For these we expect to find a similar but larger effect, in line with the results of other studies that dividend initiations are a stronger signal than increases (Officer, 2011, Lee and Mauck, 2016):

Hypothesis 1C: Firms initiating dividends subsequently increase leverage in a way not predicted by standard models and not related to predictable firm maturity variables. The effect is larger than for dividend-increasing firms.

In summary, our hypotheses are that large dividend increases and initiations signal an unpredictable change in leverage policy and that large dividend decreases do not.

II. Methodology and variable construction

To ensure that the firms making dividend increases in our sample are signaling rather than just following a Lintner-like adjustment rule, we use firms making large dividend increases. Following GMS, we define large increases as greater than 12.5% ("dividend-increasing firms"). We also include firms with dividend decreases greater than 12.5% ("dividend-decreasing firms"). The threshold of 12.5% is motivated by GMS as being 'the best in terms of including only big dividend changes' (GMS, page 391). It ensures a reasonable sample, while excluding changes that could contain no information surprise.[1]

We examine changes in both book value and market value leverage over the five years following the dividend change. Following KT, book leverage is defined as

[1] In the robustness section below we also discuss the results for a threshold of 1%.

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. Similar to KT, we drop firm-year observations where this ratio is greater than one. 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.

In our tests, we first report the raw leverage change over the five years following a dividend change. Second, we use the KT procedure to predict the five-year leverage change-based standard partial-adjustment theories and measure the effect net of this control. Third, we augment the KT control with variables that are known to be predicted by dividend changes, which could also be related to leverage changes. Finally, we test for a more subtle change in leverage policy.

II.1 Target leverage and partial adjustment

The KT procedure is a two-stage process. The first stage creates a proxy for target leverage using a regression of leverage on firm variables. We estimate this at year 0, the date of the dividend change. The second stage estimates the relationship between the five-year leverage change (over the period from year 0 to year 5) and variables measuring financial deficits (FDs), market conditions, and profitability over that same five-year period, after controlling for the leverage deficit at the beginning of the period and the change in target leverage over the five-year period.

The proxy for the target debt ratio estimated in stage 1 is the fitted value from a Tobit regression of observed debt ratios on variables that proxy for benefits of leverage, such as tax deductibility of interest and agency costs of free CF, and others that proxy for costs of leverage, such as potential financial distress and bankruptcy

costs. The 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). We include industry dummies to capture the industry-specific determinants of leverage not captured by the above variables.[2] We also include a dummy for dividend-paying firms called DIV_PAY to control for the known relationship between dividend payment and leverage. DIV_PAY is equal to 1 for dividend paying firm-years, and 0 otherwise.

Stage 2 of KT is a regression of the change in leverage over five years on variables that should be related to the change in the target leverage or the rate of moving towards the target (Baker and Wurgler 2002; Frank and Goyal 2003; Kayhan and Titman 2007; Shyam-Sunder and Myers 1999). These variables are the LevDef at the beginning of the period measured as actual minus target leverage; the five-year change in the target leverage ratio (ΔTarget), measured as the difference between the year 5 target debt ratio and the target debt ratio measured in year 0; the five-year FD; two timing measures, yearly timing (YT) and long-term timing (LT), which capture variations in the M/B; the five-year cumulative stock return (r); and the five-year cumulative profitability (EBITD5y).

The FD is the net amount of debt and equity the firm issues or repurchases in a given year. Specifically, the FD is defined as the sum of investments (I), dividends (D), changes in working capital (ΔWC), and net of net CF:

$$\text{Financial Deficit (FD)} = \Delta WC + I + D - CF$$

[2] See Kayhan and Titman (2007) for a detailed description of the measurement of these variables.

From an accounting identity, this sum is identical to net debt issues plus net equity issues. 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 CF measured net of dividends, capex, and working capital. To capture the different behavior, we include the variable FDd, which is the FD interacted with a dummy variable that takes the value of 1 when the FD is positive. The profitability measure (EBITD) is defined as the sum of earnings before interest, taxes, and depreciation over five years scaled by the beginning firm value. This variable captures the availability of internal funds.

The two timing measures, YT and LT, are based on the relationship between M/Bs and leverage (Baker and Wurgler 2002). The modified measures used by KT are:

$$\text{Yearly Timing (YT)} = \left(\sum_{h=0}^{4} \text{FD}_h * \left(\frac{M}{B} \right)_h \right) \Big/ t - \overline{FD} * \frac{M}{B}$$

$$\text{Long-term Timing (LT)} = \left(\sum_{h=0}^{4} \left(\frac{M}{B} \right)_h \Big/ t \right) * \left(\sum_{h=0}^{4} FD_h / t \right)$$

The sums are taken over years 0 to 4, so they measure the average market-to-book, FD, and the interaction of these two variables over the five-year period. The YT measure is the covariance between external financing and the M/B, which measures the propensity to decrease leverage when the stock price is high. The LT measure captures the idea that the average propensity to finance with debt is related to the level of the share price. KT show that a combination of these measures is essentially

equivalent to the measure used by Baker and Wurgler. We also use the five-year cumulative log return on the stock (r) to control for direct effects of stock price changes on the debt ratio (Welch 2004).

The Appendix shows the results of our estimation of stage 1 and stage 2 of KT. These results are in line with other studies. We use the ΔTarget to measure the behavior of leverage relative to target around the time of the dividend change, and stage 2 of KT to control for the effect on leverage of partial adjustment and of other variables subsequent to the dividend change.

II.2 Leverage change subsequent to the dividend change

To measure the fixed effects of leverage changes for dividend-change firms, we augment stage 2 of KT by including two dummy variables. The first variable, DIV_INCR, takes the value 1 if the firm has a dividend increase at time zero, and 0 otherwise. The variable DIV_DECR takes the value 1 if the firm is dividend-decreasing at time zero, and 0 otherwise. The dividend dummies are measured at the time of the dividend change and are included in stage 2 of the KT procedure, measuring leverage changes in the period (0, 5).[3]

Dividend increases are known to signal variables that could also be related to changes in leverage. We next augment the KT procedure with variables that are known to follow dividend changes and could also be related to leverage changes. These are the levels of operating CFs (Brook et al. 1998; Faulkender and Wang 2006), variability of return on equity (SD ROE) (Skinner and Soltjes 2011), firm maturity (Age) (GMS), capex (GMS), and credit rating (Charitou et al. 2011). The CF measure (CF[0, 5]) is defined as the sum of CFs from operations before capex over five years

[3] An alternative specification is given in Bae et al. (2011), which is a partial adjustment model towards a target leverage ratio. However, the KT specification includes in stage 2 the ex post values of variables for which a large dividend change could be a proxy.

after the dividend change scaled by the beginning firm value. The variability of return on equity SD ROE is measured over the five years after the dividend change. We also include the changes in CF and SD ROE. Age is the number of years of data available on Computstat up to year zero. Capex is the total capex in the period (0, 5). We proxy the debt rating by a probability of default based on the Merton risky debt model (Charitou et al. 2011).

To control for the effect of dividend status, we also interact DIV_PAY and the LevDef in stage 2. Finally, we interact the dividend change dummies with LevDef and CF to allow for different trade-off behavior of the firms' changing dividends. These interactions should pick up any simple shift in financing policy, such as a change in the speed of partial adjustment.

II.3 Policy shifts not picked up by the partial-adjustment model

To capture more subtle shifts in leverage policy, we finally introduce interaction terms between the dividend change dummies and four variables: LT, SDROE, FD, and FDd. The idea is to capture the extent to which firms with large dividend increases show a change in their response to these pecking order variables after the dividend increase. This will pick up changes in the way the pecking order is implemented. For example, it will detect if financial surpluses are being used less to pay down debt.

III. Data

Our data selection procedure broadly follows that of KT. Our sample consists of firms listed in the Center for Research in Securities Prices (CRSP) files in the period 1979–2010, which also have records in the Compustat Industrial Annual Files.

We exclude financial firms (SIC codes 6000–6999) and utilities (SIC codes 4900–4999). We also exclude firms with book values of assets below $10 million and M/Bs above 10 or below -100. We require that firms have at least five years of data so that we can track leverage over that period subsequent to a dividend change.

Following the procedure of GMS, our dividend-change firms meet the following requirements:

a) The dividend payout refers to quarterly cash dividends in US dollars.

b) The stocks on which the dividends are paid are ordinary common shares. Thus, we exclude shares of American Trust components, closed-end funds, or real estate investment trusts.

c) The previous cash dividend payment was paid within a window of 20–90 trading days prior to the current dividend announcement.

d) The percentage change in dividends is between 12.5% and 500% for the dividend increase sample. This criterion ensures that we include economically significant dividend changes at the lower bound and exclude outliers at the upper bound. For the decrease sample, the range is -12.5% to -100%.

e) The dividend announcement is not an omission or an initiation.

This sample selection process yields 4,374 cash dividend increases and 2,522 decreases.

Similar to Grullon et al (2002) and Michaely, Thaler, and Womack (1995) we define a dividend initiation as the first quarterly cash dividend payment on ordinary common shares reported in CRSP. Reinstitution of a cash dividend is not considered

as a dividend initiation. The resulting sample contains 394 cash dividend initiation events.

Firms that do not fall into the dividend increase and decrease groups are classified as firms that do not change dividends. The event year for a dividend change, T=0, is set as the corresponding fiscal year end of the quarter of the dividend change. We drop event observations with mixed (initiation, increase, and decrease) dividend changes within a five-year period. When a firm has succeeding dividend changes in the same direction within a five-year period, we keep only the first dividend change in the series.[4] The percentage change in quarterly cash dividends for firm *i* is defined as the percentage difference between the quarterly cash dividend payout reported in CRSP on the event quarter ($DIV_{i,0}$) minus the corresponding dividend payment of the previous quarter ($DIV_{i,-1}$):

$$\Delta DIV_{i,0} = \frac{DIV_{i,0} - DIV_{i,-1}}{DIV_{i,-1}}$$

This gives a pool of 7,290 dividend changes and initiations from a sample of 2,072 firms. Additional to these dividend change and initiation firms our sample contains other 3,526 firms that pay dividends but they do not exhibit significant dividend changes during the examined period. This makes a total of 5,598 dividend paying firms. In addition to the dividend paying firms, our sample contains other 11,310 not dividend paying firms. Therefore, the resulting sample consists of 16,908 dividend paying and non-dividend paying firms. These figures are consistent with the general fact that the average fraction of firms that pay dividends is close to 30% in the last 3 decades. Skinner and Soltes (2011) provide evidence of a substantial reduction

[4] Our robustness tests show qualitatively similar results when keeping the last dividend change in the series instead.

of U.S. firms that pay regular dividends, from 60% in 1975 to 20% in 2002 and 29% in 2005.

Table 1 shows summary statistics for our sample firms, separately for the initiation, dividend-increase, dividend-decrease, and no-change samples. Panel 1A compares the initiation, dividend-increase and dividend-decrease samples. The dividend-increase firms have lower leverage, but also differ in other characteristics, including market-to-book, tangible assets, and profitability. In later tables, we show the target leverage, estimated by KT stage 1, which reflects these differences.

Panel 1B shows the comparison between the dividend-change firms and those that pay dividends that change by less than the threshold amount (firms that "do not change dividends"). Firms that increase dividends have lower leverage than those that do not change dividends. Firms that decrease dividends have higher book value leverage than the no-change firms but lower market value leverage as a result of their higher M/B. The two groups also differ from the no-change group in other characteristics. Dividend increase and initiation firms have higher market-to-book, PPE, profit, and R&D than no-change firms. The dividend increase firms are bigger than the no-change firms and the initiation firms smaller. The dividend-decrease firms are larger and have higher M/Bs than the no-change firms.

In other comparisons between dividend-paying firms and non-payers (not shown), dividend-paying firms are significantly different from non-payers, having higher PPE and profitability, but lower market-to-book, SE, and R&D. The dividend-paying firms also have higher average book and market leverage.

IV. Empirical results

IV.1 Raw leverage changes

Table 2 shows the evolution of leverage and other firm characteristics over the period following a dividend change. We examine both book value and market value leverage because they can show different effects (Welch 2004). The five-year changes in book value leverage for the dividend increase, decrease, and initiation samples are +5.0%, +2.0%, and +5.6% respectively. For market value leverage, they are +5.7%, +2.7%, and +9.4% respectively. These are all highly statistically significant. Thus, all three categories increase leverage significantly following the dividend change.

There are also significant changes in other characteristics of the firms over the five-year period. In particular, all three groups show significant declines in profitability, as measured by EBITD scaled by net assets, and the dividend increase group shows a significant increase in its market-to-book ratio.

IV.2 Leverage targets and deficits

Table 3 shows the leverage target (estimated by stage 1 of KT) and LevDefs for the dividend change samples and the sample of firms that pay regular dividends but do not make significant dividend changes.[5] Panel 3A shows that firms that increase and initiate dividends have a greater LevDef than dividend-decreasing firms. The book value LevDef at time zero for dividend-increasing firms is 5.2%, on average. This is very similar to the increase in leverage of +5.0% over the five-year period following the dividend increase. Thus, the average behavior of this group is consistent with there being a conventional book value leverage target. The dividend-decreasing group has a book value LevDef of 2.8%, on average, at time zero. The subsequent increase of +2.0% in the five-year period following the dividend increase is similar to the LevDef at time zero. For initiations the figures are 7.2% for the deficit

[5]The sample for the KT procedure is slightly more restricted than that shown in Table 1.

and 5.6% for the subsequent change. Thus, the average behavior for all groups is consistent with book value leverage increases over the five-year period following the dividend change equal to the LevDefs at the time of the change, on average.

For market value leverage, there are much larger LevDefs at time zero, 11.1% for the dividend-increase firms, 8.1% for the leverage-decrease firms, and 11.5% for the initiation firms. The subsequent market value leverage increase in the five-year period following the dividend increase is 5.7% for the dividend increase firms, 2.7% for the dividend decrease firms, and 9.4% for the dividend initiation firms. Thus, the increase in market value leverage is, on average, less than the LevDef at the time of the dividend change.

IV.3 The change in leverage targets after the dividend change

Before testing whether the leverage increases can be explained by partial adjustment behavior, we examine the evolution of the leverage target after the dividend change to test whether the dividend change predicts changes in the variables that measure the leverage target. Table 4 shows the evolution of the leverage targets over the five years before and after the dividend changes. The firms making dividend increases have target leverage that increases slightly in the five years prior to the dividend change. Subsequent to the dividend change, the target is stable. The explanation for the leverage increase after the dividend increase does not lie in a change in the target. Very similar behavior is observed for the dividend decrease sample. For the initiations sample the leverage target decreases slightly after the dividend change, so it cannot explain the increase in leverage.

Table 5 summarizes the average results. The change in book value leverage over five years after the dividend change is approximately equal to the LevDef at time

zero for all three groups. In no case is any significant part of the leverage increase explained by a change in the leverage target. For market value leverage, the increase in leverage is less than the time zero deficit; but again, the change in leverage is not explained at all by a change in the target.

IV.4 Controlling for standard leverage variables and policies

The average behavior looks so far as if it may be consistent with these firms adjusting towards a standard leverage target, as implemented by stage 1 of the KT procedure. We now check whether implementing stage 2 of the KT procedure to allow for partial adjustment towards that target explains the leverage increases. Table 6 shows a series of regressions similar to stage 2 of KT, but increasingly augmented with extra terms that may be related to the dividend change. Panel 6A is for book value leverage and Panel 6B for market value leverage.

The first column in Table 6 is the average change, as discussed above. The second column, "KT model control," augments the KT stage 2 variables with dummy variables taking the value 1 for dividend increases, decreases, and initiations and 0 for other firms. All three dummies are highly significantly positive in both the book leverage and market leverage regressions, indicating that this standard implementation of the partial adjustment model does not explain the leverage increases following large dividend changes.

IV.5 Controlling for variables associated with a dividend change

The KT procedure does not include all variables that might be related to dividend changes. Table 6 shows in the third column, "Augmented KT", the result of augmenting the KT stage 2 regressions with the levels and changes of variables

known to be related to dividend changes. The level and change of CF are significantly negatively related to changes in both leverage measures, but the earnings stability variables are either insignificant or go in the wrong direction. The rating target variable is significant, as is the capex variable for book value leverage. Age is marginally significant. Capex is insignificant for market value leverage, but Age is significant in both regressions.

We also augment the KT procedure in other ways. To capture the interaction between being dividend-paying and the speed of leverage adjustment found by Fama and French (2002), we interact the dividend-paying dummy with the LevDef. This coefficient is significantly positive, indicating that dividend-paying firms adjust more slowly to their leverage targets than non-payers, as found by Fama and French. We also include interactions between the dividend change dummies and the LevDef to allow for different responses to deficits by the dividend-change firms. This might arise because firms that change their dividends are in an adjustment phase of their leverage policy, which could indicate faster reversion to target (Hovakimian and Li 2010). In the book value regression, these interactions are insignificant, but in the market leverage regressions the interaction of the LevDef with the dividend increase and initiation dummies are significantly positive. This indicates that the dividend-increasing and initiating firms respond more slowly to their market LevDefs than do other firms. Thus, although these firms have larger LevDefs than other firms and are making a major financial choice in the form of a major change in dividend policy, they appear to adjust more slowly towards their leverage targets if the standard partial adjustment formulation is used.

Even with all these controls, the dummy for dividend increases is still highly significant for both the book value and market value regressions. The initiation

dummy is highly significant for the market leverage regression and significant for the book value regression. A dividend increase predicts a subsequent adjusted five-year book leverage increase of 4.1% and market leverage increase of 5.8%, after the controls. A dividend initiation predicts a book value increase of 4.9% and a market value increase of 10.5%. Hence, the statistically and economically significant increases in leverage of dividend-increasing and initiating firms found in tests using raw averages and the standard KT procedure are not explained by this augmented specification of the KT procedure.

In contrast, for the dividend decrease sample, the dummies are now insignificant. For those firms, the augmented trade-off model explains the average leverage increase. Thus, we find significant asymmetry between dividend increasing and decreasing firms, consistent with GMS.

IV.6 What change in leverage policy is being signaled by a dividend increase?

As discussed above, dividend-increasing and initiating firms have significant LevDefs at the time of the dividend change, and they reduce these after the change. However, their move back towards their target is not captured by the augmented KT stage 2 model. Therefore, we investigate a more complex change in leverage policy following the dividend increase or initiation. This is intended to measure whether pecking order behavior changes after the dividend increase or initiation.

To capture the possibility that dividend-increasing firms respond to financing deficits in a different way to other firms, we interact the dividend change dummies with the financing deficit (FD and FDd) and allow asymmetric responses to positive and negative deficits conditional on the dividend change. We also interact the dividend change dummies with the market timing measure (LT) and risk (SDROE) to

allow for the possibility that firms changing dividends by a large amount respond differently to these variables.

The result is shown in the final column of Table 6, "With interactions". The main result is shown graphically in Figure 1, which shows the relationship between FD's in the period (0, 5) and leverage changes in that period for firms that do not change their dividend compared to those with large dividend increases. The FD is along the X-axis, with positive deficits indicating financing shortfalls and negative deficits indicating surpluses. The lower line is for firms that do not change their dividend, and indicates an almost linear response. In contrast, the higher line for firms increasing dividends indicates a highly asymmetric response. For financing surpluses, indicated by the left side of the chart, the response is insignificantly different from zero. Unlike average firms, these firms do not use financial surpluses to pay down debt. Also, the right side of the chart is steeper, indicating that they increase leverage at a higher rate in response to financing deficits. The overall effect of the more convex response function is that the average leverage of these firms increases relative to the no-change firms and relative to the pre-change level.

Thus, the change in behavior is not a simple change in the partial adjustment coefficient, but rather this more complex conditional management of leverage. The differences are both statistically and economically highly significant. The coefficient of the dividend increase dummy is now insignificant in both the book value and market value regressions, indicating that this explains the average leverage increase. The fixed effect of the dividend decrease group remains insignificant.

For dividend initiation firms the effect is qualitatively the same, although the interaction terms are not as significant because of the smaller sample. However, the size of the coefficients is greater, consistent with Hypothesis 1C.

In summary, a dividend increase or initiation appears to signal the intention to increase leverage towards a pre-existing leverage target, but the increase is made in a highly conditional way.

IV.7 The effect of firm size and incentives

Table 7 reports the coefficients of the dividend change dummies for large and small firms (i.e. the fixed effects from Table 6 with separate dummies for large and small firms). For both small and large firms, the fixed effect of dividend increases and initiations remains until the "pecking order interactions" are included and then disappears. In contrast, the augmented KT control removes the fixed effects for dividend-decrease firms in both groups, as for the entire sample.

The size of the leverage increase is different for large and small firms, with a raw average book value leverage increase of +5.7% for large firms and +2.9% for small firms that increase dividends. This difference is significant. Table 8 presents this difference in a slightly different way by scaling the leverage increase by five years' worth of the dividend increase. By this measure, large and small firms show very different behavior. Large firms that increase their dividends pay for a much larger fraction of the increase by a subsequent leverage increase. This suggests that the effect is unlikely to be primarily a signal of fundamental information that the market did not previously know. The problem of asymmetric information is much smaller for large firms, so if the signal were about fundamentals like unobserved maturity or risk, we would expect this to show a greater effect for small firms. Instead, we interpret the signal as being about a shift in policy.

Table 8 sorts a subsample of the firms for which we have executive compensation by the level of executive compensation as well as by size. There

appears to be a pattern of firms with possible agency problems caused by low executive compensation paying for more of the dividend increase with debt. Large firms with poor incentives have a ratio of leverage increase to dividend increase of 0.575 times, significant at the 1% level. In contrast, smaller firms with more high-powered incentives have an increase that is insignificantly different from zero. The relationship between compensation and the leverage increase is present for all sizes of firm.

Overall, these results are consistent with the combined dividend and leverage strategy used to control agency problems (Barclay et al. 1995; DeAngelo and DeAngelo 2007; Hail et al. 2014).

V. Robustness tests[6]

To check the robustness of the results to a different measure of the dividend change, we estimated the Lintner dividend model as in Fama and French (2002) and defined dividend changes using the residuals from this model with the same thresholds described above. The dividend dummies using the stage 2 KT control are still all highly significant. In the book (market) leverage regressions, the coefficients of the dividend increase dummies are 3.1% (2.0%) and the results are essentially unchanged.

We further decomposed the dividend change into a part that could be predicted on the basis of the general relationship between dividends and fundamental variables ("target dividend") and the remainder, which is unrelated to fundamentals and therefore discretionary. This gives a procedure that measures a "dividend gap" similar to the leverage gap in stage 1 of KT. The results are robust to the measurement of the

[6] Tables of all the results in this section are available on request from the corresponding author.

size of dividend changes using the discretionary part of the dividend change in this approach.

We then examined the effect of using a 1% threshold for the dividend change rather than the 12.5% threshold. The results are qualitatively similar to the results with the 12.5% threshold, but smaller in magnitude. In contrast, when we use a continuous variable for the dividend change, the results become very mixed. Thus it appears that the unadjusted percentage change in dividend is not as good a signal of the change in leverage policy as an increase above a threshold or the residual from a Lintner-like model.

We also tested alternative measures of risk, specifically beta and idiosyncratic variance (Grullon et al., 2002, Lee and Mauck, 2016). These variables are significant in the augmented KT regressions, but they do not explain the increased leverage for dividend-increasing and initiating firms. The qualitative and quantitative results regarding the change in leverage remain the same.

We also tested whether the explanation for the link between dividend and leverage increases is the effect of tax (Hennessy and Whited 2005). The effect of taxes is already reflected to some degree in the KT procedure by including profit variables, which should be related to tax status. In addition, to check whether the tax status of companies could be changing in a way that explains the results, we also include in the KT stage 2 regression the change in the effective tax rate, measured as taxes paid divided by profits. This is insignificant and has no effect on the results.

In our replication of KT stage 1, we include a dummy for dividend-paying firms. This is highly significant and consistent with the literature on the link between leverage and dividend levels. However, this variable is not included in the version of the target leverage regression used by KT. We replicate the results omitting this

variable from stage 1 and find that the results are insignificantly different from those with the dividend dummy in stage 1.

It is possible that the relationship between dividend changes and leverage is caused by an omitted common factor, such as negative earnings or a different measure of firm maturity than the one we use, Age. To capture the link between negative earnings and dividend decreases (DeAngelo et al. 1992), we included in the stage 2 regression a dummy variable LOSS, which takes the value 1 if there is a loss in the year prior to the dividend change, as well as its interaction with the dividend change dummies. As a measure of firm maturity, we included in the stage 2 regression a dummy variable ESTAB, which takes the value 1 if there are at least 10 years of positive earnings and dividend payments prior to the first annual loss (Koch and Sun 2004), and its interaction with the dividend change dummies. Although the variables LOSS and ESTAB are significant with the correct signs in both book and market leverage regressions, they do not significantly change the magnitude and significance of the fixed effect associated with dividend increases. The coefficient of DIV_INC is 4.7% with a p-value of 0.0% in the book value regression and 7.4% with a p-value of 0.0% in the market value regression.

To investigate further the long-term effects of dividend changes, we ran the augmented model by using the future CF variable in the five-year period from 5 to 10 years after the dividend change event. The level and change of this variable are significant in the market value leverage regression but not in the book value leverage regression. The results corroborate our previous findings. For both book value and market value leverage, the fixed effects associated with dividend increases are still highly significant and similar to those without this control.

We also examined the robustness of our results to the inclusion of mixed event observations (rather than excluding them). This gave only small differences in the economic significance of the leverage increases for the dividend-increasing firms. However, this result should be interpreted with caution. For example, if a firm initiated and increased dividends within a five-year period, and if both events have positive impact on subsequent leverage, then it would not be clear if the leverage increase should be attributed to dividend initiation or increase. Hence, the results for the sample including mixed events depend on the relative frequencies of different types of mixed events as well as the effects of different events.

We ran the same tests using samples of firms making significant repurchases. All the results are consistent with those for the dividend-increase sample in the sense that there are significant increases in leverage in the period (0, 5), and these are not explained until we include the interaction of the dividend initiation or repurchase dummy with the pecking order behavior. Furthermore, the sizes of the changes in leverage are consistent with the strength of the signal being given. We rank the strength of the dividend signal as weakest for repurchases and strongest for initiations, with dividend increases in between. The average book value (market value) leverage increases are +0.028 (+0.043) for repurchases, +0.050 (+0.057) for dividend increases, and +0.056 (+0.094) for initiations. Thus, the sizes of the average leverage increases are in the same rank order as the strength of the signals.

Finally, we tested for the effect found by Fuller and Goldstein (2011) that dividends matter more in declining markets. We estimated Table 6 for the sub-period of the crisis, 2008-2010. Consistent with their results, we found a larger leverage increase subsequent to dividend increases and initiations, especially for market value leverage. As in other periods, the leverage increase is not explained until we introduce

the pecking order interactions. Interestingly, however, the interaction of the dividend increase dummy with the financial deficit variables becomes insignificant, suggesting that the mechanism of the leverage adjustment changed during the period of the crisis.

VI. Conclusions

Firms increasing dividends by a large amount subsequently increase leverage. On average, this is equal to the leverage deficit at the time of the dividend increase, but the adjustment towards the target leverage is not captured by a standard partial adjustment model. Instead, these firms display a much more convex response to financing deficits, which raises their average leverage increase. The behavior is not explained by a moving leverage target, and is consistent with the dividend increase signalling the intention to increase leverage back to the target.

The results are robust to many alternative specifications, including augmenting the Kayhan-Titman model of empirical leverage behavior with variables known to be related to dividend increases. The signal about the discretionary change in future leverage policy given by a large dividend increase appears to be incremental to signals about other firm characteristics. In contrast, large dividend decreases also signal an increase in leverage but not one that discretionary.

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APPENDIX: Estimates of the Kayhan–Titman regressions

This Appendix shows the estimation of stages 1 and 2 of the KT model. Stage 1, shown in Table A1, relates leverage to contemporaneous firm characteristics using a Tobit regression.[7] The predicted leverage from this regression is taken as an indication of the target leverage of the firm. Despite the different data period (1980–2010 rather than 1960–2003 used by KT), the results are very similar to KT's. The variables are all highly significant and have the same sign as in KT. The average target leverage is also similar to KT's. In our regression, we augment the KT variables with a dummy variable (DIV_PAY), which takes the value 1 if the firm is dividend-paying. This is significantly negative, consistent with the result in Frank and Goyal (2009) that dividend-paying firms tend to have lower leverage.

Table A2 shows the result of stage 2 of the KT procedure.[8] This relates the change in leverage over five years to variables that include the LevDef at time zero and changes in firm characteristics over the same five years. This replicates the result in KT and gives very similar results to their paper.

[7] The regression also includes 48 industry dummies.
[8] We estimate standard errors by bootstrapping using 500 replications.

Table A1: Tobit regression of leverage on contemporaneous variables (stage 1 of KT)

This table shows estimates of stage 1 of the KT model. This relates leverage to contemporaneous firm characteristics using a Tobit regression. Specifically, this model explains the leverage ratio with the 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 1 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). The predicted value of the leverage ratio is restricted to be between 0 and 100. Panel 5A presents estimates of KT model specification. Panel 5B augments the KT model specification with a dummy variable (DIV_PAY), which takes the value 1 if the firm is dividend-paying.

Dependent variable: Book leverage		Dependent variable: Market leverage	
	Coef.(p-value)		Coef.(p-value)
DIV_PAY	-0.0433(0.00)	DIV_PAY	-0.0475(0.00)
Market-to-book	-0.0041(0.00)	Market-to-book	-0.0157(0.00)
Prop, plant & equip	0.1161(0.00)	Prop, plant & equip	0.1516(0.00)
Profitability	-0.3593(0.00)	Profitability	-0.4653(0.00)
Selling expense	-0.0510(0.00)	Selling expense	-0.0821(0.00)
R&D	-0.0623(0.00)	R&D	-0.0710(0.00)
R&D dummy	0.0305(0.00)	R&D dummy	0.0460(0.00)
Size	0.0259(0.00)	Size	0.0140(0.00)
Number of obs	101,523	Number of obs	105,117
Prob.>X^2	0.00	Prob.>X^2	0.00
LR X^2 (49)	22134.5	LR X^2 (49)	33423.7

Table A2: Regression of leverage changes on explanatory variables (stage 2 of KT)

This shows the result of stage 2 of the KT procedure. This relates the change in leverage over five years to variables that measure changes in firm characteristics over the same period. The dependent variable is the change in leverage between year t and t-5. The financial deficit (FD) is the total external financing between year t and t-5, the positive financial deficit (FDd) is the total financial deficit interacted with a dummy variable that takes the value 1 when FD is positive, and 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. The five-year cumulative stock return (r) is the cumulative log return on stock between year t and t-5. The 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. The leverage deficit (LevDef) is the difference between leverage and target leverage at t-5, the target leverage is the predicted value of the leverage ratio, and change in target (ΔTarget) is the difference in target leverage between t and t-5. The statistics are obtained from 500 bootstrap replications resampled from the actual dataset. The standard error is the sample standard error of the 500.

Dependent variable: Change in book leverage (0, 5)					
Obs 46461 (clusters 5339)	Coef.	Std. err.	p-value	[95% conf. interval]	
Financial deficit (FD)	0.0972	0.0076	0.0000	0.0823	0.1120
Financial deficit for positive (FDd)	0.0284	0.0096	0.0030	0.0097	0.0472
Yearly timing (YT)	-0.0663	0.0182	0.0000	-0.1019	-0.0308
Long-term timing (LT)	-0.1317	0.0067	0.0000	-0.1448	-0.1185
Five-year cum. Stock return (r)	-0.0190	0.0008	0.0000	-0.0206	-0.0173
Five-year cum. profitability (EBITD5y)	-0.0426	0.0031	0.0000	-0.0488	-0.0364
Book leverage deficit (BLevDef)	-0.3257	0.0067	0.0000	-0.3389	-0.3125
Change in book target (ΔTarget)	0.5181	0.0243	0.0000	0.4705	0.5657

Dependent variable: Change in market leverage (0, 5)					
Obs 46697 (clusters 5394)	Coef	Std. err.	p-value	[95% conf. interval]	
Financial deficit (FD)	0.1107	0.0076	0.0000	0.0957	0.1257
Financial deficit for positive (FDd)	0.0348	0.0096	0.0000	0.0160	0.0536
Yearly timing (YT)	-0.0730	0.0173	0.0000	-0.1070	-0.0390
Long-term timing (LT)	-0.1056	0.0072	0.0000	-0.1197	-0.0916
Five-year cum. Stock return (r)	-0.0668	0.0010	0.0000	-0.0687	-0.0649
Five-year cum. profitability (EBITD5y)	0.0018	0.0033	0.5860	-0.0046	0.0082
Market leverage deficit (MLevDef)	-0.3785	0.0068	0.0000	-0.3918	-0.3651
Change in market target (ΔTarget)	0.6459	0.0182	0.0000	0.6102	0.6817

Figure 1: Response of book value leverage to financial deficits of dividend-increasing firms relative to firms with no dividend change

The figure shows the average response to a financial deficit of the book value leverage of firms that increase dividends relative to those that do not change dividends. The leverage change is measured over the five years following the dividend change.

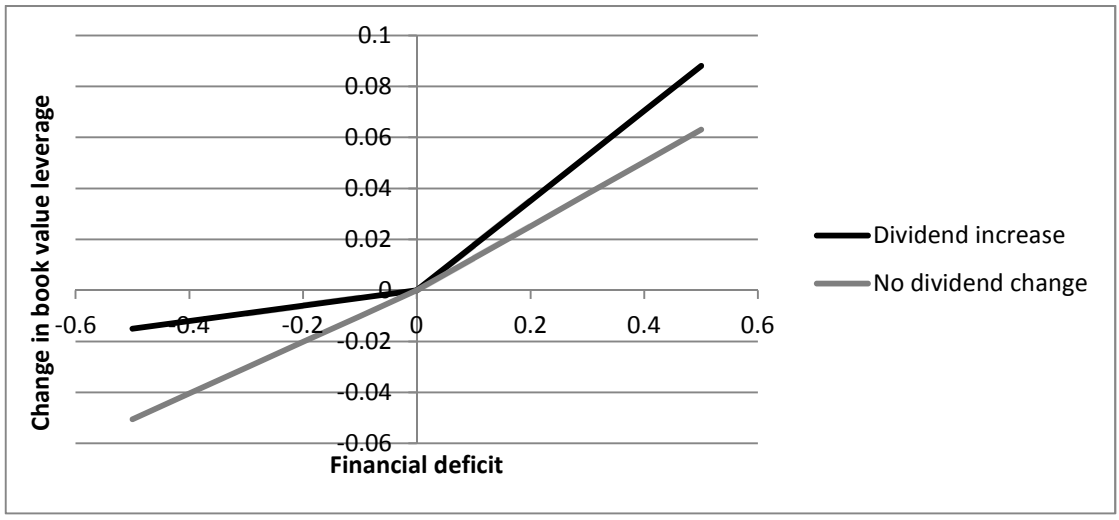

Table 1: Leverage ratios and other characteristics of firms with large dividend increases and decreases

Panel 1A shows summary statistics for dividend increases, decreases, and initiations at the time of the dividend change. Panel 1B shows summary statistics for the sample of firms that pay regular dividends but do not exhibit significant dividend changes (no dividend change sample). Date zero (the event year) is set as the corresponding fiscal year end of the quarter of the dividend change or initiation. Mixed event observations within a five-year period are excluded. When a firm has succeeding dividend changes in the same direction within a five-year period, only the first dividend change in the series is used. Book leverage (BLEV) is the book debt to book assets, and market leverage (MLEV) is the book debt to the sum of book debt and market equity. Other variables are 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), selling expense (SE, selling expense scaled by net sales), and firm size (SIZE, logarithm of net sales). The financial deficit (FD) is the total external financing between year t and t-5, the positive financial deficit (FDd) is the total financial deficit interacted with a dummy variable that takes the value 1 when FD is positive, and 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. The 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. Comparison columns show tests of differences among the different categories.

Panel 1A: Dividend increases, decreases, and initiations

	Dividend increase sample (4,374)		Dividend decrease sample (2,522)		Dividend increases minus decreases	
	Mean	Std. dev.	Mean	Std. dev.	Dif.	p-value
Book leverage	0.430	0.173	0.469	0.179	-0.039	0.000
Market leverage	0.296	0.177	0.351	0.200	-0.054	0.000
Market-to-book	2.356	1.318	2.182	1.341	0.154	0.000
Prop, plant & equip	0.352	0.209	0.372	0.213	-0.020	0.001
Profitability	0.185	0.071	0.156	0.085	0.028	0.000
Selling expense	0.204	0.123	0.196	0.130	0.008	0.037
R&D	0.017	0.036	0.013	0.028	0.004	0.000
Size	6.846	1.806	6.704	1.890	0.143	0.054
FD	0.205	0.311	0.193	0.351	0.011	0.343
FDd	0.244	0.246	0.249	0.266	-0.005	0.591
YT	0.004	0.037	0.005	0.047	-0.001	0.723
LT	0.105	0.160	0.106	0.187	-0.001	0.867
R	0.429	0.997	0.327	0.991	0.101	0.005
EBITD	0.848	0.310	0.765	0.323	0.083	0.000

(continued on next page)

Dividend initiations sample (394 obs)		Initiations minus Increase		Decrease minus Initiations	
Mean	Std. Dev.	Dif.	p-value	Dif.	p-value
0.383	0.189	-0.045	0.000	0.084	0.000
0.286	0.198	-0.010	0.352	0.065	0.000
2.200	1.297	-0.156	0.058	0.003	0.975
0.288	0.214	-0.064	0.000	0.084	0.000
0.167	0.084	-0.018	0.000	-0.010	0.061
0.213	0.141	0.009	0.272	-0.017	0.050
0.018	0.041	0.002	0.482	-0.006	0.003
5.818	1.725	-1.028	0.000	0.886	0.000
0.257	0.342	0.052	0.044	-0.063	0.031
0.294	0.290	0.050	0.014	-0.045	0.046
0.013	0.052	0.009	0.007	-0.008	0.044
0.125	0.183	0.020	0.128	-0.019	0.220
0.159	0.978	-0.270	0.001	0.168	0.043
0.758	0.363	-0.090	0.000	0.007	0.788

Panel 1B: No dividend change sample compared with increases, decreases, and initiations

	No dividend change sample (3,526 obs)		No dividend change minus increase		No dividend change minus decrease		No dividend change minus initiations	
	Mean	Std. Dev.	Dif.	p-value	Dif.	p-value	Dif.	p-value
Book leverage	0.457	0.175	0.028	0.000	-0.012	0.004	0.072	0.000
Market leverage	0.410	0.207	0.114	0.000	0.059	0.000	0.124	0.000
Market-to-book	1.588	1.113	-0.769	0.000	-0.615	0.000	-0.613	0.000
Prop, Plant & Equip	0.369	0.213	0.017	0.000	-0.002	0.629	0.081	0.000
Profitability	0.156	0.083	-0.029	0.000	-0.001	0.716	-0.011	0.027
Selling Expense	0.210	2.229	0.005	0.904	0.013	0.806	-0.004	0.978
R&D	0.013	0.081	-0.004	0.007	0.000	0.962	-0.006	0.246
Size	6.037	1.884	-0.810	0.000	-0.667	0.000	0.218	0.053
Financ. deficit (FD)	0.213	0.333	0.008	0.289	0.020	0.046	-0.044	0.099
Pos. Fin. Def. (FDD)	0.256	0.265	0.012	0.048	0.007	0.348	-0.038	0.074
Yearly timing (YT)	0.005	0.039	0.000	0.740	0.000	0.877	-0.008	0.008
Long-term tim. (LT)	0.085	0.146	-0.020	0.000	-0.021	0.000	-0.040	0.000
5-year return (r)	0.525	1.132	0.096	0.000	0.198	0.000	0.366	0.000
5-year profit. (EBITD)	0.736	0.322	-0.112	0.000	-0.029	0.002	-0.022	0.399

Table 2: Leverage ratios and firm characteristics of firms changing dividends by large amounts

This table presents leverage and other firm characteristics over time for firms that increase, decrease, and initiate dividends in panels 2A,2B, and 2C respectively. Date zero (t=0) is set as the corresponding fiscal year end of the quarter of the dividend change or initiation. Change from 0 to 5 is the change between year 0 and year +5. Book leverage (BLEV) is the book debt to book assets, and market leverage (MLEV) is the book debt to the sum of book debt and market equity. EBITD is the operating income before depreciation scaled by total assets; BE is the book value of equity; ME is the market value of equity; SIZE is the natural logarithm of net sales; R&D is the research and development expense scaled by net sales; SE is the selling expense scaled by net sales; PPE is the net property, plant, and equipment scaled by total assets; and M/B is the market-to-book ratio.

Panel 2A. Dividend increases

YEAR	0	1	2	3	4	5	Change from 0 to 5	p-value
BLEV	0.430	0.439	0.449	0.459	0.469	0.479	0.050	0.000
MLEV	0.298	0.312	0.327	0.339	0.349	0.355	0.057	0.000
EBITD	0.185	0.175	0.166	0.158	0.156	0.155	-0.030	0.000
BE	2753.8	2892.7	2928.4	2917.8	2790.7	2700.8	-53.0	0.818
ME	6634.8	7022.9	7513.6	7614.9	7692.4	7701.8	1066.9	0.077
SIZE	6.9644	7.0539	7.1068	7.1041	7.1180	7.1370	0.173	0.000
R&D	0.019	0.018	0.017	0.019	0.020	0.017	-0.002	0.323
SE	0.206	0.207	0.209	0.222	0.560	0.217	0.011	0.015
PPE	0.351	0.351	0.349	0.347	0.345	0.345	-0.006	0.272
M/B	2.360	2.242	2.390	2.201	2.373	2.544	0.184	0.003

Panel 2B. Dividend decreases

YEAR	0	1	2	3	4	5	Change from 0 to 5	p-value
BLEV	0.469	0.476	0.480	0.487	0.485	0.488	0.020	0.002
MLEV	0.354	0.368	0.376	0.384	0.383	0.381	0.027	0.000
EBITD	0.154	0.150	0.149	0.148	0.146	0.145	-0.009	0.003
BE	2863.9	2603.1	2486.1	2604.2	2582.1	2544.8	-319.0	0.348
ME	5887.7	5794.9	6145.2	6304.8	6423.7	6855.5	967.8	0.176
SIZE	6.7769	6.8339	6.8943	6.9562	6.9849	7.0315	0.255	0.000
RD	0.013	0.013	0.012	0.012	0.012	0.012	-0.002	0.094
SE	0.197	0.197	0.197	0.199	0.201	0.205	0.007	0.106
PPE	0.367	0.365	0.361	0.357	0.357	0.351	-0.016	0.026
M/B	2.177	2.309	2.060	2.253	2.129	2.514	0.338	0.232

Panel 2C. Dividend initiations

	0	1	2	3	4	5	Dif(5, 0)	Sign. Dif
BLEV	0.382	0.389	0.411	0.442	0.443	0.438	0.056	0.004
MLEV	0.282	0.300	0.330	0.358	0.374	0.376	0.094	0.000
EBITD	0.167	0.162	0.155	0.144	0.143	0.139	-0.028	0.002
BE	771.2	791.4	922.7	965.3	1136.1	806.9	35.641	0.877
ME	2001.2	1902.8	1958.1	1717.9	2155.4	2026.1	24.944	0.975
SIZESL	5.8483	5.9256	5.9965	6.1063	6.1497	6.0724	0.224	0.192
RD	0.021	0.020	0.022	0.021	0.021	0.015	-0.006	0.108
SE	0.219	0.220	0.228	0.239	0.293	2.683	2.464	0.189
PPE	0.276	0.281	0.288	0.293	0.302	0.314	0.038	0.056
M/B	2.214	2.230	2.146	1.894	1.734	1.989	-0.225	0.319

Table 3: Target leverage ratios and leverage deficits of firms with large dividend increases, decreases, and initiations

Panel 3A shows summary statistics for dividend increases, decreases, and initiations. Panel 3B shows summary statistics for the sample of firms that pay regular dividends but do not exhibit significant dividend changes (no dividend change sample). Date zero (t=0) is set as the corresponding fiscal year end of the quarter of the dividend change or initiation. Leverage deficit (LevDef) is the difference between leverage and target leverage, where target leverage is the predicted value of the leverage ratio from stage 1 of KT, as described in the Appendix. Comparison columns show tests of differences among the categories.

Panel 3A: Dividend increases, decreases, and initiations

	Dividend increase sample (4,374)		Dividend decrease sample (2,522)		Dividend increases minus decreases	
	Mean	Std. dev.	Mean	Std. dev.	Dif.	p-value
LevDef (book)	-0.052	0.136	-0.028	0.144	-0.023	0.000
LevDef (market)	-0.111	0.139	-0.081	0.160	-0.030	0.000
Target BLEV	0.487	0.078	0.495	0.071	-0.008	0.006
Target MLEV	0.412	0.106	0.429	0.095	-0.017	0.000

	Dividend initiations sample (394)		Initiations minus Increase		Initiations minus Decrease	
	Mean	Std. dev.	Mean	Std. dev.	Dif.	p-value
LevDef (book)	-0.072	0.145	-0.020	0.073	-0.043	0.000
LevDef (market)	-0.115	0.149	-0.004	0.706	-0.034	0.011
Target BLEV	0.471	0.081	-0.016	0.013	-0.024	0.000
Target MLEV	0.407	0.113	-0.005	0.582	-0.022	0.006

Panel 3B: No dividend change sample compared with increases and decreases

	No dividend change sample (3,526)		No dividend change minus increase		No dividend change minus decrease	
	Mean	Std. dev.	Dif.	p-value	Dif.	p-value
LevDef (book)	-0.025	0.145	0.027	0.000	0.003	0.431
LevDef (market)	-0.025	0.167	0.086	0.000	0.056	0.000
Target BLEV	0.488	0.074	0.001	0.458	-0.006	0.004
Target MLEV	0.433	0.096	0.021	0.000	0.003	0.229

Table 4: Evolution of leverage targets of firms changing dividends by large amounts

This table presents average leverage targets estimated using stage 1 of KT (as described in the Appendix) for firms that increase, decrease, and initiate dividends. Date zero (t=0) is set as the corresponding fiscal year end of the quarter of the dividend change. Book leverage is the book debt to book assets, and market leverage is the book debt to the sum of book debt and market equity.

Dividend increase sample											
	-5	-4	-3	-2	-1	0	1	2	3	4	5
Target book leverage	0.476	0.473	0.474	0.479	0.484	0.487	0.487	0.488	0.488	0.488	0.488
Target market leverage	0.404	0.398	0.396	0.401	0.406	0.412	0.410	0.413	0.413	0.411	0.410

Dividend decrease sample											
	-5	-4	-3	-2	-1	0	1	2	3	4	5
Target book leverage	0.488	0.488	0.490	0.492	0.493	0.495	0.495	0.496	0.496	0.497	0.499
Target market leverage	0.426	0.424	0.424	0.426	0.427	0.429	0.428	0.427	0.425	0.425	0.428

Dividend initiations sample											
	-5	-4	-3	-2	-1	0	1	2	3	4	5
Target book leverage	0.473	0.477	0.481	0.480	0.481	0.473	0.435	0.430	0.443	0.456	0.455
Target market leverage	0.423	0.429	0.432	0.428	0.427	0.414	0.368	0.359	0.374	0.391	0.390

Table 5. Target leverage ratios, leverage deficits, and changes in leverage of firms with large dividend increases, decreases, and initiations

The table shows average leverage, targets, and deficits at the time of a large dividend change (date 0), and also the changes in leverage and target over the subsequent five years (0–5). Date zero (t=0) is set as the corresponding fiscal year end of the quarter of the dividend change. Leverage targets and deficits are estimated using stage 1 of KT as described in the Appendix. Panel 5A is for firms increasing dividends, Panel 5B for firms decreasing dividends, and Panel 5C for firms initiating dividends.

Panel 5A: Dividend increase sample					
	Date 0			Change 0–5	
	Leverage	Target	Deficit	ΔLeverage	ΔTarget
Book value	0.430	0.487	-0.052	0.05	0.001
Market value	0.298	0.412	-0.111	0.057	-0.002

Panel 5B: Dividend increase sample					
	Date 0			Change 0–5	
	Leverage	Target	Deficit	ΔLeverage	ΔTarget
Book value	0.469	0.495	-0.028	0.02	0.004
Market value	0.354	0.429	-0.081	0.027	-0.001

Panel 5C: Dividend initiation sample					
	Date 0			Change 0–5	
	Leverage	Target	Deficit	ΔLeverage	ΔTarget
Book value	0.382	0.471	-0.072	0.056	-0.018
Market value	0.282	0.407	-0.115	0.094	-0.023

Table 6: Factors explaining the change in book leverage over the five years following a large dividend change

This table shows the change in book leverage of firms that increase dividends (DIV_INC), initiate dividends (DIV_INI), and decrease dividends (DIV_DEC). Leverage changes are measured over the five years following the dividend change. "No controls" measures the average change for each group. "KT model control" includes stage 2 of the KT model as a control. The KT variables are as described in the Appendix. "Augmented KT control" includes stage 2 of KT augmented with the level and change of five-year cumulative cash flow (CF), level and change of variability of return on equity (SD ROE), rating proxy (CREDIT RISK), interaction of the leverage deficit with a dividend-paying dummy (DIV_PAY*BevDef), and interactions between the dividend change dummies and the leverage deficit and cash flow. The statistics are obtained from 500 bootstrap replications resampled from the actual dataset. The standard error (in parenthesis) is the sample standard error of the 500. Significance levels are ***1%, **5%, and *10%.

Panel 6A: Dependent variable: Change in book value leverage

	No controls		KT model control		Augmented KT		With interactions	
	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Fixed effects of:								
Dividend increase (DIV_INC)	0.050	0.002***	0.031	0.003***	0.041	0.01***	0.004	0.012
Dividend decrease (DIV_DEC)	0.020	0.003***	0.016	0.004***	0.006	0.013	-0.026	0.02
Dividend initiation (DIV_INI)	0.056	0.011***	0.058	0.009***	0.049	0.027*	-0.011	0.035
Control variables:								
Book leverage deficit (BlevDef)			-0.324	0.007***	-0.345	0.012***	-0.345	0.013***
DIV_PAY*BlevDef					0.044	0.016***	0.045	0.015***
Change in book target (BlevΔtarget)			0.518	0.024***	0.311	0.034***	0.309	0.032***
Ficial deficit (FD)			0.097	0.007***	0.097	0.01***	0.101	0.01***
Ficial deficit for positive (FDd)			0.030	0.009***	0.032	0.012***	0.025	0.012**
Yearly timing (YT)			-0.064	0.018***	-0.054	0.025**	-0.054	0.028*
Long-term timing (LT)			-0.133	0.006***	-0.141	0.011***	-0.145	0.011***
Five-year cum. Stoc return (r)			-0.019	0.001***	-0.018	0.001***	-0.018	0.001***
Five-year cum. Profit. (EBITD5y)			-0.045	0.003***	0.022	0.011**	0.022	0.011*
CF (5years after)					-0.087	0.015***	-0.088	0.016***
ΔCF (after - before)					-0.069	0.007***	-0.069	0.007***
SD ROE (5years after)					-0.009	0.012	-0.009	0.013
ΔSD ROE (after - before)					0.009	0.005*	0.009	0.006
Rating target (CREDIT RISK)					0.014	0.004***	0.013	0.004***
Age					0.005	0.003*	0.005	0.003*
Capex					0.027	0.007***	0.027	0.007***
Interactions:								
DIV_INC * BlevDef					0.029	0.025	0.007	0.025
DIV_INC * CF					-0.015	0.015	0.005	0.016
DIV_INC * LT							0.031	0.042
DIV_INC * SDROE							0.081	0.035**
DIV_INC * FD							-0.071	0.037*
DIV_INC * FDd							0.121	0.043***
DIV_DEC * BlevDef					0.030	0.032	0.004	0.031
DIV_DEC * CF					0.016	0.02	0.030	0.018*
DIV_DEC * LT							0.044	0.037
DIV_DEC * SDROE							0.084	0.03***
DIV_DEC * FD							0.008	0.037
DIV_DEC * FDd							0.040	0.043
DIV_INI * BlevDef					-0.104	0.072	-0.129	0.069*
DIV_INI * CF					-0.001	0.043	0.010	0.046
DIV_INI * LT							0.229	0.098**
DIV_INI * SDROE							0.104	0.083
DIV_INI * FD							-0.212	0.126*
DIV_INI * FDd							0.216	0.137
Adj-R2	0.3%		26.5%		28.3%		28.6%	

Panel 6B: Dependent variable: Change in market value leverage

	No controls		KT model control		Augmented KT		With interactions	
	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Fixed effects of:								
Dividend increase (DIV_INC)	0.057	0.003***	0.022	0.002***	0.058	0.01***	0.012	0.012
Dividend decrease (DIV_DEC)	0.027	0.005***	0.014	0.003***	0.018	0.015	-0.016	0.013
Dividend initiation (DIV_INI)	0.094	0.012***	0.075	0.010***	0.105	0.028***	0.042	0.031
Control variables:								
Book leverage deficit (BlevDef)			-0.375	0.006***	-0.429	0.012***	-0.432	0.012***
DIV_PAY*BlevDef					0.043	0.014***	0.045	0.014***
Change in book target (BlevΔtarget)			0.647	0.017***	0.546	0.023***	0.547	0.025***
Ficial deficit (FD)			0.111	0.007***	0.113	0.009***	0.115	0.009***
Ficial deficit for positive (FDd)			0.036	0.009***	0.040	0.012***	0.035	0.012***
Yearly timing (YT)			-0.071	0.016***	-0.060	0.027**	-0.061	0.025**
Long-term timing (LT)			-0.106	0.007***	-0.117	0.01***	-0.122	0.01***
Five-year cum. Stoc return (r)			-0.067	0.001***	-0.066	0.001***	-0.066	0.001***
Five-year cum. Profit. (EBITD5y)			0.000	0.003	0.050	0.01***	0.050	0.01***
CF (5years after)					-0.085	0.014***	-0.086	0.015***
ΔCF (after - before)					-0.033	0.007***	-0.032	0.008***
SD ROE (5years after)					-0.014	0.01	-0.014	0.009
ΔSD ROE (after - before)					0.014	0.006**	0.014	0.007**
Rating target (CREDIT RISK)					0.059	0.004***	0.058	0.004***
Age					0.007	0.003**	0.007	0.003**
Capex					0.008	0.007	0.008	0.007
Interactions:								
DIV_INC * BlevDef					0.039	0.023*	0.014	0.023
DIV_INC * CF					-0.051	0.015***	-0.025	0.016
DIV_INC * LT							0.012	0.029
DIV_INC * SDROE							0.116	0.032***
DIV_INC * FD							-0.047	0.031
DIV_INC * FDd							0.119	0.038***
DIV_DEC * BlevDef					-0.013	0.035	-0.012	0.034
DIV_DEC * CF					-0.002	0.025	0.015	0.021
DIV_DEC * LT							0.074	0.036**
DIV_DEC * SDROE							0.102	0.028***
DIV_DEC * FD							0.046	0.041
DIV_DEC * FDd							-0.008	0.049
DIV_INI * BlevDef					0.163	0.076**	0.186	0.07***
DIV_INI * CF					-0.006	0.046	0.025	0.043
DIV_INI * LT							0.183	0.092**
DIV_INI * SDROE							0.112	0.065*
DIV_INI * FD							-0.185	0.096*
DIV_INI * FDd							0.185	0.099*
Adj-R2	0.6%		48.3%		49.6%		49.9%	

Table 7: Factors explaining the change in book and market leverage over the five years following a large dividend change, large and small firms

The table shows the level and significance of the leverage change following a large dividend change. The fixed effects are measured as the coefficients of dummy variables for firms that increase (DIV_INC), decrease (DIV_DEC), and initiate (DIV_INI) dividends. Leverage changes are measured over the five years following the dividend change. "No controls" measures the average change for each group. "KT model control" includes stage 2 of the KT model as a control. "Augmented KT control" includes stage 2 of KT augmented with the variables described in Table 6. "Augmented KT control plus pecking order interactions" further adds interactions between the dividend change dummies and long-term timing (LT), return volatility (SD ROE), the fiscal deficit (FD), and the positive fiscal deficit (FDd). Large firms are the larger half of firms in the sample, and small firms the smaller half. The statistics are obtained from 500 bootstrap replications resampled from the actual dataset. The standard error (in parentheses) is the sample standard error of the 500. Significance levels are ***1%, **5%, and *10%.

Panel 7A: Book value leverage

	No controls		KT model control		Augmented KT		With interactions	
	(ave. ch)	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Full sample:								
Dividend increase (DIV_INC)	0.050	0.002***	0.031	0.003***	0.040	0.010***	0.003	0.012
Dividend decrease (DIV_DEC)	0.020	0.003***	0.016	0.004***	0.006	0.011	-0.024	0.013
Dividend initiation (DIV_INI)	0.056	0.011***	0.058	0.009***	0.049	0.027*	-0.008	0.034
Large firms:								
Dividend increase (DIV_INC)	0.057	0.003***	0.026	0.003***	0.042	0.011***	0.001	0.014
Dividend decrease (DIV_DEC)	0.022	0.004***	0.013	0.004***	0.007	0.013	-0.017	0.013
Dividend initiation (DIV_INI)	0.061	0.014***	0.053	0.012***	0.032	0.036	-0.046	0.038
Small firms:								
Dividend increase (DIV_INC)	0.029	0.006***	0.021	0.006***	0.031	0.019*	-0.015	0.021
Dividend decrease (DIV_DEC)	0.019	0.007***	0.011	0.007	0.008	0.018	-0.028	0.022
Dividend initiation (DIV_INI)	0.046	0.018***	0.084	0.014***	0.049	0.037	-0.022	0.061

Panel 7B: Market value leverage

	No controls		KT model control		Augmented KT		With interactions	
	(ave. ch)	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Full sample:								
Dividend increase (DIV_INC)	0.570	0.003***	0.022	0.002***	0.059	0.009***	0.014	0.011
Dividend decrease (DIV_DEC)	0.027	0.005***	0.014	0.003***	0.019	0.013	-0.013	0.014
Dividend initiation (DIV_INI)	0.094	0.012***	0.075	0.010***	0.108	0.026***	0.051	0.034
Large firms:								
Dividend increase (DIV_INC)	0.068	0.003***	0.021	0.003***	0.045	0.012***	-0.003	0.014
Dividend decrease (DIV_DEC)	0.035	0.005***	0.016	0.004***	0.016	0.016	-0.009	0.016
Dividend initiation (DIV_INI)	0.108	0.014***	0.071	0.012***	0.104	0.04***	0.046	0.04
Small firms:								
Dividend increase (DIV_INC)	0.043	0.007***	0.018	0.007**	0.063	0.021***	0.026	0.021
Dividend decrease (DIV_DEC)	0.027	0.009***	0.003	0.008	0.018	0.025	-0.011	0.028
Dividend initiation (DIV_INI)	0.092	0.021***	0.090	0.016***	0.097	0.042**	-0.039	0.058

Table 8: The ratio of the change in leverage to five years' worth of dividend increases (large dividend-increase firms)

The table shows averages of the ratio between the dollar equivalent of the residuals from the KT stage 2 book value regression (shown in the Appendix) and five years of the annualized dollar dividend change. It measures the ratio of the change in leverage over five years to five years' worth of the dividend increase. In Panel 7A, firms are first sorted by size into two groups. In Panel 7B, the subsample of firms (783) for which we have executive compensation data is sorted into terciles by both size and the level of executive compensation. Standard errors are in parentheses. Significance levels are ***1%, **5%, and *10%.

Panel 8A: Whole sample sorted by size

	Small size	Large size	All
Average	0.212(0.065)***	0.666(0.211)***	0.440(0.111)***

Panel 8B: Executive compensation subsample sorted by size and compensation

	Small size	Medium size	Large size
Low compensation	0.252(0.099)**	0.268(0.127)**	0.575(0.154)***
Medium compensation	0.115(0.053)**	0.302(0.130)**	0.488(0.108)***
High compensation	0.021(0.050)	0.149(0.081)*	0.306(0.117)***