Dividend Smoothing and the Allocation of Internal Cash Flow

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ABSTRACT

Dividend smoothing is prevalent among dividend-paying firms. In an imperfect capital market, friction arising from dividend smoothing significantly affects the allocation of cash flow. Better access to capital markets mitigates this adverse effect which implies that dividend smoothing is costly and it costs more for more financially constrained firms. The effect persists for both permanent and transitory components of cash flow, making it unlikely to be driven by the firm's growth options. Further, we show that the results are mainly caused by rigidity of dividends rather than total payout.

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"A rate of dividend when once declared carries with it the desirability of continuity."

Alfred P. Sloan, Jr., President, Chairman and CEO of General Motors

(*The New York Times, 12 September 1935*).

Dividend smoothing is a well-documented empirical regularity. Managers are strongly reluctant to cut dividends, while being hesitant to increase them. This rigidity in the dividend payout policy introduces a friction in the cash flow allocation of the firm. If a firm is financially constrained and the costs associated with adjusting dividends are sufficiently large, then smooth dividends affect investment decisions within firms. This paper investigates the extent to which dividend smoothing, and the friction arising from it, affects the allocation of internal cash flow, while controlling for unobserved investment opportunities and other sources and uses of funds in a cash flow identity framework.

Lintner (1956) was among the first to report that firms smooth dividends relative to earnings. Half a century later, in a survey of larger sample of firms, Brav, Graham, Harvey, and Michaely (2005) echo Lintner (1956)'s conclusions conveying that managers were willing to raise external funds or trade-off assets, employees, positive-NPV projects to avoid changes in dividends. Interestingly, the highest "agreement score" (94%) of any question in their survey was about managers' reluctance to cut dividends. DeAngelo and DeAngelo (1990) conclude that "firms with long dividend histories appear particularly reluctant to omit dividends", and Floyd, Li, and Skinner (2015) show that almost 42.64% of industrial firms with losses kept paying dividends at the peak of the global financial crisis in 2008. Leary and Michaely (2011) document that dividend smoothing is on the rise, and Michaely and Roberts (2011) assert that it is more prevalent among publicly listed firms. Hence, dividend smoothing has an important and established role in shaping cash allocation policies.

Dividend smoothing and its impact on cash flow allocation is also related to the degree of financial constraint. In a perfect capital market[1] where firms are able to finance dividend smoothing by raising abundantly available external funds, dividends and the degree to which

[1]In absence of transactions costs or taxes where all market participants are price takers and have access to all available information at no cost.

dividends are smoothed become irrelevant (Miller and Modigliani, 1961). However, this claim may not hold for more financially constrained firms with limited access to external funds. In this case, altering the dividend stream becomes costly and if these costs are sufficiently large, then firms are willing to trade-off positive NPV investment to achieve smoothness.

Previous studies[2], to a large extend, assume a frictionless stream of dividends that could be cut at no additional cost whenever needed. However, despite this presumption, dividends are not a costless source of internal funds. Even financially unconstrained firms with unfettered access to capital markets may incur the additional cost of dividend cuts should they choose to do so mainly due to a credible threat of retaliation posed by displeased investors (price declines of around 6%–10%, according to DeAngelo, DeAngelo, and Skinner (2009)). Therefore, any financial constraints a firm may be subject to are likely to exacerbate the effect.

We extend the Kaplan and Zingales (1997)(Henceforth, KZ) model to accommodate costly dividend adjustments. This simple extended model predicts that, absent perfect capital markets, the investment-cash flow sensitivity is higher for dividend-paying firms compared to the non-dividend-paying firms. In addition, the model predicts a positive association between investments and the costs associated with dividend smoothing which we call the investment-dividend smoothing sensitivity. Similar to KZ, we were also unable to assure a monotonic increase in the investment-cash flow sensitivity when the cost of the dividend adjustment increases which makes the relationship between the degree of financial constraints and dividend smoothing subject of an empirical investigation.

Empirically, we follow Chang, Dasgupta, Wong, and Yao (2014)(Henceforth, CDWY) in tracking how firms allocate each additional dollar of cash flow to uses and sources of funds. Thus, our structural model includes multiple dependent variables (investment, cash reserves, dividends, net debt issuance, and equity issuance) against several common independent

[2] Almost all models pertaining to cash flow sensitivity and financial constraints apply perfect elasticity of dividends (Fazzari, Hubbard, Petersen, Blinder, and Poterba, 1988; Kaplan and Zingales, 1997; Almeida, Campello, and Weisbach, 2004; Moyen, 2004; Almeida and Campello, 2007; Riddick and Whited, 2009; Bond and Söderbom, 2013; Carvalho, 2018).

variables (cash flow, lagged control variables, and an error term) that forms a system of equations. Since firms are bound by budget constraints, the coefficients on cash flow must sum up to one for all regressions, while the sum of coefficients on all other variables must be zero so that the cash flow identity holds. This unique setting enables us to estimate the investment-cash flow sensitivity for sample firms, and lets us investigate the effects of dividend smoothing on a firm's cash-related policies by adding a lagged dividend smoothing measure into the system of equations. Then, the loadings on the dividend smoothing measure in each regression reveals the investment-dividend smoothing sensitivity and is indicative of how firms finance their dividend smoothing.

Consistent with our prediction, we find that the investment is 20% more sensitive to cash flow for dividend-paying firms compared to that of for the full sample, as well as the non-dividend paying firms. Next, two measures of dividend smoothing, namely the Speed-of-Adjustment of dividends (SOA) and the relative volatility of dividends, are estimated following Leary and Michaely (2011) and applied to show that investment is positively associated with the cost of dividend smoothing. According to the constructed measures of dividend smoothing, firms that smooth more (less) have lower (higher) SOA (relative volatility) and bear more (less) dividend smoothing cost. It is shown that a 10% decrease (more smoothing) in the SOA is associated with a 0.13%(t-stat, -2.72) increase in the investment to asset ratio.

The impact of dividend smoothing is economically significant. Assume that a dividend-paying firm has an average SOA of 0.14 (Leary and Michaely, 2011). This means that it takes almost 4.6 years to close half the gap between actual and target dividends. Now, assume that the firm decides to close this gap faster, say by two years (less smoothing). The 68% increase in the SOA from 0.14 to 0.235 is associated with an 0.84 million (2010 constant) dollar decrease in annual investments. One should note that the allocation of cash flow is determined at the margins (each additional dollar) indicating that the degree of dividend smoothing and its positive association with the level of investment is both statistically and economically significant.

In order to test the impact of financial constraints on the frictions arising from dividend smoothing, we divide our sample of firms into two sub-categories based on the level of financial constraint. Following Whited and Wu (2006), Hennessy and Whited (2007), and Hodrick and Prescott (1997), we construct two widely used indexes in the literature to differentiate between firms that are more financially constrained from those firms that are less constrained. It is observed that the impact of dividend smoothing remains statistically and economically significant in more financially constrained firms, while it erodes once we move towards less financially constrained firms. Among the more constrained, the investment-dividend smoothing sensitivity rises where a 10% decrease in the SOA (more smoothing) becomes associated with a 0.17% (t-stat, -2.61) increase in the investment to asset ratio. This implies that dividend smoothing has an impact on the allocation of cash flow and the frictions associated with it are reduced once firms have better access to external finance.

There are two identification concerns with our results. First, dividends gradually adjust to permanent cash flow while being less responsive to transitory shocks (Lintner, 1956; Kumar and Lee, 2001; Lambrecht and Myres, 2012). In this case, dividend smoothing is sustained by internally generated permanent cash flow and external finance becomes less relevant. Second, the results described above are perfectly permissible under the dividend irrelevancy theorem where dividends and investments are jointly determined by the firms investment options (q). However, the investment options of the firm are not observable and thus researchers are unable to properly control for it clearly.

To address these concerns, following CDWY, we decompose the cash flow series into transitory and permanent components and repeat the analysis. While verifying that dividends are sustained by long-term trends in cash flow, we find that the previous results hold for the allocation of transitory cash flow and if anything, the results become even more pronounced. The investment-transitory cash flow for dividend-paying firms is 48% higher than that of for non-dividend paying firms and is 35% higher when compared to the full sample. Moreover, the two measures of dividend smoothing and the impact of financial constraints on the investment-dividend smoothing sensitivity remain significant for both transitory and permanent components of cash flow, reinforcing the claim that dividend smoothing induces a friction in the cash flow allocation of the firm and a better access to external funds mitigates these frictions. CDWY show that the transitory component of cash flow is unlikely to be correlated with investment options, therefore, our results are unlikely to be driven by unobservable investment options.

Stated differently, in response to transitory shocks in cash flow, investments must remain resilient and the loading on a lagged dividend smoothing measure in investment-transitory cash flow regression must be insignificant since investments are driven by growth options of the firm, and assuming frictionless access to the capital markets, abundantly available external funds are used to finance dividend smoothing if required. However, our results indicate that the variations in cash reserves and external finance are not enough to nullify the impact of dividend smoothing on the investments even in a transitory cash flow setting, resulting in significant positive investment-dividend smoothing sensitivity. Therefore, the irrelevancy theorem breaks down once we move towards the transitory component of cash flow.

Dividends are not the only method with which firms distribute cash among shareholders. Researchers document a sharp rise in share repurchases to the extend that Fama and French (2001), Grullon and Michaely (2002), and Skinner (2008), for example, argue that dividends are disappearing and share repurchases have become a primary method of distributing cash proceeds among shareholders. Therefore, we add share repurchases to dividends to come up with a measure of total payouts. We repeat the analysis and find that the relationship between the degree of total payout smoothing and investment is weak and is not affected by financial constraints. Thus, we conclude that the investment-sensitivity of dividend smoothing is primarily driven by dividend smoothing and not total payout smoothing. This is consistent with numerous studies that document stock repurchase as being used to distribute transitory cash flow (earnings). Furthermore, it is less likely that firms define a target total payout whereas they aim for a specific target dividend. This result is also in line with recent findings in Bonaimé, Hankins, and Harford (2013) where the authors show that flexible payout policy, one that favors repurchases over dividends, and hedging are substitutes. In this sense, firms that adhere to a more flexible dividend payout policy have better discretion in neutralizing shocks to cash flow compared to those firms with more rigid dividend policy that transfer shocks to their investment policy.

The rest of the article is organized as follows. In section one, a parsimonious theoretical model is developed. Section two describes the employed methodology. Section three provides data and summary statistics for the period 1987 through 2016, and the procedure that is followed to account for the cash flow identity, as well as conditioning the sample based on the payment of dividends. Section four summarizes the main findings. Lastly, section five concludes the investigation.

1 Model

In this section, we apply a simple adjustment to the benchmark model of KZ where it is assumed that dividends are a costly source of internal funds. In their model, KZ assume that firms have access to an internal cash flow (W) that is netted out of dividends paid out. They further assume that firms have a costly access to external funds which is captured by a cost wedge between internal and external funds (k). However, dividend changes may bear some costs that make it a costly source of internal finance. Then, if we observe a firm with smaller W and higher k, there is no way to infer that, is it because of dividends that the internal funds are less available and the k is higher or is it because the firm is truly financially more constrained? We intend to elaborate on the impact of costly dividends on the cash flow allocation by extending the KZ model.

We define a simple one-period model that a firm chooses the level of investment (I) to maximize profits. Production function $f(.)$ takes I and delivers return on investment $f(I)$, where $f' > 0$ and $f'' < 0$. There are two ways in which firms can finance their investments needs, either through internal funds $(C - D)$, where C is internally generated cash flow and D is dividends paid out, or with external funds (E). To maintain comparability with KZ, we also assume that the opportunity cost of internal funds equals the cost of capital that equals one. Raising external funds is costly mainly due to a management overconfidence, risk aversion, information or agency problems that induce a deadweight cost. The cost function of external funds is represented by $C^c(E, k)$, where E is the amount of external funds raised and k is a measure of a firm's wedge between the internal and the external costs of funds. In the model, we do not consider the choice between debt or equity finance for simplicity. It is assumed that $C^c(.)$ is raising in k, that is to say that the cost of raising external funds increases with the amount that is raised.

Market frictions that cause dividend smoothing are varied, from agency and information problems to rent seeking activities by managers and etc. (Kumar, 1988; Kumar and Lee, 2001; Baker and Wurgler, 2004; Guttman, Kadan, and Kandel, 2010; Leary and Michaely, 2011; Lambrecht and Myres, 2012; Baker, Mendel, and Wurgler, 2015; Wu, 2016). We proxy for the additional cost associated with smooth dividends by a function $C^d(D, l)$, where D is the amount of dividends paid out, and l is a measure of a firm's wedge between retention and distribution costs of funds. Extant literature documents that the absolute size of the market reaction to dividend cuts is proportional to the size of the cut where omission bears the maximum punishment (Pettit, 1972; Ghosh and Woolridge, 1989; DeAngelo and DeAngelo, 1990). Therefore, it is plausible to assume that C^d is increasing in l, that is, the cost of a dividend cut monotonically increases with the amount of the cut, all the way to a dividend omission.

Now, the set of financial constraint measures include the traditional cost wedge between internal and external funds (k) and the availability of internal cash flow (C^c), as well as, a new member l which is the cost wedge between the retention and the distribution of funds.

A given firm chooses I to maximize the profits as follows:

$$\max f(I) - C^c(E,k) - C^d(D,l) - I, \qquad s.t.\ I = C - D + E \tag{1}$$

We assume that both cost functions, $C^c(.)$ and $C^d(.)$ are convex in E and l, respectively[3].

The first-best investment policy is achieved by taking first-order condition of the system (1) and equate it to zero, that is

$$f_1(I) = 1 + C^c_1(I - C + D, k) - C^d_1(C + E - I, l) \tag{2}$$

where $f_1()$ is the first derivative of f with respect to I, and $C^c_1(0)$ and $C^d_1(0)$ are the partial derivative of C^c and C^d with respect to their first arguments.

The relationship in (2) is interesting in that, even if a firm is not financially constrained, its first-best investment decision gets affected should the firm go along with cutting the dividends. Evidently, a firm with unconditional access to outside finance would contemplate on cutting dividends but still this relationship shows one of the upsides of having the cost of a dividend cut as a separate stand-alone term in the model.

By taking implicit differentiation of (2), the relationship between available internal finance and investment is immediate:

$$\frac{dI}{dC} = \frac{C^c_{11} + C^d_{11}}{C^c_{11} + C^d_{11} - f_{11}} \tag{3}$$

convexity of C^c and C^d assures that (3) is positive. Rewriting (3), we have:

$$\frac{dI}{dC} = 1 + \frac{f_{11}}{C^c_{11} + C^d_{11} - f_{11}} \tag{4}$$

[3]The convexity of $C^c(.)$ in E is questionable and as noted by KZ it might not be warranted. However, we concede to this in order to maintain comparability with the benchmark model. Convexity of $C^d(.)$ in l is less of a concern because as we discussed, prior research show that cost of cutting dividends increases with the size of the dividend cut.

In a perfect capital market where firms have access to abundant external funds without additional costs, we have $C^c(.) = 0$ and thus $C^c_{11} = 0$. In such a world, firms' access to external funds is costless which makes the cost associated with a dividend cut irrelevant ($C^d(.) = 0$) and thus $C^d_{11} = 0$. Since $f_{11} < 0$, it is clear that (4) collapses to zero, that is, investments are not sensitive to internal cash flow at all.

However, in an imperfect market where access to external funds is costly, then (4) is different than zero which means investments are positively associates with cash flow. In an extreme case, the investment-cash flow sensitivity rises to unity, that is investments are fully (100%) associated with internal cash flow.

The argument is that because $C^d_{11} > 0$, it is clear that costs associated with a dividend cut increases the investment-cash flow sensitivity. If a firm does not pay dividends at all, then the cost associated with altering dividends is effectively zero which reduces the investment-cash flow sensitivity. As it can be seen, dividends introduce a friction into the cash flow allocation of the firm which affects the sensitivity of investments to cash flow.

Following KZ, by implicit differentiation of (2), it is possible to derive the sensitivity of investment to the wedge between the cost of internal and external financing (k) as follows:

$$\frac{dI}{dk} = \frac{-C^c_{12}}{C^c_{11} - f_{11}} \tag{5}$$

consistent with KZ dI/dk is negative if $C^c_{12} > 0$ (i.e., the marginal cost of raising external finance is increasing in k), which means that there is a negative association between the cost wedge of internal and external finance and the investments.

By the same token, we can derive the sensitivity of investment to the wedge between the cost of retention and distribution of funds (l). Again, by implicit differentiation of (2), we have:

$$\frac{dI}{dl} = \frac{C^d_{12}}{C^d_{11} - f_{11}} \tag{6}$$

which is positive if the marginal cost of a dividend cut is increasing in l (i.e., $C^d_{12} > 0$).

There are two immediate implications of our model. First, dividend smoothing increases the investment-cash flow sensitivity. Second, the friction arising from dividend smoothing is positively associated with the investment. In the empirical section, we will test these two theoretical predictions.

As correctly pointed out by KZ, the results outlined above do not necessary implicate any financial constraints. We need to satisfy the monotonicity condition, i.e. to show that either d^2I/dC^2 is negative or $d^2I/dCdl$ is negative. Applying implicit differentiation to (3), we obtain:

$$\frac{d^2I}{dC^2} = \frac{f_{111}[C^c_{11}+C^d_{11}]^2 - f^2_{11}[C^c_{111}+C^d_{111}]}{(C^c_{11}+C^d_{11}-f_{11})^3} \tag{7}$$

Assuming that $f^2_{11} > 0$ and $[C^c_{11}+C^d_{11}] > 0$, we can rewrite (7) as

$$\frac{d^2I}{dC^2} = \left[\frac{f_{111}}{f^2_{11}} - \frac{[C^c_{111}+C^d_{111}]}{[C^c_{11}+C^d_{11}]^2}\right]\frac{f^2_{11}[C^c_{11}+C^d_{11}]^2}{(C^c_{11}+C^d_{11}-f_{11})^3} \tag{8}$$

Evidently, the second term is always positive, therefore to assure that $\partial^2I/\partial C^2 < 0$ is always satisfied, we need to show that $[f_{111}/f^2_{11} - [C^c_{111}+C^d_{111}]/[C^c_{11}+C^d_{11}]^2]$ is negative. We acknowledge that this condition may be violated as KZ argue. Consider a case where both $C^c(.)$ and $C^d(.)$ are quadric then one can arbitrary find numerous production functions with $f_{111} > 0$ that violate the condition numerous times. Nevertheless, it is important to note that since we require both the cost function to be the same and $[C^c_{111}+C^d_{111}] \geqslant C^c_{111}$ for any dividend paying firms, then the violation of the $d^2I/dC^2 < 0$ condition in (8) is more restrictive than that reported by KZ which only includes C^c_{111}. Moreover, Bond and Söderbom (2013) assured monotonicity once they condition on marginal q. Therefore, we leave the empirical results to determine the empirical relationship of (8) where we control for marginal q.

It is also possible to derive $d^2I/dCdl$ by implicit differentiation of (3) as:

$$\frac{d^2I}{dCdl} = \frac{f_{11}C^d_{12}[C^d_{111} - C^c_{111}] + f_{111}[C^d_{12}C^d_{11} + C^d_{12}C^c_{11}] - f_{11}C^d_{112}[C^c_{11} + C^d_{11} + f_{11}]}{(C^c_{11} + C^d_{11} - f_{11})^3} \tag{9}$$

While we find the trade-off between the third derivative of cost functions ($[C^d_{111} - C^c_{111}]$) particularly interesting, satisfying the monotonicity condition is non-trivial. To show that $\partial^2 I/\partial C\partial l$ is negative, assume that $C^c_{11}, C^d_{11}, C^d_{12}, C^d_{112} > 0$, then one of the most restrictive options is to show that $[C^c_{11} + C^d_{11}] < f_{11}$ and $f_{111} < 0$ and $C^d_{111} > C^c_{111}$ are jointly satisfied. This is rather problematic given that finding a production function f with $f_{111} > 0$ is not that difficult. This brings us to a trade-off between the third and second derivatives of the cost function and the second and third derivative of production function which is ultimately an empirical question that we intent to address later on.

2 Methodology

We closely follow CDWY, in our estimation strategy. In order to account for simultaneity in corporate cash-related policy, we employ the intertemporal budget constraint (IBC) which is an under-appreciated concept in corporate finance theories (Lambrecht and Myres, 2012). Firms are bound by IBC, that is, an additional dollar of a firm's internally generated cash flow could be distributed as dividend, retained as cash reserves (zero-NPV), spent on investment, used to repay debt or reduce equity financing. Therefore, flow-of-funds (cash flow) data provides us with the following cash flow identity for a given firm:

$$\mathrm{Inv}_t + \mathrm{CR}_t + \mathrm{Div}_t - \mathrm{ND}_t - \mathrm{NQ}_t = \mathrm{CF}_t \tag{10}$$

where the internally generated cash flow (CF_t), the net debt issuance (ND_t), and the net equity issuance (NQ_t) are considered sources of funds. The uses of funds include investment (Inv_t), the change in cash holdings (CR_t), and cash dividend Div_t.

According to Equation(10), each dollar of funds used ($\text{Inv}_t + \text{CR}_t + \text{Div}_t$) that is not financed through financing activities ($\text{ND}_t + \text{NQ}_t$) is financed by internal cash flow (CF_t).

In the baseline model, each component of the cash flow identity delineated in Equation(10) is regressed on cash flow (CF_{it}) where a vector of control variables (V) are added to control for observed heterogeneity among firms. Year dummies (y) are embedded into the regressions to account for time effects. Also, all variables are demeaned to partially treat unobserved heterogeneity. Hence, our empirical regression model is written as follows:

$$\text{Inv}_{it} = \alpha^{\text{Inv}} + \beta_1^{\text{Inv}}\text{CF}_{it} + \beta_2^{\text{Inv}}\text{V}_{it-1} + y_t + \varepsilon_{it}^{\text{Inv}}, \tag{11}$$

$$\text{Div}_{it} = \alpha^{Div} + \beta_1^{Div}\text{CF}_{it} + \beta_2^{Div}\text{V}_{it-1} + y_t + \varepsilon_{it}^{Div}, \tag{12}$$

$$\text{CR}_{it} = \alpha^{CR} + \beta_1^{CR}\text{CF}_{it} + \beta_2^{CR}\text{V}_{it-1} + y_t + \varepsilon_{it}^{CR}, \tag{13}$$

$$\text{ND}_{it} = \alpha^{ND} + \beta_1^{ND}\text{CF}_{it} + \beta_2^{ND}\text{V}_{it-1} + y_t + \varepsilon_{it}^{ND}, \tag{14}$$

$$\text{NQ}_{it} = \alpha^{NQ} + \beta_1^{NQ}\text{CF}_{it} + \beta_2^{NQ}\text{V}_{it-1} + y_t + \varepsilon_{it}^{NQ}, \tag{15}$$

For a given firm(i) in a given time(t), sources of funds must equate the uses of funds (the accounting identity). It follows that the coefficients of CF (β_1) in Equations(11)–(15) must add up to unity and since V_{t-1} are exogenously predetermined with respect to CF_t, the coefficients on all of these variables (β_2) must add up to zero. Then, we have the following constraints:

$$\beta_1^{\text{Inv}} + \beta_1^{\text{Div}} + \beta_1^{\text{CR}} - \beta_1^{\text{ND}} - \beta_1^{\text{NQ}} = 1 \tag{16}$$

$$\beta_2^{\text{Inv}} + \beta_2^{\text{Div}} + \beta_2^{\text{CR}} - \beta_2^{\text{ND}} - \beta_2^{\text{NQ}} = 0 \tag{17}$$

Since we apply flow of funds data, the cash flow identity must hold without explicit imposition of constraints (16)–(17). CDWY show that a consistent definition of cash flow variables in Equation(10) waivers the explicit imposition of the constraints. They also demonstrate that Equations(11)–(15) can be consistently estimated by OLS because the set of explanatory variables are all the same across equations that makes equation-by-equation OLS equivalent to seemingly unrelated regressions (SUR). Hence, we estimate the system of equations by applying OLS to each equation where restrictions are explicitly imposed to strictly abide by the constraints.

Following common practice in the literature, all the variables are standardized by total asset at the beginning of the fiscal year. The vector of control variables (V) includes: the market-to-book ratio (MB) to account for investment opportunities of firms, the log of the book value of assets, Ln(Assets), as a proxy for firm size, the sales growth (SalesG) as an additional control for firm growth prospects, the net PPE-to-asset ratio (Tangibility) is used to measure the tangibility of firm assets. We also include the leverage ratio (Leverage) defined as total interest-bearing debt (the sum of short-term and long-term debt) divided by total assets.

In the baseline model, we report the results of applying our structural model to the full sample in an attempt to provide a comparability with CDWY although they have not directly considered nor discussed the effect of dividend smoothing. Then, we test the first implications of our model in (3) by dividing our sample into dividend paying and non-dividend paying firms, while expecting higher investment-cash flow sensitivity among dividend paying firms compared to their non-dividend paying peers.

Furthermore, to test the second implication of our model in (6), we include an estimate of dividend smoothing (DS) into the system of cash flow allocation as follows:

$$\text{Inv}_{it} = \alpha^{\text{Inv}} + \beta_1^{\text{Inv}}\text{CF}_{it} + \beta_2^{\text{Inv}}\text{DS}_{it-1} + \beta_3^{\text{Inv}}\text{V}_{it-1} + y_t + \varepsilon_{it}^{\text{Inv}}, \tag{18}$$

$$\text{Div}_{it} = \alpha^{Div} + \beta_1^{Div}\text{CF}_{it} + \beta_2^{Div}\text{DS}_{it-1} + \beta_3^{Div}\text{V}_{it-1} + y_t + \varepsilon_{it}^{Div}, \tag{19}$$

$$\text{CR}_{it} = \alpha^{CR} + \beta_1^{CR}\text{CF}_{it} + \beta_2^{CR}\text{DS}_{it-1} + \beta_3^{CR}\text{V}_{it-1} + y_t + \varepsilon_{it}^{CR}, \tag{20}$$

$$\text{ND}_{it} = \alpha^{ND} + \beta_1^{ND}\text{CF}_{it} + \beta_2^{ND}\text{DS}_{it-1} + \beta_2^{ND}\text{V}_{it-1} + y_t + \varepsilon_{it}^{ND}, \tag{21}$$

$$\text{NQ}_{it} = \alpha^{NQ} + \beta_1^{NQ}\text{CF}_{it} + \beta_2^{NQ}\text{DS}_{it-1} + \beta_3^{ND}\text{V}_{it-1} + y_t + \varepsilon_{it}^{NQ}, \tag{22}$$

Dividend smoothing measure is lagged (DS_{t-1}) and is determined in last period which makes it strictly exogenous to the current period cash flow identity, so the corresponding restrictions are

$$\beta_1^{\text{Inv}} + \beta_1^{\text{Div}} + \beta_1^{\text{CR}} - \beta_1^{\text{ND}} - \beta_1^{\text{NQ}} = 1 \tag{23}$$

$$\beta_2^{\text{Inv}} + \beta_2^{\text{Div}} + \beta_2^{\text{CR}} - \beta_2^{\text{ND}} - \beta_2^{\text{NQ}} = 0 \tag{24}$$

$$\beta_3^{\text{Inv}} + \beta_3^{\text{Div}} + \beta_3^{\text{CR}} - \beta_3^{\text{ND}} - \beta_3^{\text{NQ}} = 0 \tag{25}$$

Adding a measure of dividend smoothing provides several interesting insights that are central to the thesis of current study. As discussed in section 1, our theoretical prediction in (6) suggests that higher dividend smoothing must be positively associated with investments. Furthermore, it is expected that DS is positively associated with other uses of funds (CR_t) while simultaneously, it has a negative relationship with the sources of funds (ND_t and NQ_t).

If a firm is more financially constrained, then more (less) dividend smoothing increases (decreases) the impact of DS on available cash flow and the firm has less (more) discretion in modifying its response to transitory shocks to cash flow. The notion of dividends as a precommitment device is explored by John, Knyazeva, and Knyazeva (2015) where they conclude that firms that are more prone to weak governance scheme, precommit to a regular dividend payout scheme to mitigate the agency costs of cash flow. Nevertheless, we investigate the precommitment constraint that dividend smoothing imposes on the allocation of internal cash flow and the ways in which it alters the cash-related decisions.

Second, one should note that the positive relationship between dividend smoothing and investments is on a yearly basis. However, it is a stylized fact that a firm's growth options usually span beyond one year and are long-term in nature (Lambrecht and Myres, 2012). Given fixed cash flow, less variation in investment must mean more changes in cash reserves, changes in net debt issuance, changes in equity issuance, or more flexible payout. Therefore, it follows that firms that smooth dividends more (less) must have more (less) changes in their cash reserves, outside finance, or both. Later on, we provide further evidence in support of this proposition.

Lastly, the most prevailing critique for this approach is the inability to observe (and thus properly control for) true q (i.e. investment options) which undermines the robustness of estimate measures due to measurement errors. We address this concert by decomposing cash flow into its transitory and permanent components. CDWY show that the transitory component of the cash flow is quite random in nature and thus is less likely to be correlated with the firms investment options. We follow this procedure although we apply different filtering scheme due to its proficiency.

Cash flow decomposition

In order to investigate how dividend smoothing alters the allocation of cash flow, we need to properly control for unobserved q. Therefore, we decompose the cash flow into its transitory and permanent components and investigate the impact of dividends and dividend smoothing on the transitory shocks in cash flow. CDWY show that the transitory component of cash flow is uncorrelated with investment options (q).

We decompose the CF series for each firm (i) into its trend and cyclical components by applying a rational square-wave filters method of Pollock (2000) (Henceforth, BW) which is a variation of the Butterworth (1930) high-pass filters tailored towards economic applications. In the baseline model, we stick to the BW filter and leave other alternative filters (Christiano and Fitzgerald, 2003; Baxter and King, 1999) as robustness checks[4].

Despite the inherent complexity of the BW filter, it has certain attributes which makes it an appropriate choice for our work. The BW filter is "maximally flat", that is, its gain function approaches zero (flat line) for unwanted frequencies-ripples while becoming nearly a flat line (full gain at 1) for the wanted frequencies. In the current work of decomposing the CF series into its trend and cycle components, we also should limit the possibility of spill overs from trend components into cyclical components, or vice versa.

High-pass filters block lower-frequency stochastic cycles while passing through stochastic cycles that are at or above a specific frequency. Assume that we have a finite time series of interest y_t as defined below:

$$y_t = \tau_t + c_t \tag{26}$$

where $(t = 1, ..., T-1)$, τ_t is trend components and $c_t \sim i.i.d.N(0, \sigma^2)$ is the cyclical component. τ_t may be non-stationary, i.e. it may contain a deterministic or a stochastic trend.

Like many other filters,the BW filter initially estimates stationary cyclical components (c_t), that is stochastic cycles within a specified range of periods, and then the trend (τ_t) is simply the difference:

$$\tau_t = y_t - c_t \tag{27}$$

Further, according to Pollock (2000), the gain function of the BW high-pass filter is given by:

[4]We do not tabulate the results of applying Hodrick and Prescott (1997)'s filter due to severe criticism in the literature (Pollock, 2000; Hamilton, 2017)

$$\psi(\omega) = \left[\left\{ 1 + \frac{tan(\omega_c/2)}{tan(\omega_c/2)} \right\}^{2m} \right]^{-1} \tag{28}$$

where m represents the order of the filter, $\omega_c = 2\pi/p_h$ is the cutoff frequency, and p_h is the maximum period. Following general practice, we set p_h to 8 years since we have annual data.

One could write y_t as a function of ν_t and ϵ_t, two zero mean, covariance stationary, and i.i.d shocks as follows:

$$y_t = \frac{(1+L)^m}{(1-L)^m}\nu_t + \epsilon_t \tag{29}$$

where L is lag operators which moves forward and backward over y_t.

Pollock (2000) shows that the optimal estimate for c_t (represented in a vector containing all cs is given by:

$$c = \lambda \mathrm{Q}(\Omega_L + \lambda\Omega_H)^{-1}\mathrm{Q}^{'}y \tag{30}$$

where $\lambda = tan(\pi/p_h)^{-2m}$ which is a function of order and maximum period, $\Omega_L = \frac{Var\{\mathrm{Q}^{`}(y-c)\}}{\sigma_\nu^2}$ and $\Omega_H = \frac{Var\{\mathrm{Q}^{`}c\}}{\sigma_\epsilon^2}$ are symmetric Toeplitz matrices. $\mathrm{Q}^{'}$ is a matrix which stores the coefficients of the polynomial $(1-L)^d = 1 + \delta_1 L + ... + \delta_d L^d$.

After applying the filter to the unscaled CF series for each firm, we obtain the trend (CF_Trend) and cycle (CF_Cycle) components of the original series which we then deflate by the beginning-of-period book value of assets to arrive at the applicable variables that are included in our analysis.

Estimating dividend smoothing measures

In order to test the second implication of our model in (6), we need a measure of dividend smoothing. Empirically, estimating the degree to which firms smooth dividends is not an easy task. Lintner (1956) was the first to propose an empirical partial adjustment model that predicts changes in dividends. According to this model:

$$\Delta \text{Dividend}_t = \alpha + \text{SOA}(\text{Target Dividend}_t - \text{Dividend}_{t-1}) + \epsilon_t \tag{31}$$

where $\Delta\text{Dividend}_t$ is the change in dividend from the previous dividend at period $t-1$, $\text{SOA} < 1$ is the Speed of Adjustment of dividend, Target Dividend_t is the target dividends payout ratio at time t multiplied by current earnings, *alpha* is a constant and ϵ_t is an error term. The target payout ratio, α, and SOA are assumed constant over time, although they can vary across firms. The outcome variable is a smooth dividend as a function of earnings.

However, Leary and Michaely (2011) show that even within the current structure of Lintner's model, the Speed of Adjustment of dividend (SOA) is a materially biased estimate of the true SOA mainly due to the small-sample bias in estimating autoregressive models. Furthermore, they proposed two measures that correct for the SOA's estimation biases. Their first measure is a two-step procedure to estimate SOA. Firstly, they estimate an unobservable target dividend payout ratio (Target_i) as the firm median dividend payout ratio over 10-year rolling windows in the sample period. They defined the dividend payout ratio as common dividends divided by net income.

Next, they estimate the gap between the lagged dividends and the target dividends as follows:

$$\text{dev}_{it} = \text{Target}_i * \text{E}_{it} - \text{Dividend}_{it-1} \tag{32}$$

Lastly, they regress deviation from the target measure on changes in dividend in a 10–year rolling window, obtaining a time series estimate for the β coefficient which is the alternative SOA. We closely follow this procedure to obtain an estimate of SOA. Given that this measure captures the degree of smoothness as defined by Lintner's model, we report our baseline results in this section by applying this proxy for the SOA.

$$\Delta \text{Dividend}_{it} = \alpha + \beta * \text{dev}_{it} + \epsilon_{it} \tag{33}$$

where $\Delta\text{Dividend}_{it}$ is change in dividend, dev_{it} is an estimate of deviation from the target dividend, E_{it} is earnings, and Div_{it-1} is the lagged dividend.

The second alternative measure of dividend smoothing introduced by Leary and Michaely (2011) is a non-parametric measure of dividend smoothing. The logic behind this measure is the inherent limitations in the SOA. For example, Brav et al. (2005) survey results show that only 28% of CFOs claim that they target the payout ratio, while almost 40% claim that they target the level of dividend per share (DPS). This casts doubts on the empirical relevance of Lintner's model in more recent samples of firms. Leary and Michaely (2011) acknowledge the potential impact of ignoring a sub-sample of firms that target DPS instead of a payout ratio and introduce a model free non-parametric measure of smoothing. They construct a measure of dividend volatility relative to that of earnings. First, they multiply the firm's median dividend payout ratio by each year's earnings to mitigate the effect of the dividend level on the relative volatilities. Then, the series are detrended by the following regressions:

$$\text{AdjDPS}_{it} = \alpha_1 + \beta_1 * t + \beta_2 * t^2 + \epsilon_{it}, \tag{34}$$

$$\text{Target}_i * \text{AdjEPS}_{it} = \alpha_2 + \gamma_1 * t + \gamma_2 * t^2 + \eta_{it} \tag{35}$$

The regressions are estimated in the same 10-year rolling window as before. Lastly, they define their measure as the ratio of the root mean squared errors from these two regressions $(\sigma(\epsilon)/\sigma(\eta))$ and refer to it as a relative volatility measure.

In order to measure the SOA, we require sample firms to have at least 10 years of dividend payment and non-missing cash flow variable data for at least 15 years. We start from 1972 to allow for a 10-year estimation window required by our measures. Then, we divide the panel into 10–year overlapping rolling window panels. Over each panel, the median target payout ratio and the deviation from the target are estimated according to Equation(32). The SOA is obtained by fitting Equation(33) and estimating β. We remove negative SOA and SOA larger than one to be consistent with Lintner's distributed lag model. The alternative dividend smoothing measure, relative volatility, is also calculated over rolling windows in the same fashion by applying earlier outlined methodology. To assure that the results are not driven by outliers and also to achieve a more stable estimates, the two measures are winsorized at the top 1% (consistent with (Leary and Michaely, 2011)). We apply this procedure in an attempt to provide an alternative method of analysis and thus offer a robustness check for our results.

Figure1 illustrates the time series evolution of the median SOA and the relative volatility measures, as well as related empirical distributions for the period 1982-2016. The two measures of dividend smoothing are highly correlated. The correlation between the median SOA and the median relative volatility measure is 0.87 and the correlation between the SOA and the relative volatility is 0.58. Since the relative volatility measure is unbounded from above, it differs from SOA in the scale. The pattern in the figure is close to what is reported by (Leary and Michaely 2011, Panel A Figure 6) for the comparable time period. However, since their sample ends in 2005, we can provide more information on the evolution of smoothing over a more recent period.

After the 2000-2002 turmoil in the market, smoothing measures were steadily on the rise which could be the product of dividend cuts during the period of economic unrest. Nevertheless, both measures remain fairly stable throughout the sample period, consistent with the findings of Floyd et al. (2015) and Almeida, Campello, Laranjeira, and Weisbenner (2009) that assert dividends are resilient. The empirical distribution of the two measures show a sizable variation in our panel. There is a mass of 28% and 9% concentrated exactly at zero for SOA and relative volatility, respectively which shows relative prevalence of zero dividend changes (i.e. dividend stickiness) among sample firms.

It is important to note that these two measures of dividend smoothing are not substitutable and capture different aspects of dividend smoothing. In the SOA measure of dividend smoothing, deviation from the target is a key factor in determining the degree of smoothing whereas the relative volatility measure of dividend smoothing captures the relative variations in dividends with respect to earnings and does not include deviation from the target. Therefore, we treat the SOA as the main dividend smoothing estimate, while appending it with the relative volatility measure of dividend smoothing to provide a more comprehensive picture.

3 Data and summary statistics

Our sample includes all U.S. firms in the intersection of the Compustat industrial annual files and CRSP tape at any point between 1987 and 2016. Compustat maintains an indicative variable (format code) to account for the different methods of reporting flow-of-fund data. We limit the sample to those firms with non-missing format code 7 to maintain consistency in the definition of flow-of-funds data. Limiting sample firms to have non-missing flow-of-funds data forces the starting point of our sample to 1987. Although Compustat starts to report flow-of-funds data extensively in 1971, we notice that prior to 1984, changes in cash variables (Compustat item CHECH, Cash and Cash Equivalents - Increase/Decrease) has missing values for up to 93% of the sample firms. This casts doubt on the validity of the cash flow identity in Equation(10) prior to 1984. To account for this and to consider the substantial increase in share repurchases in 1982 (Bagwell and Shoven, 1989), we set the starting point of the sample to 1984. However, by applying more filters to the data, the sample period is limited to 1987–2016. We closely follow Frank and Goyal (2003) and CDWY in setting up our cash flow identity variables. The GDP deflator was used to convert all dollar values into 2010 constant dollars.

We exclude financial institutions (SIC codes 6000–6999), utilities (SIC codes 4900–4999), from our sample to maintain comparability with prior studies. The sample is also restricted to those firms with non-missing dividend data, and those with non-missing data for key cash flow identity variables. Following Almeida et al. (2004), firms with extreme asset growth (larger than 100%), a market value of assets below $1 million, and those with annual sales lower than $1 million are dropped from the sample to make sure that the sample is not biased towards more financially distressed firms. Moreover, following CDWY, if the absolute value of the difference between the left-hand and right-hand sides of Equation(1) is greater than 1% of the beginning-of-period total assets, we exclude that observation. To avoid concerns arising from firms' attrition in an unbalanced panel, we require a given firm to pay dividends for at least 10 years (for dividend-paying firms) and at least 10 years of non-dividend paying (for non-dividend paying firms). We restrict the sample to firms that are listed in Compustat for at least 15 years to allow for the BW filter to detect the trend and decompose the series. Last, we are left with 28,313 firm-year observations and the final sample period that runs from, 1987 to 2016.

Following CDWY, we define cash flow (CF) as the operating cash flow, net of the change in working capital which mitigate the unwanted positive correlation between investment and working capital accruals. Earnings is defined as income before extraordinary items plus extraordinary items and discontinued operations. These variables and all other variables are scaled by the beginning of the year total asset and winsorized at the 1% top and bottom level.

Summary statistics of main variables

Summary statistics for the key variables in the full sample, dividend-paying, and non-dividend-paying sub-samples are reported in Table1. An average firm in our full sample distributes 15% of its income as dividends which mounts to an average annual figure of $26 million (2010 constant dollar), has a total payout ratio (dividends plus repurchases divided by net income) of 31%, reports $0.1 earnings per share, has $369 million of total assets with a 0.13% annual sales growth rate, an annual earnings volatility of 0.07%, 27% of its total assets are tangible assets, has an average leverage of 0.20, and its Market-to-Book ratio is approximately 1.81.

Dividend-paying firms are biased towards bigger and more mature firms compared non-dividend-paying firms, with more tangible assets, more leverage and a higher ROA. Consisted with intuition, non-dividend payers have a higher sales growth, higher Book-to-Market ratio, higher earnings volatility, and a lower total payout ratio (%11) relative to dividend-paying firms (56%).

Clearly, the two sub-samples of dividend-payers and non-dividend payers are not fully comparable. However, this is by necessity since we intent to investigate both dividend smoothing and cash flow allocation behavior among firms that limit our sample to firms that pay dividends for at least 10 years and have non-missing cash flow variable data for at least 15 years. This approach is also consistent with the claim that Lintner's model is most applicable to large (publicly-traded) mature firms (Lintner, 1956; Myers and Majluf, 1984; Lambrecht and Myres, 2012). Furthermore, we keep reporting the results for non-dividend paying firms in order to supply the readers with characteristics of a sub-sample of firms that are not the focus of this study.

We manage to replicate the mean, median, and standard deviation(SD) of almost all cash flow variables reported in CDWY, except for the mean and the SD of investments. CDWY report a mean and a SD of 0.092 and 0.142, respectively, while we report 0.08 and 0.13, respectively. We attribute this discrepancy to the sample period difference since our median is closely matched theirs.

Dividend-paying firms, on average, have two times higher cash flow at their disposal compared to non-dividend paying firms. The mean of investments of the two sub-samples are only weakly (at 10%) different where non-dividend paying firms invest slightly more than their non-dividend paying firms. Non-dividend paying firms issue more shares than dividend paying firms, while the two sub-samples have the same average net debt issuance.

An average firm in our sample pays 1% of its total assets as dividends (Div) and reserve 1% of its total assets as a cash buffer (CR) while it invests 8% of its total assets (Inv) this use of funds is almost entirely financed by internally generated cash flow which amounts to

8% of the total assets. Outside finance plays a much less important role in the cash flow allocation of our typical firm in the sample that only issues 1% of its total assets as new debt (ND) while it retires its equity (NQ) by 1% of its assets.

We find that the average dividend-paying firm in our sample invests and holds cash almost at the same level as the average firm in the full sample, while paying 1 cent more dividends out of an additional dollar of cash flow. On the other hand, dividend-paying firms issue more debt (1 cent of a dollar more) and retire equity more (1 cent of a dollar more). A priori, we find that these results are consistent with our sample selection where we select dividend-paying firms that are well-established and have better access to capital market.

Lastly, we report a residual term (DIF) which is the absolute value of the difference between the left-hand and right-hand sides of Equation(10). The mean of DIF is close to zero and it has a very small SD in the full sample showing that the cash flow identity holds well in our sample. Moreover, Table 1 depicts that the cash flow decomposition was successful in filtering the cash flow series into zero mean cash flow cycles in the full sample, as well as in the two sub-samples. Notice that the mean of cash flow cycles are not statistically differentiable in the two sub-samples which provides us with ground to argue that cash flow shocks have the same mean property in the two sub-samples. Naturally, the cash flow trend must and is different in the two sub-samples.

In order to show that smoothing measures have a significant variation in the cross-section of firms, we divide our sample into Quintiles based on the beginning of the year SOA (relative volatility) measures. Then, within each Quintile, the mean (median) statistics are reported in Table 2. The last column presents the t-statistics of the difference between the highest (Q5) and the lowest (Q1) of the SOA measure, as well as the relative volatility measure.

According to our SOA measure of dividend smoothing, firms that smooth more (Q1) are, on average, larger, more levered firms with a lower Market-to-Book ratio, a lower Return-on-Asset (ROA) ratio, and lower cash flow compared to firms that smooth less (Q5). Consistent with the findings of Leary and Michaely (2011), we also find that firms that smooth dividends more, pay out less dividends (2% of total assets) than firms that smooth less (3% of total assets). In effect, firms that smooth dividends the most have lower average dividends and total payout ratios (32%, and 54%, respectively) compared to firms that smooth the least (44%, and 61%, respectively). However, firms in first quintile have higher DPS and EPS than the firms in fifth quintile although the difference is only marginally significant.

The alternative measure of dividend smoothing (relative volatility) provides more or less the same picture. The only difference is that the difference in DPS and EPS of the lowest quintile and the highest quintile is not significant at traditional levels, and firms that smooth the most buy back their own shares more, causing larger changes in the net equity issuance relative to firms that smooth dividends the least. There is no significant difference between average investment to asset ratios, cash reserve to asset ratios, dividend yields, and cyclical components of cash flow.

Lower (average) dividend payout ratio for firms that smooth dividend the most has an immediate implication. Empirically, dividend are one of the most widely used variables in determining a firms' financial constraint (Farre-Mensa and Ljungqvist, 2016), dating back to the seminal work of Fazzari et al. (1988). In a sample of 49 firms, Fazzari et al. (1988) found that firms that pay no or low dividends experience larger cash flow sensitivity of investment. In response, Kaplan and Zingales (1997) show that only 15% of firms in the Fazzari et al. (1988) sample were actually financially constrained, and therefore, low dividends could not be a valid indicator in screening financially constrained firms. Along this line of literature and consistent with our conjecture, Table 2 shows that the key missing component is dividend smoothing, where firms that smooth dividends more have lower dividend payout ratios compared to firms that smooth dividends less. Therefore, we provide insight into the potential impact of dividends (and its smoothing) on the financial constraint of the firm.

4 Results

In this section, we test the first implication of our model (3) that dividend-paying firms must have higher investment-cash flow sensitivity. We start by reporting the results for the full sample, then move on to the output for the two sub-samples of dividend-paying and non-dividend paying firms.

Dividends and cash flow allocation

We estimate Equations (11)–(15) where constraints(16)–(17) are simultaneously imposed for the full sample and the two sub-samples, separately. Green (2012, p. 293-295) argues that if the same explanatory variables are applied to a system of equation, SUR is equivalent to equation-by-equation OLS. CDWY confirm this results and mathematically derive equivalency between SUR and equation-by-equation OLS. On the other hand, Baum (2006, p. 242) suggests that applying SUR to a system of equations with adding-up constraints will results in estimator failure due to a singular covariance matrix. Therefore, we employ OLS equation-by-equation to estimate regressions and impose the adding-up constraints, simultaneously.

We control for other variables that potentially may affect the allocation of cash flow, add year dummy variables to control for time trends in the data, and demeaned all variables to account for possible unobservable variables that may affect the relationship of our interest but we can not control for.

First, we compare our results outlined in Table 3 with the findings outlined in CDWY (Table 3). Economically, in response to a one-dollar increase in the overall cash flow, sample firms, on average, payout 1 cents as dividend, use 25 cents to invest, retain 31 cents as cash, reduce equity finance by 19 cents, and retire 24 cents of the debts. Except for the coefficient on net equity issuance, our results are close to the findings in CDWY. Signs, statistical significance (t-stats), and the magnitude of the coefficients on the lagged control variables are also very much in line with the output reported in CDWY.

However, when we move on to the trend and cycle components of the cash flow, we observe that our results slightly differ to those reported by CDWY. For example, we document that firms pay almost three times more dividends (3 cents out of each additional dollar) out of the trend component of cash flow than they do from the cyclical component (0.004 cents out of each additional dollar) but CDWY find that firms keep paying 1 cents out of each additional dollar of either transitory or permanent component of cash flow. This could be due to additional screening with regards to dividends we put in place, different sample period we applied, or alternatively it could be attributable to a more consistent definition of cash flow we have in our study. In any case, we find our results more aligned with the literature (Lintner, 1963; Fama and Babiak, 1968; Skinner, 2008; Lambrecht and Myres, 2012) that shows firms pay dividends out of permanent earnings more so than they do out of transitory earnings.

In terms of the coefficients of the trend and cyclical cash flows on investments and cash reserve, our results are very much close to CDWY. In this sense, we are able to verify CDWY's main findings that in response to cyclical cash flow shocks, firms tend to retain more cash rather than spend on investments. In terms of outside finance, however, we observe that net equity issuance is more active in responding to both components of the cash flow in our results than it is in CDWY's report although the qualitative role of external finance remains consistent with their findings. Again, finding signs, statistical significance (t-stats), and the magnitude of the coefficients on the lagged control variables very much in line with the output reported in CDWY is reassuring that we are on the same page in Table 3.

Next, we estimate the same system of equations in the two sub-samples of dividend-paying and non-dividend paying firms. Table 4 summarizes the results. Although all of the control variables and time dummies were included in the model while estimating, for brevity they were not reported in the output.

The results are conclusive. The investment-cash flow sensitivity is 20% higher for dividend-paying firms than non-dividend paying firms and the full sample. In order to mitigate unobserved growth options, it is beneficial to study how firms allocate their transitory cash flow since cyclical component of cash flow is unlikely to be correlated with growth options as shown by CDWY. The investment-transitory cash flow sensitivity of dividend-paying firms is almost 48% higher than that of for non-dividend paying firms and it is 35% higher compared to the full sample. This verifies the first implication of our model that cash flow sensitivity of investment in dividend paying firms is higher than that of non-dividend paying firms.

Out of each additional dollar of cash flow, dividend-paying firms spend 30 cents on investment, 3 cents on dividends and retain 33 as cash reserves, while repaying 28 cents of outstanding debt and buying back only 6 cents of outstanding equity. In this sense, there is a stark difference between the way in which dividend-paying firms allocate their internal cash flow and the rest of non-dividend paying firms, as well as the full sample. Non-dividend paying firms allocate 25 cents of an additional dollar of internal cash flow to investment, spend zero on dividends, retain 31 cents as cash, repay 23 cents of outstanding debt, and spend much higher on buying back shares, almost 21 cents out of each dollar. Although dividend-paying firms also have higher cash flow sensitivity of cash than non-dividend paying firms and the full sample, it is not as severe as their investment-cash flow sensitivity. For instance, on average, a dividend-paying firm retains 12% more out of transitory cash flow than a non-dividend paying firm does. The net equity issuance is not so active in responding to cyclical cash flow, only 3 cents out of each dollar whereas non-dividend paying firms spend almost 20 cents out of each additional dollar of transitory cash flow to buy back shares.

Another interesting finding is that investments' response to permanent and transitory parts of cash flow is almost the same (29% versus 30%, respectively) for dividend-paying firms. At the same time, non-dividend paying firms' investment response to permanent and transitory parts of cash flow differ drastically (37% versus 21%, respectively). This shows that the higher investment-cash flow sensitivity prevails through both transitory and permanent cash flow components.

We further observe that the cash sensitivity of permanent cash flow in dividend-paying firms is 11%, which is much lower than that documented in CDWY (29%) whereas, dividend sensitivity of permanent cash flow is much higher (10% compared to the trivial 1% documented by CDWY). This is consistent with the notion that cash flow sensitivity of cash is reduced in dividend-paying firms since the excess cash is distributed through dividends which in turn increases the dividend-sensitivity of cash flow. Alternatively, it is equally possible that dividend paying firms smooth their cash holdings which results in reduced sensitivity. Although lion share of dividend is paid out of the permanent component of cash flow, dividend is still significantly sensitive to the transitory components of cash flow where economically, 1.4 cents of transitory cash flow is paid out as dividend.

Therefore, consistent with the prediction put forth in (3), it is clear that the investment-cash flow sensitivity of dividend-paying firms is higher than that of non-dividend paying firms. Theoretically, since the marginal cost of dividends ($C^d(.)$) is increasing in the cost wedge between retention and distribution of cash(l), then it is quite permissible for dividend-paying firms to have higher investment-cash flow sensitivity. Moreover, we show that the investment-transitory cash flow sensitivity is as much as 48% more than that of non-dividend paying firms. Given that the transitory component of the cash flow is less likely to be correlated with the firm's investment options, our results are not likely driven by the difference in unobservable growth options.

Dividend smoothing and the cash flow allocation

In section 4, we discussed how dividends affect the cash flow allocation in the cross-section of firms after controlling for possible trends in time, growth options, and other observables. However, the second implication of our theoretical setting in (6) is that the higher marginal cost of dividends (l) must be positively associated with investments. This has a firm-year impact on the allocation of cash flow because firms smooth dividends through time and thereby accounts for one of the major concerns raised by KZ. Given that dividend smoothing provides a good proxy for the marginal cost of cutting dividends, then it must be positively associated with investments.

We investigate the effect of dividend smoothing on the allocation of cash flow by including two measures of dividend smoothing, namely the SOA and relative volatility into the simultaneous equations model as described in Equations(18)–(22), while imposing restrictions in Equations(23)–(25). The lower (higher) SOA and relative volatility represents more (less) dividend smoothing. The model is estimated for overall cash flow, and its permanent and transitory components. This approach has two main advantages. First, it enables us to study the impact of dividend smoothing on each cash flow variables, separately. Second, the two measures of dividend smoothing are entered into the system in lagged terms, that is they are determined in previous year ($t-1$), and thus lies beyond current year budgetary constraints at time (t). This assures its exogeneity and avoids concurrency error raised by Dhrymes and Kurz (1967).

Table 5 shows that both lagged measures of dividend smoothing are negatively associated with investments, that is firms that smooth dividends more (less) have higher (lower) investment to asset ratios. In effect, a 10% decrease in the SOA (smoothing less) increases the investment to asset ratio by 0.13% (t-stat, -2.72). This holds for the allocation of cash flow, as well as its two components. In a transitory cash flow framework, the magnitude of the coefficient is higher than the loadings on the lagged Market-to-Book ratio(0.007) and lagged log of total assets (-0.012) in the investment regression.

In order to give an economic sense to this result, we follow Leary and Michaely (2011) and assume that a dividend-paying firm has an average SOA of 0.14, that is it takes almost 4.6 years to close half the gap between actual and target dividends. Now, assume that the firm decides to close this gap earlier, say by one year. This means that the firm must increases the SOA to 0.175 to close the half the gap in 3.6 years. Given the mean investment to asset ratio of 0.084 among dividend-paying firms, then a 25% increase in the SOA from 0.14 to 0.175 is associated with 1 \$0.308 million (2010 constant dollar) decrease in investment. Should the firm choose to reduce the time of closing the half gap by 2 years, a 68% increase in the SOA from 0.14 to 0.235 is associated with a $0.84 million (2010 constant dollar) reduction in investment.

It is important to note that we are presenting the results for the allocation of the transitory cash flow which is, on average, zero. How do firms finance the increase in the SOA in a transitory cash flow framework? It seems that they largely rely on investments since the external funds remain largely quiet and insignificant both economically and statistically. Alternatively, a 10% decrease in the relative volatility (smoothing less) increases the investment to asset ratio by 0.04%. Therefore, consistent with our expectation, the two measures of dividend smoothing are entered into dividends and investment regressions significantly with predicted signs. The lagged SOA and lagged relative volatility measures are both positively associated with dividends once we control for cash flow and its two components. This means that firms that smooth dividends more (less) have a smaller (larger) dividend payout ratio, once more, verifying the findings reported in Table2.

The cyclical component of the cash flow is unlikely to be correlated with a firms' investment options, this is the reason why we focus on the allocation of the cyclical cash flow. Now, given that investments are determined by investment opportunities of the firm that is long-term in nature, firms must finance smoothing entirely through cash reserves, or outside finance. Since transitory cash flow is expected to be uncorrelated with investment options, significant loading of the smoothing measures in the investment regression in transitory cash flow settings (CF_Cycle) implies that dividend smoothing has an impact on investment when external finance (debt, equity mix) failed to neutralize the variations resulted from smoothing dividends.

Dividend smoothing and the financial constraints

As outlined in section 1, satisfying the monotonicity condition for investment-cash flow sensitivity and investment-marginal cost of dividends sensitivity are challenging because they are dependent on the curvature of the production function and the trade-off between the curvature of the dividend cost function and the cost of raising external finance function. Therefore, we resort to empirical testing in order to investigate the impact of dividend smoothing on the cash flow allocation and the way in which it is affected by the financial constraint of firms.

In order to investigate this matter, we apply two measures[5] of financial constraints that are widely used in the literature. The WW Index is constructed following Whited and Wu (2006) and Hennessy and Whited (2007), and the HP Index is constructed following Hodrick and Prescott (1997) to differentiate between firms that are financially more constrained from those firms that are less constrained. Then, applying our model, we investigate how dividend smoothing is financed in firms with different degrees of financial constraint.

The two indexes of financial constraint are constructed such that the higher scores of the two indexes show that firms are more financially constrained. Therefore, for each year a given firm is classified as more (less) financially constrained if its HP or WW index falls in the top (bottom) four deciles of the distribution. Then, similar to previous analysis, we estimate Equations(18)–(22), while imposing restrictions in Equations(23)–(25) for firms that are categorized as more financially constrained and less financially constrained, respectively. Table6 and Table7 illustrate the results for applying the SOA and the relative volatility measures, respectively where we only report the loadings of the cash flow (CF) and its two components (CF_Trend) and CF_Cycle). However, we focus on the allocation of transitory cash flow since it is unlikely to be correlated with the investment options of a firm.

According to the results outlined in Table6, when we apply the HP index to differentiate between financially more (less) constrained firms, the lagged SOA (SOA_{t-1}) is no more significant across all cash flow variable regressions for firms that are less financially constrained. Conversely, for more financially constrained firms, the SOA remains significant for

[5]We have not considered the KZ Index constructed according to Lamont, Polk, and Saaá-Requejo (2001) due to criticisms raised by Hodrick and Prescott (1997) on the measure's validity in capturing constrained firms, and the fact that the KZ Index relies on the dividend level rather than smoothing which does not suits our purpose.

both dividend and investment regressions. In fact, the coefficient on SOA_{t-1} in investment regressions rises from from -0.013 (t-stat, -2.72) in Table 5 to -0.017 (t-stat, -2.61). Given the small number of observations (2,350 firm-year), this result is robust.

Alternatively, applying the WW index to categorize firms into more (less) financially constrained deliverers (qualitatively) the same results although the coefficient on SOA_{t-1} in investment regressions of more financially constrained firms is marginally significant (-0.015, t-stat -1.94). We could trace this small discrepancy to fundamental differences in the ways in which the two indexes are constructed. The HP index applies no proxy for dividend payment and hence better suits our tests. However, the WW index uses a dummy variable to differentiate dividend-paying firms from non-dividend payers which we set to one. This small change affects the way in which this index categorizes the firms as more (less) financial constrained. Acknowledging this, one must note that none of the existing financial constraint indexes employs the degree of dividend smoothing to categorize firms based on their degree of financial constraint.

In summary, dividend smoothing has an impact on the investments in more financially constrained firms, while it does not materially impact less financially constrained firms. This shows that limited access to external finance, combined with a costly adjustment of dividends, results in the adjustment of investments in response to transitory cash flow variations. Also, variation in cash reserves is not helpful in insulating investments from dividends. We observe that the impact of dividend smoothing on the investment and dividends is much less severe in firms that are categorized as less financially constrained. It is worth mentioning that these results are obtained by applying the estimates to cyclical components of cash flow which is less likely to be correlated with the investment options of a firm. Further, the conclusion remains qualitatively the same for both of our measures of dividend smoothing.

Total payout smoothing and the allocation of cash flow

So far, our analysis has focused on dividend policy. Although we have controlled for changes in share repurchases through net equity issuance, one cannot ignore the fact that there has been a sharp increase in share repurchases as a method with which firms distribute cash back to shareholders. Fama and French (2001) document that dividends are disappearing. (Grullon and Michaely, 2002) and Skinner (2008) document that share repurchases are substituting dividend payment in becoming the dominant form of payout.

To address this issue, we attempt to include share repurchases into our analysis by adding it to dividends and coming up with a total payout measure. Then, the total payout measure is applied in our system of equation specifications which is adjusted for total payout. We also re-estimate the total payout smoothing by substituting total payout instead of dividends as delineated in section 2.

We modify the cash flow identity in Equation(10) to account for total payout instead of dividends alone. We define NQ as Sale of Common and Preferred Stock (Compustat item "SSTK") minus Purchase of Common and Preferred Stock (Compustat item "PRSTKC"). Then, NQ^{Adj} is defined as Sale of Common and Preferred Stock. Then, Purchase of Common Preferred Stock is sent to the left-hand side of the cash flow identity and added up with cash dividends to form total payout (Tpay). Hence, we have:

$$\text{Inv}_t + \text{CR}_t + \text{Tpay}_t - \text{ND}_t - \text{NQ}_t^{Adj} = \text{CF}_t \tag{36}$$

where the net debt issuance (ND_t), and the net equity issuance excluding share repurchases (NQ_t^{Adj}) are considered sources of funds. The uses of funds include investment (Inv_t), the change in cash holdings (CR_t), and total payout Tpay_t that includes both cash dividends and share repurchases and CF_t is the internally generated cash flow.

The model specifications is similar to the previous setup in Equations(18)–(22) and simultaneous imposition of constraints in Equations(23)–(25) for the added dividend smoothing measures. Moreover, the equations are estimated by applying the same methodology as before, in reporting the results however, we suppress the output results for the time dummy although they are included in the model while estimating. Table 8 illustrates the results of applying the baseline model to the cash flow and its cycle and trend components for the full sample.

As expected, the coefficients of cash flow and its components in Tpay regressions increase and remain statistically significant compared to the dividends only setup. Firms payout 5 cents out of each additional dollar of cash flow as total payout which is much larger than just 1 cents out of each additional dollar of cash flow paid out as dividends documented in Table 3. Moreover, firms payout almost 12 cents out of each additional dollar of permanent cash flow compared to only 3 cents of dividend payout. Firms' total payout out of transitory cash flow component is 3 cents out of each dollar which is 2.96 cents more than that of for only dividends. Overall, it is clear that share repurchases are a significant way of distributing cash. The loadings of cash flow and its two components on other uses and sources of funds have not changed drastically from those that are reported in Table 3 for the dividends only model.

Table 9 reports the results of dividing the full sample into dividend and non-dividend paying firms. Consistent with the first implication of our model in (3), the investment-transitory cash flow sensitivity remains 50% higher for dividend-paying firms compared to the non-dividend paying sub-sample. Firms that pay regular dividends have a total payout of 9 cents out of each additional dollar of cash flow when it reaches a 28 cents of each additional dollar of permanent cash flow and 5 cents of each additional dollar of transitory cash flow. The corresponding numbers for regular non-dividend paying firms are 2 cents, 4 cents, and 1 cents out of each additional dollar of cash flow, cyclical, and trend components of cash flow, respectively.

For our purpose, to put the second implication of our model in (6) to test, we need to re-estimate the payout smoothing measures based on total payout. Figure2 illustrates the time series evolution of median SOA^{Tpay} and median Rel-Vol^{Tpay} measures, calculated based on total payout ratios, and their related empirical distributions for the period 1982-2016. The two measures of total payout smoothing are highly correlated. The correlation between the time series evolution of the two measures' median is 0.86 and the correlation between the SOA^{Tpay} and Rel-Vol^{Tpay} is 0.42 which is lower than the correlation between the SOA and the relative volatility of dividends reported in section 2 (0.58). This is due to the fact that share repurchases are less binding promises to payout and have more flexibility attached, reducing the correlation between the two measures. There is a pronounced upward trend in both of the payout smoothing measures which is attributed to the surge in share repurchases among firms over the last three decades. There is a bump at the peak of global financial crisis in 2008 which shows the fact that during the crisis, firms adjusted their payout policy more rapidly to reflect upon their deteriorating earnings. The empirical distribution of the two measures show a sizable variation in the cross-section which varies more than dividends only smoothing measures possibly due to variability and flexibility of share repurchases.

Next, we include the two measures of payout smoothing in the model and estimate the response of each uses and sources of cash flow, separately. Table 10 summarizes the results for the SOA$^{\mathrm{Tpay}}$ in Panel A and the alternative measure, Rel-Vol$^{\mathrm{Tpay}}$ in Panel B. Interestingly, the coefficients' signs of cash flow (and its two components) in the investments and dividends regressions are flipped compared to the dividends only framework. In other words, we find that the degree of total payout smoothing (SOA$^{\mathrm{Tpay}}$) is negatively associated with investments (t-stat, 1.87) and dividends (t-stat, 1.43) in the cyclical cash flow framework. This shows that our findings with respect to dividend smoothing apply only to dividends and not total payout.

We argue that rigidity in dividend policy is the primary driver of the effect we discuss throughout this paper and once we allow share repurchases to freely fluctuate then much of the results disappear. This finding is also consistent with Bonaimé et al. (2013) where the authors find that flexible payout policy, one that favors repurchases over dividends, and hedging are substitutes, meaning that the excessive variations in cash flow that is not captured by rigid dividend policy is being absorbed by flexible share repurchases which in turn provides a hedging tool for managers.

In order to investigate how financial constraints affect the total payout smoothing and the allocation of cash flow, we undertake a procedure similar to the one outlined in section 4. The results of adding the total payout smoothing (SOA^{Tpay}) into our system of equations, while differentiating more (less) financially constrained firms by using HP or WW indexes are summarized in Table11. For brevity, we only report the loadings of the cash flow (CF) and its two components (CF_Trend and CF_Cycle). We keep the focus on the allocation of transitory cash flow since it is unlikely to be correlated with investment options.

Clearly, being financial constraint does not significantly impact the total payout smoothing and the allocation of transitory cash flow the way it affects dividend smoothing. When the HP index is applied as the measure of financial constraint, total payout smoothing is not significant for more financially constrained firms. If anything, financially less constraint firms that smooth total payout less have higher investment (0.042, t-stat 4.77). On the other hand, according to the WW index, the total payout smoothing (SOA^{Tpay}) is not significant no matter the degree of constraint. This asserts that the frictions arising from dividend smoothing is the main driver of the frictions in the allocation of the cash flow as opposed to total payout.

Table 12 reports the results for applying our alternative measure of total payout smoothing ($\text{Rel-Vol}^{\text{Tpay}}$) in our structural model where firms are separated into more (less) financially constrained firms by applying the HP or WW indexes. We observe that this measure of the total payout smoothing enters into investment and dividend regressions significantly for firms that are more financially constrained, while the measure becomes less significant for financially less constrained firms although the effect is weaker than when we applied the relative volatility measure in Table 7. This is consistent with our theory that total payout smoothing measured by relative volatility, induces some frictions that are mitigated by better access to capital markets. Also, it worth noting that there is a fundamental differences between relative volatility measure and the SOA measure for total payout smoothing since the former measure captures the volatility in total payout relative to earnings rather than setting the Speed-of-Adjustment to a target total payout ratio.

5 Conclusion

Despite the empirical fact that dividend smoothing is quite common among dividend-paying firms, little is known about its impact on the cash flow of firms. We investigate how dividend smoothing affects a firms' cash flow allocation.

We extend the Kaplan and Zingales (1997) benchmark model to account for costly dividend adjustments and provide two testable implications. First, the investment-cash flow sensitivity should be higher for dividend-paying firms. Second, investments should be positively associated with dividend smoothing. Moreover, we conjecture that if dividend smoothing introduces a friction in the cash flow allocation of firms, then better access to external capital markets must reduce this additional cost.

Our empirical strategy follows that of Chang et al. (2014) where we study the effects of dividend smoothing on corporate cash-related policies through a firm's intertemporal budget constraint (IBC). Firms use an additional dollar of cash flow to pay out dividends, repay debt or reduce equity issuance, accumulate precautionary cash savings, or invest in new projects. In this setting, cash flow is assumed to be exogenously determined because it is a realization of the firm's past investments and current consumer's behavior (Gatchev, Pulvino, and Tarhan, 2010). Hence, our structural model includes multiple dependent variables (investment, cash reserves, dividends, net debt issuance, and equity issuance) against several common independent variables (cash flow, lagged control variables, and an error term) that forms a system of equations. Chang et al. (2014) show that so long as the system is determined by the same set of explanatory variables, it is equivalent to equation-by-equation

OLS, a procedure that we follow in estimating our empirical model.

In order to mitigate concerns about unobservable investment options in our estimates, we decompose the cash flow into transitory and permanent components where the former is much less likely to be correlated with growth options of the firm.

We show that, the investment-cash flow sensitivity of dividend-paying firms is up to 35% higher than full sample of firms in transitory cash flow settings. In addition, by adding two measures of dividend smoothing (Leary and Michaely, 2011) into our system, we verify that the investment-dividend smoothing sensitivity is positive. A 10% decrease in the Speed-of-Adjustment of dividends (SOA) increases the investment to total asset ratio by 0.13%.

Further, we apply two widely used measures of financial constraint to differentiate more (less) financially constrained firms and are able to show that investment-dividend smoothing sensitivity weakens once firms have better access to capital markets. This asserts that costs associated with dividend smoothing imposes an additional friction on the cash flow allocation that is bounding for more financially constrained firms.

Lastly, we apply the regression model to total payout that includes both dividends and share repurchases and observe that the results hold solely for dividend smoothing not the total payout smoothing. This is consistent with the notion that more flexible payout policy that also includes share repurchases could substitute hedging activities and thus neutralize the excessive changes in investment caused by rigid dividend payouts.

The results are robust to an array of control variables, time and firm fixed effects (de-meaned), as well as applying two distinct measures of dividend smoothing and several other filtering alternatives for cash flow decomposition.

The friction arising from dividend smoothing has remained largely unexplored. One implication that we leave for future work could be the debt overhang problem of Myers (1977). We already document that firms that smooth dividends more are significantly more levered than those firms that smooth dividends less. Then, given the rigidity of dividend smoothing, do firms pass on positive NPV project because of their debt overhang problem?

The Brav et al. (2005) survey results point to “yes”, however, it would be beneficial to investigate this matter empirically.

Moreover, we do not get to observe the shape of the dividends cost function. However, there is one way to infer its curvature. DeAngelo, DeAngelo, and Skinner (1992) show that almost half of the 167 dividend-paying firms with losses reduce dividends during their initial loss year, while only 15% of such firms omit dividends. Eventually, faced with economic turmoil and volatile earnings, the vast majority of firms in their sample either cut or omit dividends. Perhaps, the extend to which a firm can tolerate shocks to their cash flow without cutting dividends provides a plausible indication of the curvature of the dividend cost function.

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Appendix A. Variable Definitions.

ROA (return on assets): Income Before Extraordinary Items (item 18) plus Interest and Related Expense - Total (item 15) plus Deferred Taxes (item 126) over total assets.
Earning Volatility: The standard deviation of the ratio of EBITDA (item 13) to assets over the sample period.
Sales growth: The annual percentage increase in sales: $\text{Sales}_{it}/\text{Sales}_{it-1} - 1$ (item 117).
Leverage: The sum of short-term (item 34) and long-term debt (item 9) divided by book assets.
Asset tangibility: Net property, plant and equipment (item 8) scaled by total assets.
Dividends per share (DPS): Common dividends per share (item 26).
Earnings per share (EPS): Compustat data item 58.
Payout ratio: Common dividends (item 21) divided by net income (item 18).
Dividend yield: DPS divided by the year-end share price (item 24).
Firm age: The number of years since the firm first appeared in the Compustat database.
Firm size: The natural log of book assets in constant 2010 dollars.
Market-to-book ratio (MB): The market value of equity (product of items 24 and 25) plus the book value of assets (item 6) minus the book value of equity, all divided by the book value of assets.
Book value of equity: Book assets minus book liabilities (item 181) minus preferred stock plus deferred taxes (item 35).
Preferred stock: Equals the liquidation value (item 10) if not missing; otherwise we use the redemption value (item 56) if not missing; otherwise the carrying value (item 130).
Non-dividend payers: Firms that have not paid dividends (item 21 zero) at least for 10 years during sample period.
Dividend payers: Firms that have paid dividends (item 21 non-zero) at least for 10 years during sample period.
Net Repurchases: Following Fama and French (2001) it is measured as the increase in common treasury stock if treasury stock is not zero or missing. If treasury stock is zero in the current and prior quarter, we measure repurchases as the difference between stock purchases and stock issuances from the statement of cash flows. If either of these amounts is negative, repurchases are set to zero.
HP Index: Defined as $0.737\text{Size} + 0.043\text{Size}^2\ \ 0.040\text{Age}$, where Size equals the log of total assets (item 6) in 2010 constant dollars, and Age is defined as above.
WW Index: Defined as - 0.091 [(ib + dp)/at] - 0.062A* + 0.021[dltt/at] - 0.044 [log(at)] + 0.102[average industry sales growth, estimated separately for 49 Fama-French industry

portfolios and each year] - 0.035 [sales growth]. In original formula A* is defined as an indicator set to one if dvc + dvp is positive, and zero otherwise, we set this equal to one since we only consider dividend-paying firms.

KZ Index: Defined as -1.001909[(ib + dp)/lagged ppent] + 0.2826389[(at + prcc_f x csho - ceq - txdb)/at] + 3.139193[(dltt + dlc)/(dltt + dlc + seq)] - 39.3678[(dvc + dvp)/lagged ppent] - 1.314759[che/lagged ppent].

Cash flow variables

Inv: Defined as capital expenditure (capx) + increase in investment(ivch) + acquisition(aqc) - sale of PPE(sppe) - sale of investment(siv) - change in shortterm investment(ivstch) - other investing activities(ivaco).

Div: Defined as cash dividends (dv).

CR: Defined as cash and cash equivalents increase/decrease (chech).

ND: Defined as long-term debt issuance(dltis) - long-term debt reduction(dltr) + changes in current debt(dlcch).

NQ: Defined as sale of common and preferred stock (sstk) - purchase of common and preferred stock(prstkc).

Δ ***WC:*** Defined as -change in account receivable(recch) - change in inventory(invch) - change in account payable(apalch) - accrued income taxes(txach) - other changes in assets and liabilities (aoloch) - other financing activities(fiao).

CF: Defined as income before extra items (ibc) + extra items & discontinued operation(xidoc) + depreciation & amortization(dpc) + deferred taxes(txdc) + equity in net loss(esubc) + gains in sale of PPE & investment(sppiv) + other funds from operation(fopo) + exchange rate effect(exre) - ΔWC.

Tpay: Defined as Dividends Common/Ordinary (dvc) plus purchase of common and preferred stock(prstkc).

NQ^{Adj}: Defined as sale of common and preferred stock (sstk).

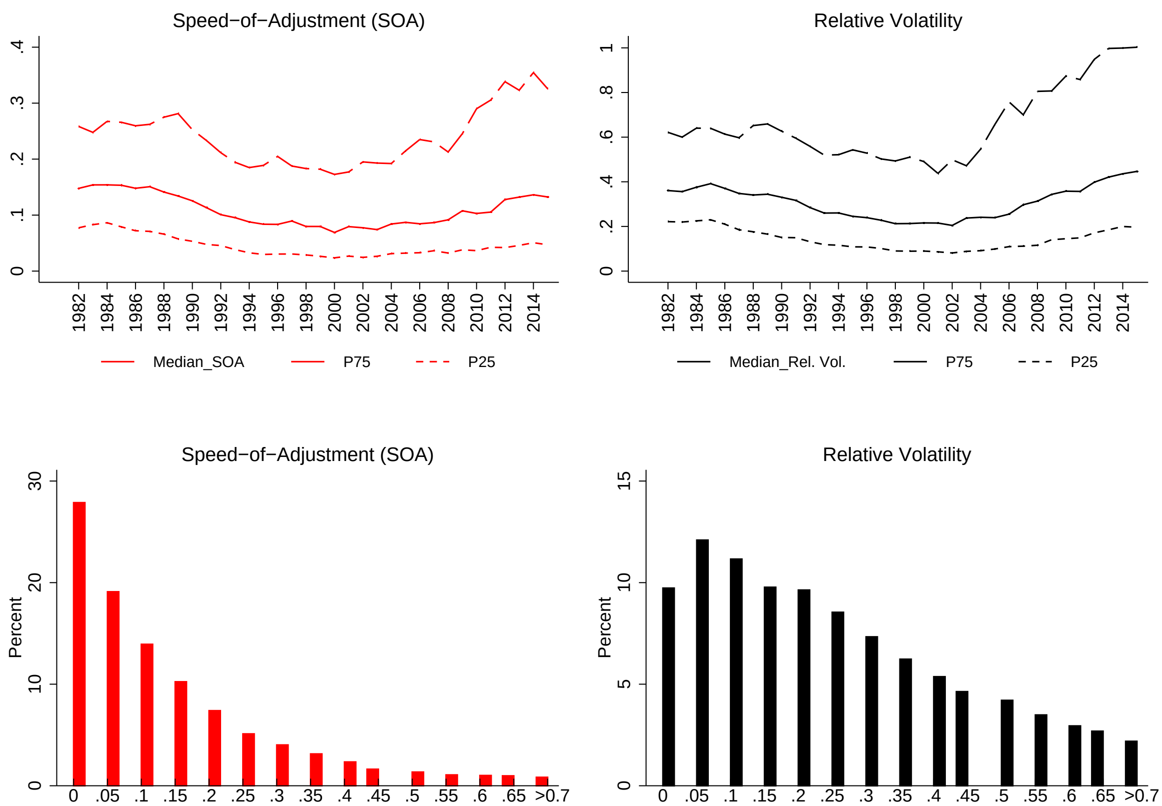

Figure 1. Time series and empirical distribution of the Speed-of-Adjustment -SOA- (left) and the Relative Volatility (right) of dividends measures. For the period 1982-2016, a sample of dividend-paying industrial firms with at least 10 year of non-missing data on dividend is divided into panels of 10–years overlapping windows. Speed-of-Adjustment (SOA) and Relative Volatility measures of dividend smoothing are estimated within each panel by applying Leary and Michaely (2011) methodology. If SOA <0 or SOA $>=1$, corresponding observation is set to missing. Measures are winsorized at top 1%. Time trends show median SOA and Relative Volatility measures for each year.

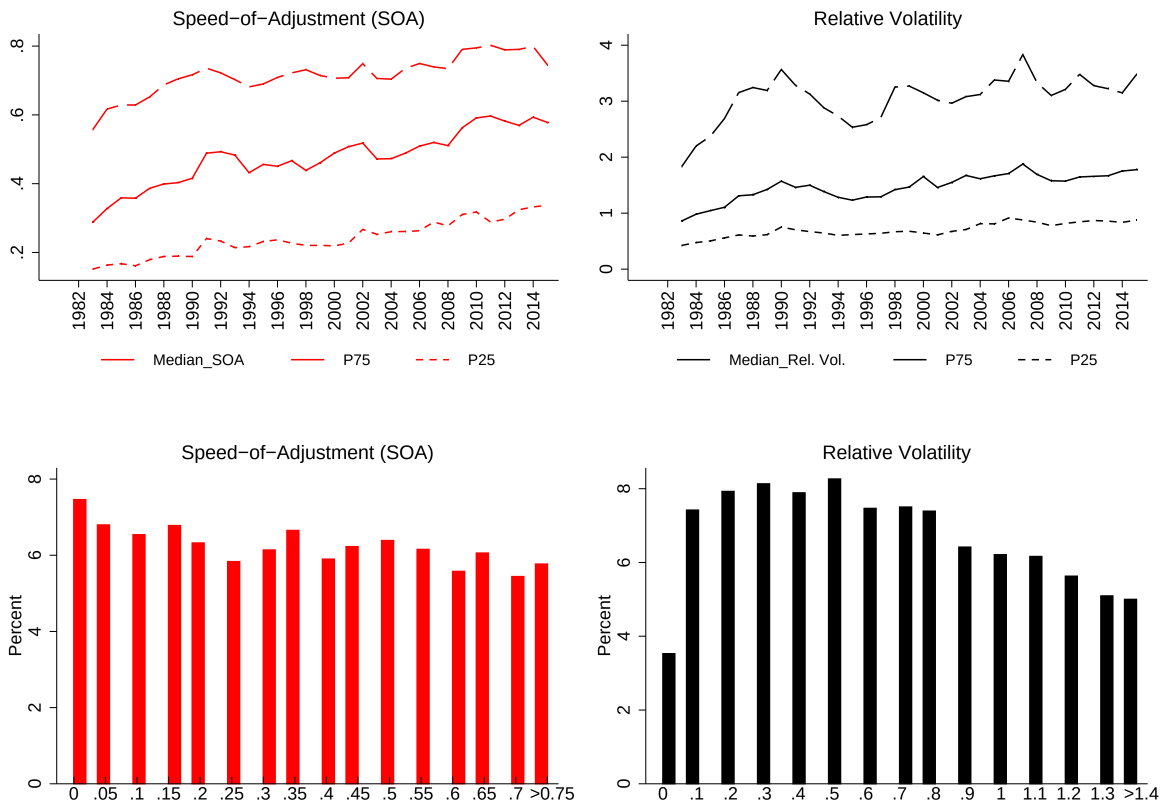

Figure 2. Time series and empirical distribution of Speed-of-Adjustment - SOA^{Tpay}- (left) and Rel-Vol^{Tpay} (right) of total payouts measures. For the period 1982-2016, a sample of dividend-paying industrial firms with at least 10 year of non-missing data on dividend is divided into panels of 10–years overlapping windows. Total payout is defined as cash dividends plus shares buybacks. Then, the SOA^{Tpay} and Rel-Vol^{Tpay} measures of total payout smoothing are estimated within each panel by applying Leary and Michaely (2011) methodology. If SOA^{Tpay} < 0 or SOA^{Tpay} $>= 1$, corresponding observation is set to missing. Measures are winsorized at top 1%. Time trends show median SOA^{Tpay} and Rel-Vol^{Tpay} measures for each year.

Table 1 Summary statistics of main variables. The sample includes U.S. industrial firms in the intersection of annual Compustat file and CRSP during 1987–2016. To be included in the sample, firms are required to have non-missing cash flow variables for at least 15 years. The full sample is divided into two groups of dividend-paying firms that paid dividend for at least 10 years and non-dividends paying firms that do not pay dividends for at least 10 years. DPS and EPS are dividend and earnings per share, respectively. Dividend Ratio is dividends for common divided by income before extraordinary items. Total payout Ratio is dividends for common plus share repurchases divided by income before extraordinary. ROA is return on asset defined as income before extraordinary items plus total interest and related expense plus deferred taxes all scaled by book assets. Earnings Volatility in year t is the standard deviation of the ratio of EBITDA to assets over the prior ten years. Asset Tangibility is the net PPE over total assets. Market-to-Book is defined as the market value of assets divided by the book value of assets. Leverage is defined as total debt divided by total assets. SaleG is the one-year change in sales. Repurchase is defined following Fama and French (2001). All cash flow identity variables are calculated based on the method described in Chang et al. (2014) where Div is cash dividends, Inv is investment, CR is changes in cash reserves, NQ is changes in net equity, ND is changes in net debt all scaled by lagged assets.

	Full Sample				Dividend-Payers[1]				Non-Dividend Payers[2]				Mean [1] $\neq$ Mean[2]		
	#Obs	Mean	SD	Median	#Obs	Mean	SD	Median	#Obs	Mean	SD	Median	#Obs	T-stat	
DPS	28095	0.24	0.47	0.00	11285	0.55	0.58	0.36	8782	0.00	0.00	0.00	20067	-89.19	***
EPS	27973	0.10	13.73	0.56	11357	1.33	4.09	1.17	8664	-1.04	20.46	0.15	20021	-12.04	***
Ln(Asset)	28313	5.91	2.10	5.86	11476	7.03	1.96	6.99	8782	4.81	1.75	4.71	20258	-83.56	***
ROA	26711	0.04	0.13	0.06	11022	0.07	0.06	0.08	8129	-0.01	0.17	0.04	19151	-44.63	***
Asset Tangibility	28288	0.27	0.21	0.21	11460	0.31	0.20	0.26	8782	0.23	0.22	0.16	20242	-26.71	***
Market-to-Book	28253	1.81	1.47	1.42	11465	1.73	0.96	1.46	8748	1.99	2.05	1.44	20213	12.00	***
Leverage	28155	0.20	0.18	0.17	11465	0.21	0.16	0.20	8693	0.19	0.20	0.13	20158	-8.03	***
SaleG	28277	0.13	3.84	0.05	11474	0.05	0.19	0.04	8760	0.25	6.78	0.06	20234	3.07	***
Earnings Volatility	25844	0.07	0.11	0.05	11031	0.04	0.03	0.03	7645	0.10	0.19	0.07	18676	32.93	***
Dividend yield	28060	0.01	0.02	0.00	11302	0.02	0.02	0.01	8749	0.00	0.00	0.00	20051	-73.53	***
Dividends Ratio	27731	0.15	0.32	0.00	10969	0.34	0.41	0.27	8781	-0.00	0.01	0.00	19750	-78.85	***
Total Payout Ratio	27729	0.31	0.68	0.01	11128	0.56	0.75	0.40	8690	0.11	0.53	0.00	19818	-48.75	***
Repurchase	28246	0.01	0.03	0.00	11455	0.01	0.03	0.00	8757	0.01	0.03	0.00	20212	-15.13	***
Cash Flow Variables															
Div	28313	0.01	0.02	0.00	11476	0.02	0.02	0.01	8782	0.00	0.00	0.00	20258	-92.09	***
Inv	28313	0.08	0.13	0.06	11476	0.08	0.11	0.06	8782	0.09	0.15	0.05	20258	1.67	*
CR	28313	0.01	0.09	0.00	11476	0.01	0.06	0.00	8782	0.01	0.12	0.00	20258	4.11	***
NQ	28313	0.01	0.11	0.00	11476	-0.01	0.05	0.00	8782	0.04	0.16	0.00	20258	29.63	***
ND	28313	0.01	0.10	0.00	11476	0.02	0.08	0.00	8782	0.02	0.11	0.00	20258	1.46	
Cash Flow	28313	0.08	0.11	0.09	11476	0.11	0.08	0.10	8782	0.05	0.14	0.06	20258	-41.17	***
DIF	28313	0.00	0.01	0.00	11476	0.00	0.00	0.00	8782	0.00	0.01	0.00	20258	-34.74	***
CF_Cycle	28313	0.00	0.08	-0.00	11476	0.00	0.05	-0.00	8782	0.00	0.09	-0.00	20258	-0.13	
CF_Trend	28313	0.08	0.08	0.09	11476	0.11	0.05	0.10	8782	0.05	0.10	0.06	20258	-57.69	***

Table 2 Summary statistics of main variables in firms with different degree of dividend smoothing. The sample includes U.S. industrial firms in the intersection of annual Compustat file and CRSP during 1987–2016. To be included in the sample, firms are required to have non-missing cash flow variables for at least 15 years and paid dividend for at least 10 years. Speed-of-Adjustment (SOA) and Relative Volatility of dividends are the two measures of dividend smoothing estimated following Leary and Michaely (2011). In each year firms are sorted according to each measure of dividend smoothing and divided into Quintiles where the lowest Quintile (Q1) includes firms that smooth dividends the most and the highest Quintile (Q5) includes firms that smooth dividends the least. DPS and EPS are dividend and earnings per share, respectively. Dividend Ratio is dividends for common divided by income before extraordinary items. Total payout Ratio is dividends for common plus share repurchases divided by income before extraordinary. ROA is return on asset defined as income before extraordinary items plus total interest and related expense plus deferred taxes all scaled by book assets. Earnings Volatility in year t is the standard deviation of the ratio of EBITDA to assets over the prior ten years. Asset Tangibility is the net PPE over total assets. Market-to-Book is defined as the market value of assets divided by the book value of assets. Leverage is defined as total debt divided by total assets. SaleG is the one-year change in sales. Repurchase is defined following Fama and French (2001). All cash flow identity variables are calculated based on the method described in Chang et al. (2014) where Div is cash dividends, Inv is investment, CR is changes in cash reserves, NQ is net equity issuance, ND is net debt issuance where all cash flow variables are scaled by lagged assets.

	Speed of Adjustment (SOA)					**Relative Volatility**				
	Mean[Q1]	Median	Mean[Q5]	Median	[Q1] $\neq$ [Q5]	Mean[Q1]	Median	Mean[Q5]	Median	[1] $\neq$ [5]
DPS	0.76	0.51	0.69	0.45	**	0.76	0.53	0.74	0.46	
EPS	1.85	1.44	1.64	1.31	*	1.80	1.44	1.86	1.40	
Ln(Asset)	7.53	7.59	7.20	7.26	***	7.56	7.61	7.42	7.48	**
ROA	0.06	0.07	0.09	0.09	***	0.06	0.07	0.09	0.09	***
Asset Tangibility	0.31	0.27	0.30	0.27	**	0.31	0.27	0.30	0.26	*
Market-to-Book	1.57	1.38	1.88	1.58	***	1.54	1.36	2.04	1.77	***
Leverage	0.24	0.24	0.18	0.17	***	0.24	0.24	0.18	0.17	***
SaleG	0.03	0.03	0.04	0.04	*	0.03	0.02	0.05	0.05	***
Earnings Volatility	0.03	0.03	0.04	0.03	***	0.03	0.03	0.04	0.03	***
Dividend yield	0.02	0.01	0.02	0.02		0.02	0.01	0.02	0.01	
Dividends Ratio	0.32	0.30	0.44	0.34	***	0.34	0.29	0.40	0.32	***
Total Payout Ratio	0.54	0.42	0.61	0.48	*	0.55	0.38	0.62	0.49	**
Repurchase	0.01	0.00	0.01	0.00		0.01	0.00	0.02	0.00	***
Inv	0.08	0.06	0.08	0.07		0.08	0.06	0.08	0.07	
Div	0.02	0.02	0.03	0.03	***	0.02	0.02	0.03	0.03	***
CR	0.00	0.00	0.01	0.00		0.01	0.00	0.01	0.00	
ND	0.01	-0.00	0.01	0.00		0.01	-0.00	0.01	0.00	*
NQ	-0.01	0.00	-0.01	0.00	*	-0.01	0.00	-0.02	-0.00	***
Cash Flow	0.10	0.10	0.12	0.11	***	0.10	0.10	0.12	0.12	***
DIF	0.00	0.00	0.00	0.00	*	0.00	0.00	0.00	0.00	**
CF_Cycle	-0.00	-0.00	0.00	-0.00		-0.00	-0.00	-0.00	-0.00	
CF_Trend	0.10	0.10	0.12	0.11	***	0.10	0.10	0.12	0.12	***

Table 3 Dividends payout – The allocation of cash flow in the full sample. The sample includes U.S. industrial firms in the intersection of annual Compustat file and CRS tapes during 1987–2016 with at least 15 years of non-missing record for cash flow variables. The table reports the allocation of internally generated cash flow (CF). Inv is investment, CashR is cash reserve, ND is net debt issuance, and NQ is net equity issuance. The cash flow variables are defined in the Appendix. Flow-of-funds data in Compustat is used to set-up cash flow variables according to Chang et al. (2014). The cash flow variable is decomposed by applying Butterworth's filter. All control variables are lagged to control for contemporaneous effect and includes SaleG that is annual growth rate in sales, Leverage is defined as total debt (the sum of short-term and long-term debt) divided by total assets, MB is defined as the market value of assets divided by the book value of assets, LnAsset is natural logarithm of total assets, and Tangibility is the net PPE over total assets. All variables are demeaned to account for all unobservable that might affect the results (firm fixed effect), year dummy is included to reduce the impact of time trend on our results (year fixed effect).

	CF Series					**Trend**					**Cycle**				
	Inv	Div	CR	ND	NQ	Inv	Div	CR	ND	NQ	Inv	Div	CR	ND	NQ
CF	0.252***	0.009***	0.310***	-0.242***	-0.187***										
	(40.39)	(10.44)	(60.92)	(-44.10)	(-34.85)										
CF_Trend						0.316***	0.027***	0.186***	-0.185***	-0.286***					
						(22.19)	(14.06)	(15.64)	(-14.73)	(-23.58)					
CF_Cycle											0.230***	0.004***	0.352***	-0.257***	-0.156***
											(31.96)	(4.42)	(60.11)	(-40.65)	(-25.33)
$SaleG_{t-1}$	0.029***	-0.001***	0.002	0.018***	0.011***	0.028***	-0.001***	0.003*	0.018***	0.011***	0.029***	-0.001***	0.001	0.018***	0.011***
	(14.78)	(-5.21)	(1.43)	(10.63)	(6.89)	(14.05)	(-4.77)	(1.91)	(10.43)	(6.80)	(14.94)	(-5.00)	(0.82)	(10.67)	(6.50)
$Leverage_{t-1}$	-0.120***	-0.010***	0.018***	-0.182***	0.070***	-0.116***	-0.009***	0.010**	-0.178***	0.063***	-0.113***	-0.010***	0.011***	-0.181***	0.070***
	(-24.52)	(-14.86)	(4.61)	(-42.18)	(16.60)	(-22.94)	(-12.81)	(2.39)	(-39.86)	(14.66)	(-22.98)	(-15.06)	(2.76)	(-42.12)	(16.59)
MB_{t-1}	0.019***	0.001***	0.004***	0.006***	0.018***	0.018***	0.001***	0.005***	0.006***	0.018***	0.019***	0.001***	0.004***	0.006***	0.018***
	(29.90)	(15.64)	(7.66)	(11.72)	(32.62)	(28.10)	(15.13)	(9.51)	(11.00)	(33.24)	(29.97)	(15.96)	(8.14)	(11.77)	(33.29)
$LnAT_{t-1}$	-0.015***	0.001***	-0.012***	-0.002**	-0.024***	-0.015***	0.001***	-0.011***	-0.003***	-0.023***	-0.016***	0.001***	-0.010***	-0.002**	-0.023***
	(-15.52)	(8.60)	(-15.38)	(-2.19)	(-29.12)	(-15.57)	(6.63)	(-13.06)	(-2.88)	(-27.01)	(-16.80)	(8.86)	(-13.32)	(-2.30)	(-28.56)
Tangibility $_{t-1}$	0.025***	-0.007***	0.059***	0.047***	0.030***	0.023***	-0.008***	0.065***	0.044***	0.035***	0.017**	-0.007***	0.067***	0.046***	0.031***
	(3.51)	(-7.74)	(10.27)	(7.55)	(4.91)	(3.12)	(-8.72)	(10.72)	(6.88)	(5.67)	(2.47)	(-7.43)	(11.59)	(7.45)	(5.08)
Constant	0.012**	-0.002***	-0.009**	0.011***	-0.008**	0.011**	-0.003***	-0.008**	0.011***	-0.006*	0.013**	-0.002***	-0.006	0.009**	-0.009**
	(2.31)	(-4.54)	(-2.47)	(2.80)	(-2.04)	(2.14)	(-4.97)	(-2.03)	(2.59)	(-1.66)	(2.51)	(-4.24)	(-1.55)	(2.36)	(-2.21)
N	27321														
R^2	0.119	0.092	0.118	0.115	0.112	0.098	0.095	0.029	0.074	0.097	0.109	0.089	0.118	0.110	0.100

t statistics in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

Table 4 Dividends payout – The allocation of cash flow in two sub-samples of dividend-paying and non-dividend paying firms. The sample includes U.S. industrial firms in the intersection of annual Compustat file and CRS tapes during 1987–2016 with at least 15 years of non-missing record for cash flow variables. We divide the sample and report the results for two subsamples of dividend-paying firms that pay dividend for at least 10 years (Panel A) and non-dividend paying firms that do not pay dividend for at least 10 years (Panel B), separately. The table reports the allocation of internally generated cash flow (CF). Inv is investment, CashR is cash reserve, ND is net debt issuance, and NQ is net equity issuance. The cash flow variables are defined in the Appendix. Flow-of-funds data in Compustat is used to set-up cash flow variables according to Chang et al. (2014). The cash flow variable is decomposed by applying Butterworth's filter. All control variables are lagged to control for contemporaneous effect and includes SaleG that is annual growth rate in sales, Leverage is defined as total debt (the sum of short-term and long-term debt) divided by total assets, MB is defined as the market value of assets divided by the book value of assets, LnAsset is natural logarithm of total assets, and Tangibility is the net PPE over total assets. All variables are demeaned to account for all unobservable that might affect the results (firm fixed effect), year dummy is included to reduce the impact of time trend on our results (year fixed effect). All the control variables were included in the model while estimating but were not reported in the output.

Panel A-Dividend Payers

	CF Series					**Trend**					**Cycle**				
	Inv	Div	CR	ND	NQ	Inv	Div	CR	ND	NQ	Inv	Div	CR	ND	NQ
CF	0.303***	0.028***	0.331***	-0.283***	-0.055***										
	(26.78)	(12.65)	(41.86)	(-26.44)	(-8.64)										
CF_Trend						0.288***	0.099***	0.105***	-0.324***	-0.184***					
						(10.10)	(18.14)	(5.09)	(-12.03)	(-11.66)					
CF_Cycle											0.305***	0.014***	0.379***	-0.273***	-0.030***
											(24.36)	(5.69)	(43.58)	(-23.05)	(-4.18)
Constant	0.003	-0.003***	-0.002	0.001	0.002	0.008	-0.004***	0.003	-0.002	0.002	0.008	-0.003***	0.002	-0.003	0.001
	(0.46)	(-3.95)	(-0.73)	(0.27)	(0.59)	(1.25)	(-4.56)	(0.90)	(-0.38)	(0.81)	(1.27)	(-3.30)	(0.58)	(-0.57)	(0.36)
N	11294														
R^2	0.122	0.183	0.134	0.108	0.085	0.094	0.196	0.021	0.078	0.089	0.115	0.174	0.143	0.099	0.080

Panel B-Non-Dividend Payers

	CF Series					**Trend**					**Cycle**				
	Inv	Div	CR	ND	NQ	Inv	Div	CR	ND	NQ	Inv	Div	CR	ND	NQ
CF	0.249***	-0.000	0.312***	-0.232***	-0.208***										
	(22.27)	(-0.85)	(31.99)	(-25.43)	(-19.18)										
CF_Trend						0.371***	-0.002***	0.263***	-0.164***	-0.203***					
						(15.03)	(-2.73)	(11.97)	(-8.07)	(-8.47)					
CF_Cycle											0.212***	0.000	0.336***	-0.254***	-0.198***
											(16.39)	(0.60)	(29.69)	(-24.02)	(-15.96)
Constant	0.033***	-0.000	-0.013	0.027***	-0.007	0.028**	-0.000	-0.016	0.030***	-0.004	0.033***	-0.000	-0.010	0.026***	-0.007
	(2.60)	(-0.69)	(-1.22)	(2.91)	(-0.56)	(2.19)	(-0.48)	(-1.51)	(3.07)	(-0.32)	(2.58)	(-0.43)	(-1.00)	(2.74)	(-0.56)
N	8297					8297					8256				
R^2	0.117	0.004	0.117	0.123	0.136	0.101	0.005	0.046	0.073	0.116	0.103	0.004	0.108	0.118	0.133

t statistics in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

Table 5 Dividend smoothing and the allocation of cash flow. The sample includes U.S. industrial firms in the intersection of annual Compustat file and CRS tapes during 1987–2016 with at least 15 years of non-missing record for cash flow variables. Firms must pay dividend for at least 10 years to be included in our sample. The table reports the allocation of internally generated cash flow (CF). Inv is investment, CashR is cash reserve, ND is net debt issuance, and NQ is net equity issuance. The cash flow variables are defined in the Appendix. Flow-of-funds data in Compustat is used to set-up cash flow variables according to Chang et al. (2014). The cash flow variable is decomposed by applying Butterworth's filter. SOA_{t-1} is the lagged Speed-of-Adjustment and SOA-rel_{t-1} is the lagged relative volatility estimated by the method described in Leary and Michaely (2011). All variables are demeaned to account for all unobservable that might affect the results (firm fixed effect). Control variables, year dummy variables, and constant are included in the model while estimating but suppressed in the output for brevity.

Panel A-Speed-of-Adjustment of diviends (SOA) and the allocation of internal cash flow

	CF Series					**Trend**					**Cycle**				
	Inv	Div	CR	ND	NQ	Inv	Div	CR	ND	NQ	Inv	Div	CR	ND	NQ
CF	0.291***	0.039***	0.278***	-0.295***	-0.097***										
	(20.47)	(12.40)	(28.33)	(-21.77)	(-12.99)										
SOA_{t-1}	-0.013***	0.008***	-0.001	-0.004	-0.002	-0.012**	0.007***	-0.001	-0.004	-0.001	-0.013***	0.008***	-0.000	-0.004	-0.002
	(-2.67)	(7.42)	(-0.23)	(-0.84)	(-0.73)	(-2.41)	(7.09)	(-0.39)	(-0.90)	(-0.58)	(-2.72)	(7.15)	(-0.08)	(-0.83)	(-0.68)
CF_Trend						0.289***	0.134***	0.110***	-0.262***	-0.206***					
						(8.39)	(17.94)	(4.51)	(-7.99)	(-11.60)					
CF_Cycle											0.291***	0.019***	0.315***	-0.302***	-0.073***
											(18.47)	(5.20)	(29.07)	(-20.10)	(-8.80)
N	6018														
R^2	0.142	0.191	0.132	0.133	0.141	0.111	0.213	0.033	0.092	0.136	0.132	0.175	0.136	0.124	0.128

Panel B-Relative volatility of dividends (Rel-Vol) and the allocation of internal cash flow

	CF Series					**Trend**					**Cycle**				
	Inv	Div	CR	ND	NQ	Inv	Div	CR	ND	NQ	Inv	Div	CR	ND	NQ
CF	0.312***	0.045***	0.266***	-0.281***	-0.096***										
	(23.65)	(15.21)	(30.11)	(-22.25)	(-14.09)										
Rel-Vol_{t-1}	-0.004***	0.002***	-0.001	-0.001	-0.001**	-0.003***	0.002***	-0.001	-0.001	-0.001*	-0.004***	0.002***	-0.000	-0.001	-0.001**
	(-4.07)	(11.22)	(-1.32)	(-1.19)	(-2.52)	(-3.78)	(9.84)	(-0.89)	(-1.37)	(-1.82)	(-4.40)	(11.13)	(-0.68)	(-1.03)	(-2.53)
CF_Trend						0.317***	0.142***	0.085***	-0.242***	-0.215***					
						(10.03)	(20.58)	(3.92)	(-8.00)	(-13.34)					
CF_Cycle											0.311***	0.023***	0.306***	-0.290***	-0.070***
											(21.19)	(6.93)	(31.42)	(-20.64)	(-9.16)
N	7490														
R^2	0.140	0.190	0.123	0.124	0.142	0.108	0.210	0.031	0.089	0.140	0.129	0.170	0.130	0.116	0.130

t statistics in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

Table 6 Financial constraint, dividend smoothing (SOA) and the allocation of changes. The sample includes U.S. industrial firms in the intersection of annual Compustat file and CRS tapes during 1987–2016 with at least 15 years of non-missing record for cash flow variables. Firms must pay dividend for at least 10 years to be included in our sample. A firms is categorized as financially more(less) constrained if its HP (Panel A) of WW (Panel B) indexes falls in the top (bottom) 40%. The results are reported for cash flow (CF) and its trend and cyclical components where Inv is investment, CR is cash reserve, ND is net debt issuance, and NQ is net equity issuance. The cash flow variables are defined in the Appendix. Flow-of-funds data in Compustat is used to set-up cash flow variables according to Chang et al. (2014). The cash flow variable is decomposed by applying Butterworth's filter. The table uses SOA_{t-1} as the lagged Speed-of-Adjustment of dividends as a proxy for dividend smoothing measure estimated by the method described in Leary and Michaely (2011). All variables are demeaned to account for all unobservable that might affect the results (firm fixed effect). Control variables, year dummy variables, and constant are included in the model while estimating but suppressed in the output for brevity.

Panel A-Financial constraint - HP Index

	CF Series					Trend					Cycle				
	Inv	Div	CR	ND	NQ	Inv	Div	CR	ND	NQ	Inv	Div	CR	ND	NQ
More Financially Constrained Firms															
SOA_{t-1}	-0.016**	0.010***	-0.001	-0.003	-0.004	-0.015**	0.009***	-0.001	-0.003	-0.003	-0.017***	0.010***	0.000	-0.003	-0.004
	(-2.45)	(6.58)	(-0.17)	(-0.49)	(-1.23)	(-2.22)	(6.20)	(-0.21)	(-0.52)	(-1.02)	(-2.61)	(6.43)	(0.10)	(-0.46)	(-1.22)
CF	0.280***	0.023***	0.320***	-0.287***	-0.089***										
	(14.47)	(5.29)	(22.27)	(-15.88)	(-9.13)										
CF_Trend						0.338***	0.084***	0.137***	-0.283***	-0.158***					
						(6.77)	(7.48)	(3.55)	(-6.05)	(-6.35)					
CF_Cycle											0.268***	0.012**	0.356***	-0.288***	-0.077***
											(12.58)	(2.45)	(22.64)	(-14.47)	(-7.10)
Less Financially Constrained Firms															
SOA_{t-1}	0.005	0.004*	-0.005	0.008	-0.005	0.005	0.003	-0.006	0.008	-0.005	0.004	0.003	-0.005	0.008	-0.005
	(0.48)	(1.66)	(-0.84)	(0.87)	(-1.02)	(0.53)	(1.50)	(-0.86)	(0.81)	(-0.96)	(0.47)	(1.56)	(-0.78)	(0.88)	(-1.00)
CF	0.331***	0.052***	0.255***	-0.266***	-0.097***										
	(11.84)	(8.26)	(13.75)	(-9.89)	(-6.55)										
CF_Trend						0.283***	0.168***	0.135***	-0.224***	-0.190***					
						(4.48)	(12.37)	(3.14)	(-3.70)	(-5.77)					
CF_Cycle											0.343***	0.022***	0.287***	-0.276***	-0.073***
											(10.85)	(2.97)	(13.73)	(-9.09)	(-4.34)

Panel B-Financial constraint - WW Index

	CF Series					Trend					Cycle				
	Inv	Div	CR	ND	NQ	Inv	Div	CR	ND	NQ	Inv	Div	CR	ND	NQ
More Financially Constrained Firms															
SOA_{t-1}	-0.013*	0.011***	-0.008	-0.006	-0.004	-0.013*	0.010***	-0.006	-0.006	-0.003	-0.015*	0.011***	-0.006	-0.006	-0.004
	(-1.73)	(5.78)	(-1.37)	(-0.88)	(-1.02)	(-1.70)	(5.44)	(-1.04)	(-0.84)	(-0.87)	(-1.94)	(5.72)	(-1.13)	(-0.88)	(-1.04)
CF	0.190***	0.031***	0.360***	-0.334***	-0.085***										
	(9.28)	(6.24)	(23.66)	(-17.27)	(-8.34)										
CF_Trend						0.201***	0.126***	0.167***	-0.344***	-0.161***					
						(4.02)	(10.58)	(4.26)	(-7.22)	(-6.60)					
CF_Cycle											0.188***	0.011*	0.401***	-0.332***	-0.068***
											(8.29)	(1.95)	(23.93)	(-15.47)	(-6.05)
Less Financially Constrained Firms															
SOA_{t-1}	-0.011	0.007***	0.005	0.000	0.000	-0.011	0.006***	0.003	-0.001	0.000	-0.011	0.006***	0.005	-0.001	0.001
	(-1.62)	(4.40)	(0.99)	(0.01)	(0.01)	(-1.56)	(4.07)	(0.71)	(-0.22)	(0.03)	(-1.60)	(3.95)	(1.06)	(-0.08)	(0.15)
CF	0.416***	0.054***	0.182***	-0.234***	-0.114***										
	(17.38)	(10.30)	(11.17)	(-10.18)	(-8.19)										
CF_Trend						0.405***	0.141***	0.050	-0.161***	-0.243***					
						(7.28)	(11.74)	(1.31)	(-3.03)	(-7.62)					
CF_Cycle											0.418***	0.032***	0.212***	-0.254***	-0.084***
											(15.80)	(5.43)	(11.80)	(-9.99)	(-5.38)

t statistics in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table 7 Financial constraint, dividend smoothing (Relative volatility) and the allocation of changes. The sample includes U.S. industrial firms in the intersection of annual Compustat file and CRS tapes during 1987–2016 with at least 15 years of non-missing record for cash flow variables. Firms must pay dividend for at least 10 years to be included in our sample. A firms is categorized as financially more(less) constrained if its HP (Panel A) of WW (Panel B) indexes falls in the top (bottom) 40%. The results are reported for cash flow (CF) and its trend and cyclical components where Inv is investment, CR is cash reserve, ND is net debt issuance, and NQ is net equity issuance. The cash flow variables are defined in the Appendix. Flow-of-funds data in Compustat is used to set-up cash flow variables according to Chang et al. (2014). The cash flow variable is decomposed by applying Butterworth's filter. The table uses Rel-Vol$_{t-1}$ as the lagged Relative volatility of dividends as a proxy for dividend smoothing measure estimated by the method described in Leary and Michaely (2011). All variables are demeaned to account for all unobservable that might affect the results (firm fixed effect). Control variables, year dummy variables, and constant are included in the model while estimating but suppressed in the output for brevity.

	CF Series					Trend					Cycle				
	Inv	Div	CR	ND	NQ	Inv	Div	CR	ND	NQ	Inv	Div	CR	ND	NQ
Panel A-Financial constraint - HP Index															
More Financially Constrained Firms															
Rel-Vol$_{t-1}$	-0.004***	0.004***	-0.000	-0.001	0.000	-0.004***	0.003***	0.000	-0.001	0.000	-0.005***	0.004***	0.000	-0.001	0.000
	(-3.45)	(12.45)	(-0.05)	(-0.82)	(0.20)	(-3.39)	(11.72)	(0.29)	(-0.90)	(0.55)	(-3.67)	(12.26)	(0.34)	(-0.73)	(0.16)
CF	0.316***	0.029***	0.296***	-0.274***	-0.085***										
	(17.53)	(7.13)	(22.66)	(-16.13)	(-9.30)										
CF_Trend						0.380***	0.102***	0.103***	-0.237***	-0.178***					
						(8.25)	(9.99)	(3.02)	(-5.48)	(-7.82)					
CF_Cycle											0.304***	0.015***	0.333***	-0.281***	-0.067***
											(15.34)	(3.31)	(23.38)	(-15.08)	(-6.64)
Less Financially Constrained Firms															
Rel-Vol$_{t-1}$	-0.003*	0.001**	-0.002	-0.001	-0.003***	-0.003*	0.000	-0.001	-0.001	-0.003***	-0.003*	0.001**	-0.001	-0.000	-0.003***
	(-1.78)	(2.02)	(-1.58)	(-0.41)	(-3.69)	(-1.66)	(0.95)	(-1.43)	(-0.67)	(-3.34)	(-1.92)	(2.05)	(-1.16)	(-0.25)	(-3.68)
CF	0.359***	0.058***	0.240***	-0.244***	-0.100***										
	(13.83)	(9.72)	(14.76)	(-9.73)	(-7.42)										
CF_Trend						0.385***	0.174***	0.090**	-0.171***	-0.179***					
						(6.73)	(13.77)	(2.47)	(-3.11)	(-6.09)					
CF_Cycle											0.352***	0.026***	0.281***	-0.263***	-0.079***
											(11.93)	(3.75)	(15.32)	(-9.27)	(-5.12)
Panel BFinancial constraint - WW Index															
More Financially Constrained Firms															
Rel-Vol$_{t-1}$	-0.003**	0.003***	-0.001	-0.001	0.000	-0.003**	0.003***	-0.000	-0.001	0.000	-0.004***	0.003***	-0.000	-0.001	0.000
	(-2.53)	(10.25)	(-0.84)	(-0.66)	(0.14)	(-2.48)	(9.28)	(-0.29)	(-0.72)	(0.58)	(-3.04)	(10.15)	(-0.18)	(-0.65)	(0.11)
CF	0.228***	0.036***	0.334***	-0.327***	-0.075***										
	(11.89)	(7.36)	(23.86)	(-17.97)	(-8.00)										
CF_Trend						0.300***	0.124***	0.123***	-0.293***	-0.161***					
						(6.43)	(10.75)	(3.46)	(-6.59)	(-7.16)					
CF_Cycle											0.213***	0.017***	0.380***	-0.334***	-0.057***
											(9.98)	(3.04)	(24.65)	(-16.55)	(-5.42)
Less Financially Constrained Firms															
Rel-Vol$_{t-1}$	-0.003*	0.002***	-0.001	0.001	-0.003***	-0.003*	0.002***	-0.001	0.000	-0.002***	-0.003*	0.002***	-0.001	0.001	-0.003***
	(-1.93)	(6.01)	(-1.17)	(0.51)	(-3.42)	(-1.79)	(4.93)	(-1.00)	(0.18)	(-2.89)	(-1.94)	(5.86)	(-0.94)	(0.64)	(-3.38)
CF	0.410***	0.059***	0.173***	-0.226***	-0.131***										
	(18.21)	(12.44)	(11.99)	(-10.41)	(-10.51)										
CF_Trend						0.388***	0.154***	0.022	-0.166***	-0.271***					
						(7.44)	(14.23)	(0.64)	(-3.31)	(-9.50)					
CF_Cycle											0.416***	0.036***	0.208***	-0.243***	-0.098***
											(16.66)	(6.54)	(13.05)	(-10.10)	(-6.98)

t statistics in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table 8 Total payout – The allocation of cash flow in the full sample. The sample includes U.S. industrial firms in the intersection of annual Compustat file and CRS tapes during 1987–2016 with at least 15 years of non-missing record for cash flow variables. The table reports the allocation of internally generated cash flow (CF), and its trend and cycle components where Inv is investment, Tpay is a measure for total payout (i.e., cash dividends plus shares buybacks), CR is cash reserve, ND is net debt issuance, and NQ^{Adj} is net equity issuance adjusted for share buybacks. The cash flow variables are defined in the Appendix. Flow-of-funds data in Compustat is used to set-up cash flow variables according to Chang et al. (2014). The cash flow variable is decomposed by applying Butterworth's filter. All control variables are lagged to control for contemporaneous effect and includes SaleG that is annual growth rate in sales, Leverage is defined as total debt (the sum of short-term and long-term debt) divided by total assets, MB is defined as the market value of assets divided by the book value of assets, LnAsset is natural logarithm of total assets, and Tangibility is the net PPE over total assets. All variables are demeaned to account for all unobservable that might affect the results (firm fixed effect), year dummy is included to reduce the impact of time trend on our results (year fixed effect).

	CF Series					**Trend**					**Cycle**				
	Inv	Tpay	CR	ND	NQ^{Adj}	Inv	Tpay	CR	ND	NQ^{Adj}	Inv	Tpay	CR	ND	NQ^{Adj}
CF	0.240***	0.048***	0.300***	-0.236***	-0.175***										
	(38.67)	(19.91)	(59.48)	(-43.43)	(-33.92)										
CF_Trend						0.287***	0.118***	0.162***	-0.183***	-0.249***					
						(20.49)	(22.20)	(13.95)	(-14.87)	(-21.56)					
CF_Cycle											0.222***	0.030***	0.344***	-0.251***	-0.154***
											(30.85)	(10.62)	(59.09)	(-39.97)	(-25.76)
$SaleG_{t-1}$	0.030***	-0.007***	0.002	0.018***	0.007***	0.029***	-0.007***	0.003*	0.018***	0.007***	0.030***	-0.007***	0.001	0.018***	0.007***
	(15.47)	(-9.45)	(1.41)	(10.50)	(4.53)	(14.75)	(-9.01)	(1.75)	(10.32)	(4.46)	(15.65)	(-9.19)	(0.93)	(10.56)	(4.33)
$Leverage_{t-1}$	-0.118***	-0.048***	0.021***	-0.185***	0.041***	-0.114***	-0.043***	0.012***	-0.181***	0.036***	-0.110***	-0.048***	0.014***	-0.184***	0.040***
	(-23.85)	(-24.88)	(5.34)	(-42.82)	(10.05)	(-22.49)	(-22.18)	(2.80)	(-40.58)	(8.62)	(-22.29)	(-25.27)	(3.47)	(-42.71)	(9.69)
MB_{t-1}	0.018***	0.004***	0.004***	0.006***	0.019***	0.017***	0.004***	0.005***	0.006***	0.020***	0.017***	0.004***	0.004***	0.006***	0.019***
	(28.55)	(15.99)	(7.93)	(11.65)	(37.33)	(26.69)	(15.08)	(10.08)	(10.90)	(37.80)	(27.87)	(16.65)	(8.42)	(11.74)	(37.16)
$LnAT_{t-1}$	-0.015***	0.008***	-0.013***	-0.002**	-0.018***	-0.016***	0.008***	-0.011***	-0.003***	-0.017***	-0.017***	0.009***	-0.011***	-0.002**	-0.017***
	(-16.09)	(22.67)	(-16.06)	(-2.22)	(-22.21)	(-15.96)	(19.94)	(-13.42)	(-2.89)	(-20.57)	(-17.61)	(22.86)	(-14.08)	(-2.40)	(-21.71)
Tangibility $_{t-1}$	0.027***	-0.009***	0.059***	0.049***	0.028***	0.026***	-0.013***	0.066***	0.046***	0.032***	0.021***	-0.009***	0.066***	0.048***	0.030***
	(3.84)	(-3.38)	(10.34)	(7.90)	(4.85)	(3.57)	(-4.82)	(10.96)	(7.25)	(5.42)	(2.91)	(-3.19)	(11.53)	(7.77)	(5.07)
Constant	0.011**	0.004**	-0.009***	0.011***	-0.005	0.010**	0.003*	-0.008**	0.010**	-0.004	0.012**	0.004***	-0.006*	0.009**	-0.006
	(2.17)	(2.44)	(-2.59)	(2.68)	(-1.37)	(2.02)	(1.78)	(-2.08)	(2.49)	(-1.05)	(2.33)	(2.66)	(-1.74)	(2.23)	(-1.64)
N	27833														
R^2	0.115	0.107	0.114	0.114	0.096	0.095	0.111	0.028	0.074	0.080	0.104	0.099	0.114	0.108	0.084

t statistics in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table 9 Total payout – The allocation of cash flow in two sub-samples of dividend-paying and non-dividend paying firms. The sample includes U.S. industrial firms in the intersection of annual Compustat file and CRS tapes during 1987–2016 with at least 15 years of non-missing record for cash flow variables. We divide the sample into two subsamples of dividend-paying firms that pay dividend for at least 10 years (Panel A) and non-dividend paying firms that do not pay dividend for at least 10 years (Panel B). The table reports the allocation of internally generated cash flow (CF), and its trend and cycle components where Inv is investment, Tpay is cash dividends plus shares buybacks, CR is cash reserve, ND is net debt issuance, and NQ^{Adj} is net equity issuance adjusted for share buybacks. The cash flow variables are defined in the Appendix. Flow-of-funds data in Compustat is used to set-up cash flow variables according to Chang et al. (2014). The cash flow variable is decomposed by applying Butterworth's filter. All control variables are lagged to control for contemporaneous effect and includes SaleG that is annual growth rate in sales, Leverage is defined as total debt (the sum of short-term and long-term debt) divided by total assets, MB is defined as the market value of assets divided by the book value of assets, LnAsset is natural logarithm of total assets, and Tangibility is the net PPE over total assets. All variables are demeaned to account for all unobservable that might affect the results (firm fixed effect), year dummy is included to reduce the impact of time trend on our results (year fixed effect). All the control variables were included in the model while estimating but were not reported in the output.

Panel A-Dividend Payers

	CF Series					**Trend**					**Cycle**				
	Inv	Tpay	CR	ND	NQ^{Adj}	Inv	Tpay	CR	ND	NQ^{Adj}	Inv	Tpay	CR	ND	NQ^{Adj}
CF	0.299***	0.093***	0.325***	-0.277***	-0.006										
	(26.63)	(17.10)	(41.17)	(-26.18)	(-1.22)										
CF_Trend						0.269***	0.282***	0.094***	-0.315***	-0.041***					
						(9.63)	(21.41)	(4.63)	(-11.97)	(-3.51)					
CF_Cycle											0.304***	0.054***	0.373***	-0.269***	0.002
											(24.54)	(9.03)	(43.14)	(-23.01)	(0.32)
Constant	0.003	0.002	-0.002	0.000	0.003	0.008	0.001	0.003	-0.003	0.003	0.008	0.004*	0.002	-0.004	0.003
	(0.47)	(1.09)	(-0.70)	(0.05)	(1.48)	(1.26)	(0.50)	(0.92)	(-0.57)	(1.54)	(1.30)	(1.76)	(0.48)	(-0.80)	(1.35)
N	11588														
R^2	0.116	0.157	0.129	0.107	0.037	0.088	0.168	0.020	0.078	0.037	0.109	0.142	0.138	0.097	0.036

Panel B-Non-Dividend Payers

	CF Series					**Trend**					**Cycle**				
	Inv	Tpay	CR	ND	NQ^{Adj}	Inv	Tpay	CR	ND	NQ^{Adj}	Inv	Tpay	CR	ND	NQ^{Adj}
CF	0.237***	0.017***	0.301***	-0.224***	-0.222***										
	(21.29)	(5.18)	(31.18)	(-24.62)	(-20.72)										
CF_Trend						0.342***	0.037***	0.224***	-0.161***	-0.236***					
						(14.05)	(5.41)	(10.36)	(-8.01)	(-10.08)					
CF_Cycle											0.203***	0.011***	0.328***	-0.244***	-0.215***
											(15.66)	(2.84)	(29.24)	(-23.16)	(-17.28)
Constant	0.030**	0.005	-0.015	0.028***	-0.007	0.026**	0.004	-0.017	0.030***	-0.004	0.030**	0.005	-0.012	0.026***	-0.007
	(2.39)	(1.54)	(-1.42)	(2.93)	(-0.59)	(2.00)	(1.37)	(-1.64)	(3.08)	(-0.31)	(2.35)	(1.52)	(-1.16)	(2.75)	(-0.61)
N	8385					8385					8385				
R^2	0.114	0.060	0.114	0.119	0.129	0.098	0.060	0.043	0.073	0.106	0.099	0.058	0.106	0.114	0.120

t statistics in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

Table 10 Total payout smoothing and the allocation of cash flow. The sample includes U.S. industrial firms in the intersection of annual Compustat file and CRS tapes during 1987–2016 with at least 15 years of non-missing record for cash flow variables. Firms must pay dividend for at least 10 years to be included in our sample. The table reports the allocation of internally generated cash flow (CF), and its trend and cycle components where Inv is investment, Tpay is cash dividends plus shares buybacks, CR is cash reserve, ND is net debt issuance, and NQ^{Adj} is net equity issuance adjusted for share buybacks. The cash flow variables are defined in the Appendix. Flow-of-funds data in Compustat is used to set-up cash flow variables according to Chang et al. (2014). The cash flow variable is decomposed by applying Butterworth's filter. SOA_{t-1}^{Tpay} is the lagged Speed-of-Adjustment of total payouts and $\text{Rel-Vol}_{t-1}^{Tpay}$ is the lagged relative volatility of total payouts estimated by the method described in Leary and Michaely (2011). All variables are demeaned to account for all unobservable that might affect the results (firm fixed effect). Control variables, year dummy variables, and constant are included in the model while estimating but suppressed in the output for brevity.

Panel A-Speed-of-Adjustment of Total payout (SOA) and the allocation of internal cash flow

	CF Series					Trend					Cycle				
	Inv	Tpay	CR	ND	NQ^{Adj}	Inv	Tpay	CR	ND	NQ^{Adj}	Inv	Tpay	CR	ND	NQ^{Adj}
CF	0.298***	0.110***	0.323***	-0.271***	0.002										
	(20.17)	(14.43)	(30.60)	(-19.31)	(0.54)										
$\text{SOA}_{t-1}^{\text{Tpay}}$	0.007**	0.003	0.002	0.009***	0.002**	0.007**	0.002	0.002	0.009***	0.002**	0.007*	0.003	0.003	0.010***	0.002**
	(1.98)	(1.47)	(0.79)	(2.86)	(2.43)	(2.07)	(1.13)	(0.73)	(2.75)	(2.40)	(1.87)	(1.43)	(1.03)	(2.90)	(2.47)
CF_Trend						0.297***	0.291***	0.113***	-0.286***	-0.013					
						(8.10)	(15.69)	(4.15)	(-8.21)	(-1.48)					
CF_Cycle											0.299***	0.073***	0.365***	-0.268***	0.005
											(18.37)	(8.64)	(31.68)	(-17.36)	(1.24)
N	5469														
R^2	0.141	0.204	0.152	0.124	0.035	0.110	0.209	0.031	0.091	0.036	0.132	0.186	0.160	0.115	0.035

Panel B-Relative volatility of Total payout (Rel-Vol) and the allocation of internal cash flow

	CF Series					Trend					Cycle				
	Inv	Tpay	CR	ND	NQ^{Adj}	Inv	TpayDiv	CR	ND	NQ^{Adj}	Inv	Tpay	CR	ND	NQ^{Adj}
CF	0.315***	0.108***	0.307***	-0.269***	-0.001										
	(24.36)	(15.90)	(33.97)	(-21.86)	(-0.35)										
$\text{Rel-Vol}_{t-1}^{\text{Tpay}}$	-0.000	0.001***	-0.000	0.000	0.000**	-0.000	0.001***	0.000	0.000	0.000**	-0.001	0.001***	-0.000	0.000	0.000**
	(-0.88)	(4.89)	(-0.70)	(0.72)	(2.16)	(-0.71)	(3.94)	(0.01)	(0.84)	(2.30)	(-1.19)	(4.97)	(-0.06)	(0.90)	(2.28)
CF_Trend						0.269***	0.294***	0.094***	-0.325***	-0.018**					
						(8.45)	(18.00)	(4.09)	(-10.76)	(-2.44)					
CF_Cycle											0.325***	0.069***	0.351***	-0.257***	0.002
											(22.80)	(9.18)	(35.49)	(-18.97)	(0.72)
N	7193														
R^2	0.137	0.205	0.142	0.119	0.036	0.101	0.212	0.026	0.089	0.037	0.129	0.188	0.151	0.108	0.036

t statistics in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

Table 11 Financial constraint, total payouts smoothing ($\mathbf{SOA}_{t-1}^{Tpay}$) and the allocation of cash flow. The sample includes U.S. industrial firms in the intersection of annual Compustat file and CRS tapes during 1987–2016 with at least 15 years of non-missing record for cash flow variables. Firms must pay dividend for at least 10 years to be included in our sample. A firms is categorized as financially more(less) constrained if its HP (Panel A) of WW (Panel B) indexes falls in the top (bottom) 40%. The table reports the allocation of internally generated cash flow (CF), and its trend and cycle components. Inv is investment, Tpay is cash dividends plus shares buybacks, CR is cash reserve, ND is net debt issuance, and NQ^{Adj} is net equity issuance adjusted for share buybacks. The cash flow variables are defined in the Appendix. Flow-of-funds data in Compustat is used to set-up cash flow variables according to Chang et al. (2014). The cash flow variable is decomposed by applying Butterworth's filter. The $\mathrm{SOA}_{t-1}^{Tpay}$ is the lagged Speed-of-Adjustment of total payouts estimated by the method described in Leary and Michaely (2011). All variables are demeaned to account for all unobservable that might affect the results (firm fixed effect). Control variables, year dummy variables, and constant are included in the model while estimating but suppressed in the output for brevity.

	CF Series					Trend					Cycle				
	Inv	Tpay	CR	ND	NQ^{Adj}	Inv	Tpay	CR	ND	NQ^{Adj}	Inv	Tpay	CR	ND	NQ^{Adj}
Panel A-Financial constraint - HP Index															
More Financially Constrained Firms															
$\mathrm{SOA}_{t-1}^{\mathrm{Tpay}}$	0.001	0.005**	0.000	0.004	0.002	0.001	0.004*	0.000	0.004	0.002	0.000	0.005**	0.001	0.004	0.002*
	(0.13)	(2.09)	(0.09)	(0.90)	(1.63)	(0.19)	(1.78)	(0.13)	(0.83)	(1.62)	(0.03)	(2.08)	(0.29)	(0.95)	(1.69)
CF	0.317***	0.104***	0.344***	-0.242***	0.007										
	(16.26)	(11.13)	(23.26)	(-13.38)	(1.63)										
CF_Trend						0.360***	0.253***	0.139***	-0.231***	-0.016					
						(6.97)	(10.49)	(3.43)	(-4.83)	(-1.44)					
CF_Cycle											0.307***	0.078***	0.384***	-0.243***	0.012**
											(14.32)	(7.50)	(23.77)	(-12.22)	(2.43)
Less Financially Constrained Firms															
$\mathrm{SOA}_{t-1}^{\mathrm{Tpay}}$	0.042***	-0.009*	0.003	0.035***	0.001	0.043***	-0.010**	0.003	0.035***	0.001	0.042***	-0.009*	0.004	0.035***	0.001
	(4.82)	(-1.87)	(0.50)	(4.17)	(0.50)	(4.91)	(-2.09)	(0.40)	(4.10)	(0.48)	(4.77)	(-1.89)	(0.63)	(4.18)	(0.50)
CF	0.250***	0.137***	0.287***	-0.313***	-0.013										
	(7.73)	(7.77)	(13.00)	(-10.10)	(-1.46)										
CF_Trend						0.175**	0.353***	0.053	-0.404***	-0.015					
						(2.30)	(8.58)	(0.98)	(-5.51)	(-0.74)					
CF_Cycle											0.273***	0.088***	0.333***	-0.294***	-0.013
											(7.74)	(4.52)	(13.92)	(-8.69)	(-1.30)
Panel B-Financial constraint - WW Index															
More Financially Constrained Firms															
$\mathrm{SOA}_{t-1}^{\mathrm{Tpay}}$	0.005	-0.001	-0.001	0.006	0.000	0.004	-0.001	-0.004	0.007	0.000	0.005	-0.002	-0.002	0.006	0.000
	(0.69)	(-0.45)	(-0.27)	(1.03)	(0.23)	(0.50)	(-0.43)	(-0.80)	(1.13)	(0.13)	(0.71)	(-0.53)	(-0.40)	(1.05)	(0.22)
CF	0.288***	0.090***	0.393***	-0.231***	0.003										
	(13.63)	(7.74)	(22.95)	(-12.02)	(0.57)										
CF_Trend						0.261***	0.232***	0.165***	-0.318***	-0.025*					
						(4.97)	(8.24)	(3.72)	(-6.71)	(-1.95)					
CF_Cycle											0.297***	0.061***	0.435***	-0.215***	0.008
											(12.88)	(4.77)	(23.44)	(-10.21)	(1.42)
Less Financially Constrained Firms															
$\mathrm{SOA}_{t-1}^{\mathrm{Tpay}}$	0.006	0.002	0.005	0.010	0.004***	0.007	0.002	0.006	0.009	0.004***	0.007	0.002	0.006	0.009	0.004***
	(0.88)	(0.75)	(1.43)	(1.55)	(2.97)	(0.97)	(0.71)	(1.55)	(1.41)	(2.96)	(1.05)	(0.86)	(1.58)	(1.40)	(2.93)
CF	0.377***	0.121***	0.231***	-0.276***	0.005										
	(14.26)	(8.83)	(13.29)	(-10.85)	(0.72)										
CF_Trend						0.402***	0.307***	0.082*	-0.203***	-0.007					
						(6.37)	(9.52)	(1.95)	(-3.34)	(-0.43)					
CF_Cycle											0.372***	0.080***	0.261***	-0.294***	0.007
											(12.83)	(5.26)	(13.74)	(-10.52)	(0.93)

t statistics in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

Table 12 Financial constraint, total payouts smoothing (Rel-Vol$^{Tpay}_{t-1}$) and the allocation of cash flow. The sample includes U.S. industrial firms in the intersection of annual Compustat file and CRS tapes during 1987–2016 with at least 15 years of non-missing record for cash flow variables. Firms must pay dividend for at least 10 years to be included in our sample. A firms is categorized as financially more(less) constrained if its HP (Panel A) of WW (Panel B) indexes falls in the top (bottom) 40%. The table reports the allocation of internally generated cash flow (CF), and its trend and cycle components where Inv is investment, Tpay is cash dividends plus shares buybacks, CR is cash reserve, ND is net debt issuance, and NQ^{Adj} is net equity issuance adjusted for share buybacks. The cash flow variables are defined in the Appendix. Flow-of-funds data in Compustat is used to set-up cash flow variables according to Chang et al. (2014). The cash flow variable is decomposed by applying Butterworth's filter. The Rel-Vol$^{Tpay}_{t-1}$ is the lagged relative volatility of total payouts estimated by the method described in Leary and Michaely (2011). All variables are demeaned to account for all unobservable that might affect the results (firm fixed effect). Control variables, year dummy variables, and constant are included in the model while estimating but suppressed in the output for brevity.

	CF Series					Trend					Cycle				
	Inv	Tpay	CR	ND	NQ^{Adj}	Inv	Tpay	CR	ND	NQ^{Adj}	Inv	Tpay	CR	ND	NQ^{Adj}
Panel A-Financial constraint - HP Index															
More Financially Constrained Firms															
Rel-Vol$^{Tpay}_{t-1}$	-0.001**	0.001***	-0.001*	-0.001*	0.000	-0.001**	0.001***	-0.000	-0.001	0.000	-0.002***	0.001***	-0.001	-0.001	0.000
	(-2.45)	(4.63)	(-1.65)	(-1.67)	(0.72)	(-2.38)	(3.97)	(-0.91)	(-1.49)	(0.97)	(-2.71)	(4.74)	(-1.17)	(-1.52)	(0.89)
CF	0.312***	0.099***	0.343***	-0.252***	0.007*										
	(18.33)	(11.84)	(26.94)	(-15.82)	(1.88)										
CF_Trend						0.294***	0.254***	0.133***	-0.302***	-0.016*					
						(6.50)	(11.70)	(3.78)	(-7.18)	(-1.72)					
CF_Cycle											0.315***	0.072***	0.382***	-0.243***	0.011***
											(16.90)	(7.79)	(27.60)	(-13.93)	(2.76)
Less Financially Constrained Firms															
Rel-Vol$^{Tpay}_{t-1}$	-0.001	0.001**	0.000	0.001	0.000	-0.000	0.001*	0.001	0.001	0.000*	-0.001	0.001**	0.001	0.001	0.000
	(-0.57)	(2.40)	(0.53)	(0.73)	(1.58)	(-0.43)	(1.78)	(0.91)	(0.76)	(1.66)	(-0.75)	(2.46)	(0.94)	(0.86)	(1.62)
CF	0.324***	0.129***	0.264***	-0.273***	-0.011										
	(11.57)	(8.23)	(14.18)	(-10.17)	(-1.42)										
CF_Trend						0.283***	0.312***	0.059	-0.317***	-0.028*					
						(4.50)	(9.02)	(1.38)	(-5.26)	(-1.73)					
CF_Cycle											0.335***	0.082***	0.315***	-0.262***	-0.006
											(10.67)	(4.61)	(15.23)	(-8.70)	(-0.72)
Panel BFinancial constraint - WW Index															
More Financially Constrained Firms															
Rel-Vol$^{Tpay}_{t-1}$	-0.001*	0.001***	-0.001**	-0.001*	-0.000	-0.001*	0.001***	-0.001	-0.001	-0.000	-0.002**	0.001***	-0.001*	-0.001*	-0.000
	(-1.87)	(3.27)	(-2.43)	(-1.90)	(-0.77)	(-1.69)	(2.64)	(-1.60)	(-1.59)	(-0.45)	(-2.18)	(3.24)	(-1.92)	(-1.82)	(-0.62)
CF	0.275***	0.086***	0.380***	-0.260***	0.000										
	(14.66)	(7.98)	(25.55)	(-15.12)	(0.08)										
CF_Trend						0.209***	0.248***	0.145***	-0.366***	-0.033***					
						(4.57)	(9.75)	(3.81)	(-8.75)	(-3.02)					
CF_Cycle											0.292***	0.051***	0.426***	-0.238***	0.007
											(14.26)	(4.35)	(26.32)	(-12.63)	(1.40)
Less Financially Constrained Firms															
Rel-Vol$^{Tpay}_{t-1}$	0.001	0.001*	0.001*	0.001**	0.000***	0.001	0.000	0.001**	0.001**	0.001***	0.000	0.001*	0.001**	0.002**	0.001***
	(0.81)	(1.75)	(1.89)	(2.27)	(2.98)	(0.89)	(1.12)	(2.27)	(2.29)	(3.00)	(0.69)	(1.94)	(2.13)	(2.39)	(3.08)
CF	0.367***	0.137***	0.220***	-0.279***	0.004										
	(16.19)	(11.55)	(15.07)	(-12.75)	(0.66)										
CF_Trend						0.284***	0.365***	0.053	-0.300***	0.002					
						(5.18)	(12.97)	(1.48)	(-5.68)	(0.18)					
CF_Cycle											0.386***	0.088***	0.254***	-0.276***	0.004
											(15.51)	(6.66)	(15.92)	(-11.47)	(0.59)

t statistics in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$