Dividend Smoothing and Predictability

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Abstract

We show that, even if dividends are supposed to be predictable without smoothing, dividend smoothing can bury this predictability in a finite sample. We further show that aggregate dividends are dramatically more smoothed in the postwar period than before. Therefore, the lack of dividend growth predictability in the postwar period, as widely documented in the literature, does not necessarily mean that there is no cash flow news in stock price variations; rather, a more plausible interpretation is that dividends are smoothed. To confirm this point, we sort firms into portfolios based on how smooth their dividends are. We find that dividend growth is unpredictable for firms that have most smoothed their dividends, but predictable for firms that have least smoothed their dividends. In contrast, earnings growth is predictable for all portfolios. Our take-away messages are that (i) dividend smoothing can severely affect dividend predictability in a finite sample, (ii) there is significant cash flow news in stock price variations, and (iii) when smoothed, dividends do not represent well the outlook of future cash flows.

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1 Introduction

In their seminal paper, Miller and Modigliani (1961) argue forcefully that dividend policy is irrelevant: while corporate managers have large discretion over payout options, such discretion should be irrelevant for stock prices. Rather, stock prices should be driven by "real" behavior – the earnings power of corporate assets and investment policy – and, crucially, not by how the earnings power is distributed.[1]

The evolving history of dividend payout appears to be largely consistent with Miller and Modigliani's (1961) intuition. For example, Lintner's (1956) early analysis finds that corporations are loathe to cut dividends; dividends are smoothed and tied to long-term sustainable earnings. However, more recently there has been a dramatic shift in dividend payout: in 1973, 52.8% of publicly traded firms (excluding financials and utilities) paid dividends; this number peaked at 66.5% in 1978 and dropped to 20.8% in 1999 (Fama and French (2001)). The remaining dividend payers are content with maintaining past levels of dividends per share; after that the payout policy is of secondary importance (Brav, Graham, Harvey, and Michaely (2005)). With the declining tendency to pay dividends, stock repurchases emerged as an economically significant channel of payout in the early 1980s (Bagwell and Shoven (1989)) and are now of roughly the same magnitude as aggregate dividends (Skinner (2008)). In a nutshell, we have seen a wide range of dividend payout polices in the past 60 years.

Although dividends might not be relevant for stock prices, they are critical for economic analysis. Understanding stock price variation has concerned economists for many years and has focused on determining whether investors' revised forecasts regarding future cash flows or discount rates are the drivers of price variation. Empirically, the answer to this question is usually inferred from the predictability of cash flows relative to that of stock returns.[2] Since dividends are habitually seen

[1]While payout policy might be relevant to shareholders when the capital market is incomplete or imperfect (see the excellent survey by Allen and Michaely (2003) and the references therein), the intuition remains that the fundamental driver of a firm's cash flow, namely, its earnings power, is of the first order importance for the firm's valuation.

[2]The idea is that, if cash flow growth rates and stock returns are predictable, the expected cash flow growth rates and the expected returns must be time-varying. Such variations must cause stock prices to change, and thus the relative predictability reveals which component is more important in driving price movements.

as the cash flows to stockholders, "predictability of dividends and/or returns form, in many ways, the rational paradigm to interpret asset price variation." (Bansal and Yaron (2007)).[3]

The general conclusion of the extant literature is that in the post war period the dividend-price ratio (i.e., dividend yield) can predict aggregate returns, but not dividend growth. This finding has led to the widely accepted view that almost all the variation in the dividend yield is driven by the variation in discount rates (Cochrane (1992, 2001, 2006) and Campbell and Ammer (1993)). However, Chen (2009) shows that dividend growth is strongly predictable by the dividend yield in the period 1872-1945 but, consistent with the extant literature, this predictability completely disappears in the postwar period. This finding raises an interesting paradox since any conclusions regarding asset price variations based on the relative dividend growth/return predictability findings would be the *opposite* for the pre- and postwar periods.

What has caused such a dramatic change of predictability? Dividend policy, being irrelevant, should not affect stock prices, but it affects dividend growth by definition (e.g., Marsh and Merton (1986)). Therefore, how much of the inability of the dividend yield to predict dividend growth stems from the fact that over any period of time dividends can be arbitrary and delinked from asset prices? The answers to these questions are important since they shape our understanding of stock price movements.

We first ask whether dividend smoothing changes in the postwar period relative to the prewar period by fitting various dividend behavior models based on Lintner (1956) and Marsh and Merton (1987). The evidence is compelling: dividend payout at the aggregate level has become much more smoothed. For example, when running the standard Lintner's (1956) model for the prewar period (1871-19459, the speed of adjustment to target is 0.37; the corresponding number for the postwar period (1946-2006) is 0.09. In other words, in the postwar period dividends adjust to their earnings target at a speed about one fourth of that in the prewar period. As another example, if we regress dividend change on its own lag, the coefficient is 0.061 for the prewar period and

[3]For example, to explain the equity premium puzzle, Campbell and Cochrane (1999) focus on modeling the time-varying expected return while Bansal and Yaron (2004) model both expected return and dividend growth. As another example, see Ang and Liu (2004) for how to discount future cash flows using time-varying discount rates.

is statistically insignificant. The corresponding coefficient is 0.687 in the postwar period and statistically significant at the 1% level. Dividend policy has evolved in such a way that its own lag has become its best predictor in the postwar period, consistent with the survey by Brav, Graham, Harvey, and Michaely (2005).

Having established the evidence of dividend smoothing, we then ask whether dividend smoothing affects predictability. To the best of our knowledge this question has been largely ignored despite the voluminous literature on predictability. Using simulation analysis, we start with the null hypothesis that dividends are predictable by the dividend yield. We then change the degree of dividend smoothing and study its impact on predictive regressions. Throughout these simulations, we adopt the dividend policy such that it is sustainable and the dividend yield is always within a sensible range. Our simulated results show that, even though dividends are generated to be strongly predictable without smoothing, introducing dividend smoothing can completely eliminate this predictability at normal horizons through which we run regressions in a finite sample. Severe dividend smoothing also makes the dividend yield very persistent, a pattern evident in the data: the autoregressive coefficient for the log dividend yield is 0.557 in the prewar period, and 0.956 in the postwar period.

The combined evidence that (i) dividends are much more smoothed in the postwar period and (ii) dividend smoothing can severely affect predictability has the following implication: the lack of dividend growth predictability in the postwar period does not mean that aggregate stock price variations contain no cash flow news; rather, a more logical interpretation is that dividends are so smoothed that they do not reflect well future cash flows.

Given the finding that dividend smoothing in the postwar period eliminates dividend predictability, are there alternative cash flow measures that reflect actual future cash flows better, while still allowing for a meaningful comparison of the relative cash flow/return predictability? We examine two such cash flow measures. The first is the repurchase-included dividend payout (e.g., Boudoukh, Michaely, Richardson, and Roberts (2007) and Skinner (2008)) which addresses one aspect of the postwar change in dividend policy. Confirming Boudoukh, Michaely, Richardson, and Roberts (2007), we find that the payout yield predicts returns. However, it does not predict payout growth in the postwar period. This finding is not surprising since Miller and Modigliani (1961) suggest that all payout policies are irrelevant for valuations.

The second cash flow measure we use is the aggregate earnings growth. Stock prices reflect the present value of future earnings power; whether such earnings are distributed, and in what form of payout, can be arbitrary. For this reason, if one wants to understand whether price movements reflect cash flows, it is appropriate to examine whether earnings growth is predictable.[4]

We find that the earnings yield strongly predicts earnings growth in the postwar period. We note that the dividend growth rate is equal to the earnings growth rate plus the payout ratio growth rate; the latter is defined as the growth rate of the dividend/earnings ratio. Since dividend growth is not predictable but earnings growth is strongly predictable, the payout ratio growth rate must also be strongly predictable in the postwar period. We find this is indeed the case. This finding has an intuitive interpretation: stock price variation contains significant news about future earnings. However, since dividends are smoothed, they do not respond strongly to earnings. As a result, earnings predictability is equivalent to payout ratio growth predictability because payout ratio growth absorbs the variation of earnings growth.

In order to further highlight the role of dividend smoothing in cash flow predictability, we sort firms into three portfolios based on how smooth a firm's dividend payout is. Smoothness is defined as the standard deviation of dividend growth divided by the standard deviation of earnings growth; a lower ratio suggests that the firm's dividend payout is more smoothed. Interestingly, in the postwar period dividend growth is predictable by the dividend yield for the portfolio that is least smoothed, but not so for the portfolio that is most smoothed. This evidence further

[4]The benefit of using earnings as the meaningful measure of cash flows is summarized by Miller and Modigliani (1961): "We can follow the standard practice of the security analyst and think in terms of price per share, dividends per share, and the rate of growth of dividends per share; or we can think in terms of the total value of the enterprise, total earnings, and the rate of growth of total earnings. Our own preference happens to be for the second approach primarily because certain additional variables of interest — such as dividend policy, leverage, and size of firm – can be incorporated more easily and meaningfully into test equations in which the growth term is the growth of total earnings."

supports our hypothesis that dividend smoothing played a crucial role in the lack of dividend growth predictability. While there are clear variations in dividend growth predictability conditional on the smoothness of dividend payout, we find that earnings growth and payout ratio growth are predictable for both portfolios in the postwar period.

Our take-away message is that dividends are severely smoothed in the postwar period. This eliminates all dividend growth predictability. As a result, comparing relative dividend growth/return predictability to make inferences regarding stock price variations becomes pointless. This is because dividends, when smoothed, do not reflect well future cash flows. If one wants to study the relative importance of cash flow news/discount rate news in driving the variation of stock returns, it is more meaningful to use cash flow measures that are less likely to be smoothed, such as earnings growth. By doing so, we find substantial cash flow news in stock returns for the postwar period.

Link to the literature Using firm-level data, some studies have shown that dividends are more smoothed since the 1980s (e.g., Brav, Graham, Harvey, and Michaely (2005) and Skinner (2008)). As Marsh and Merton (1987) point out, since many stories of dividend behavior are motivated at the firm level, it is important to separately examine the dividend behavior at the aggregate level. Surprisingly, very limited evidence has been documented in this regard. Marsh and Merton (1987) develop a model to summarize the dividend behavior at the aggregate level, but they do not emphasize the contrast in dividend behavior for the prewar and postwar periods. Therefore, our finding that aggregate dividends have been dramatically more smoothed in the postwar period provides a new, useful summary of the aggregate dividend dynamics for the past 130 years.

There is a large literature that compares the relative dividend/return predictability (e.g., Campbell and Shiller (1988, 1998), Cochrane (1992, 2001, 2008), Ang (2002), Goyal and Welch (2003), Lettau and Nieuwerburgh (2006), Ang and Bekaert (2007), Binsbergen and Koijen (2007), and Chen (2009)). To the best of our knowledge, there is no study that systematically examines the impact of dividend smoothing on predictability.[5] Given that dividends are widely regarded as the measure of cash flow to shareholders, and that dividends can be easily manipulated by firms, understanding the impact of dividend smoothing seems important. This study fills this void. Our message is that dividend growth might not be predictable by the dividend yield simply because dividends are smoothed. Notably, Lettau and Ludvigson (2005) point out another reason, different from dividend smoothing, of why the dividend growth might not be predicted by dividend yield.

A separate literature tries to incorporate more forms of payout in addition to dividends when running predictive regressions of returns (e.g., Vuolteenaho (2000), Bansal, Khatchatrian, and Yaron (2005), Boudoukh, Michaely, Richardson, and Roberts (2007), Bansal and Yaron (2007), Ang and Bekaert (2007), Sadka (2007), Larrain and Yogo (2008), and Hansen, Heaton, and Li (2008)). Our paper is in spirit close to this literature. But our focus is to study the impact of dividend smoothing on predictability and use this to explain the dramatic reversal of dividend growth predictability. As new evidence, we also show that simply adding repurchases to dividends does not lead to predictability of dividend growth.

The remainder of the paper is organized as follows. Section 2 provides a theoretical motivation on why dividend smoothing might affect predictability. Section 3 provides empirical evidence regarding the aggregate dividend behavior. Section 4 studies whether dividend smoothing affects predictability. The predictability of dividend growth, earnings growth, returns, and the payout ratio is assessed in section 5. A number of robustness checks are carried out in section 6. Section 7 concludes.

[5] Chen (2009) also asks whether dividend smoothing has contributed to the lack of dividend predictability in the postwar period. To answer this question, he examines whether the book-to-market ratio can predict the earnings return on equity and finds the answer is no. But he does not provide any evidence on increased dividend smoothing in the postwar period; nor does he investigate how dividend smoothing affects predictability. We do both, and, in addition, we find that the earnings yield can predict earnings growth. Our combined evidence thus leads to a different conclusion.

2 Theoretical motivation

Campbell and Shiller (1988) show that the log dividend yield, suppressing a constant, can be approximated as

$$d_t - p_t = E_t \left[\sum_{j=0}^{\infty} \rho^j r_{t+1+j} \right] - E_t \left[\sum_{j=0}^{\infty} \rho^j \Delta d_{t+1+j} \right], \tag{1}$$

where d_t is log dividend, p_t is log price, r_{t+1+j} is log return, and Δd_{t+1+j} is log dividend growth. Equation (1) says that the log dividend yield is the difference between expected future returns and expected future dividend growth. It follows that the variation of the dividend yield must predict the revisions in the two expectation components.

This identity has inspired economists to examine whether expected returns or expected dividend growth is more predictable by the dividend yield. In doing so, the key interest is to understand why stock prices vary (see Bansal and Yaron (2007) for discussion). Intuitively, stock price variation could reflect either a revised outlook on future cash flows or revisions to discount rates. The predictive regression reveals which component is revised in prices.

There is, however, a potential problem in this predictive regression approach. On one hand, dividend policy is irrelevant in valuation (Miller and Modigliani (1961) and Marsh and Merton (1986)); on the other hand, dividend policy determines the path of dividend growth in a finite sample. This creates a potentially large wedge between price variation and future dividend growth variation. The rationale for running predictive regressions is to understand whether price variation contains news about future cash flows. However, if dividends do not vary according to the outlook of future cash flows, then it deems the exercise of predictive regressions futile. In the language of Miller and Modigliani (1961), the nature of the problem is that stock returns have little to do with how cash flows are distributed, but dividend growth has everything to do with it.

The counterargument is that the aggregate dividend yield seems to be historically stationary in the sense that it does not reach zero or explode. In other words, since dividend growth does seem to keep pace with price in the long run, dividend policy cannot be too wild. The difficulty comes down to identifying how long is the "long run." For example, dividend growth is only unpredictable by the dividend yield in the postwar period. Given that the postwar period has experienced a large change in dividend policy, how much has this contributed to the lack of predictability?

In addition, imagine that the firm lets dividends grow at the constant long-term capital gain rate plus a noise. For such a dividend policy, the dividend yield will be stationary, and yet its variation is completely uninformative about revisions to future cash flows. In other words, it is quite possible to find that the dividend yield is stationary and does not predict future dividend growth. Yet, this finding would say nothing about whether stock price variation contains news about future cash flows.

A model In order to clearly understand the potential problems that payout policy can have on predictability, consider the Lintner (1956) partial adjustment model in log form:

$$\Delta d_{t+1} = \alpha_0 + \alpha_1 e_{t+1} + \alpha_2 d_t + u_{t+1}, \tag{2}$$

where e_{t+1} is earnings and u_{t+1} is an error term. Rewrite (2) in terms of differences:

$$\Delta d_{t+1} - \Delta d_t = \alpha_1 \Delta e_{t+1} + \alpha_2 \Delta d_t + \Delta u_{t+1}, \tag{3}$$

or

$$\Delta d_{t+1} = \alpha_1 \Delta e_{t+1} + (1 + \alpha_2) \Delta d_t + \Delta u_{t+1}. \tag{4}$$

Dividends are most smoothed if $\alpha_1 = 0$ and $\alpha_2 = 0$, in which case dividends grow at a constant rate plus some noise.

The summation of dividend growth is

$$\begin{aligned}
\sum_{j=0}^{\infty}\rho^{j}\Delta d_{t+1+j} &= \alpha_0+\alpha_1\Delta e_{t+1}+(1+\alpha_2)\,\Delta d_t+u_{t+1}+\rho\alpha_0+\rho\alpha_1\Delta e_{t+2}+\rho\,(1+\alpha_2)\,\Delta d_{t+1} \\
&\quad +\rho u_{t+2}+\rho^2\alpha_0+\rho^2\alpha_1\Delta e_{t+3}+\rho^2\,(1+\alpha_2)\,\Delta d_{t+2}+\rho^2 u_{t+3}+... \qquad (5)\\
&= \text{constant}+\frac{(1+\alpha_2)}{1-(1+\alpha_2)\,\rho}\Delta d_t+\frac{\alpha_1}{1-(1+\alpha_2)\,\rho}\sum_{j=0}^{\infty}\rho^{j}\Delta e_{t+1+j} \\
&\quad +\frac{1}{1-(1+\alpha_2)\,\rho}\sum_{j=0}^{\infty}\rho^{j}u_{t+1+j}. \qquad (6)
\end{aligned}$$

Suppressing the constant, the dividend yield can then be written as

$$\begin{aligned}
d_t-p_t &= E_t\left[\sum_{j=0}^{\infty}\rho^{j}r_{t+1+j}\right]-E_t\left[\sum_{j=0}^{\infty}\rho^{j}\Delta d_{t+1+j}\right] \qquad (7)\\
&= E_t\left[\sum_{j=0}^{\infty}\rho^{j}r_{t+1+j}\right]-\left[\frac{(1+\alpha_2)}{1-(1+\alpha_2)\,\rho}\Delta d_t+\frac{\alpha_1}{1-(1+\alpha_2)\,\rho}E_t\left(\sum_{j=0}^{\infty}\rho^{j}\Delta e_{t+1+j}\right)\right] \qquad (8)\\
&= \text{Discount rate component}-\text{Cash flow component} \qquad (9)\\
&= \text{Discount rate component}-[\text{Smoothing component}+\text{Earnings component}]\,, \qquad (10)
\end{aligned}$$

where

$$\begin{aligned}
\text{Discount rate component} &= E_t\left[\sum_{j=0}^{\infty}\rho^{j}r_{t+1+j}\right], \qquad (11)\\
\text{Cash flow component} &= \text{Smoothing component}+\text{Earnings component}, \qquad (12)\\
\text{Smoothing component} &= \frac{(1+\alpha_2)}{1-(1+\alpha_2)\,\rho}\Delta d_t, \qquad (13)\\
\text{Earnings component} &= \frac{\alpha_1}{1-(1+\alpha_2)\,\rho}E_t\left(\sum_{j=0}^{\infty}\rho^{j}\Delta e_{t+1+j}\right). \qquad (14)
\end{aligned}$$

The intuition is as follows. The variation of the dividend yield must reflect the variation of either the discount rate component or the cash flow component. Within the cash flow component, the smoothing component is deterministic as it is known at time t. Given Δd_t, one knows precisely its contribution to future dividend payout as a result of dividend smoothing. For the purpose of understanding price variation, the earnings component is important because its variation represents cash flow news; the smoothing component is not important because it is deterministic. If dividends are very smoothed (i.e., both α_1 and α_2 are close to zero), the variation of dividend growth is not informative of future cash flows.

The above theoretical discussion indicates that dividend smoothing could defeat the purpose of predictive regressions using dividend growth. If so, it could explain the puzzling finding by Chen (2009) that dividend growth is strongly predictable during the prewar period but is not predictable in the postwar period.

Based on this discussion, in the remainder of the paper, we undertake three steps to explore the effect of dividend smoothing on cash flow predictability. First, we examine whether aggregate dividends are much more smoothed during the postwar period than during the prewar period. An affirmative answer seems necessary if one intends to argue that dividend smoothing has contributed to the lack of dividend growth predictability in the postwar period. In addition, surprisingly, despite its importance, few studies have documented the dynamics of aggregate dividends. Therefore, besides the implication on predictive regressions, this evidence is important in its own right for the understanding of dividend behavior.

Second, having established the presence of dividend smoothing, we conduct simulations to examine how different degrees of dividend smoothing affects dividend growth and return predictability. In particular, we start with "true" cash flow and return generating processes without smoothing. We then assume different degrees of dividend smoothing and study how they affect predictability.

Third, if, due to dividend smoothing, dividends do not reflect future cash flows, it is natural to ask what does. In this regard, we examine two alternative cash flow measures: (i) dividends plus stock repurchase and (ii) earnings. Our prior is that dividends plus stock repurchases are still subject to the manipulation issue since they are choice variables by the firm. In comparison, as Miller and Modigliani (1961) point out, stock prices are determined by the earnings power of corporate assets and investment opportunities. Regardless of the payout policy, stock prices will change if the outlook on future earnings is revised. It follows that earnings growth seems a natural measure of cash flows that gets around of the payout policy issue.

In sum, our three steps ask the following questions: (i) are dividends more smoothed in the postwar period? (ii) does dividend smoothing affect predictability? and (iii) do alternative cash flow measures that are less smoothed address the issue? We examine these three steps in sequence.

3 Are dividends more smoothed in the postwar period?

Dividend growth is strongly predictable in the prewar period, but this predictability completely disappears in the postwar period (Chen (2009)). To understand the cause of the change in predictability, we first examine whether there is a significant change of dividend policy from the prewar to the postwar period.

3.1 Dividend policy models

Based on interviews with managers, Lintner (1956) established the following stylized facts about dividend-setting behavior:

1. There is a long-run target dividend payout ratio to which managers adjust actual dividends gradually.
2. The focus is on changes in dividends rather than the levels of dividends.
3. Managers will change dividends in response to a permanent change in earnings.
4. Managers are reluctant to make dividend changes that will have to be reversed at a later date.

From these stylized facts, Lintner's (1956) seminal partial adjustment model of the dividend-setting behavior is written as:

$$\Delta D_t = \alpha_0 + \alpha_1 E_t + \alpha_2 D_{t-1} + u_t \tag{15}$$

where ΔD_t is the change of the level of dividends, E_t is earnings and u_t is an error term. In this equation $-\alpha_1/\alpha_2$ is the target payout ratio (TPR) and $-\alpha_2$ is the speed of adjustment (SA) to the target. Equation (15) is the first dividend policy model we will test.

If we take the first difference of equation (15), we obtain the second testable model:[6]

$$\Delta D_t = \beta_0 + \beta_1 \times \Delta E_t + \beta_2 \times \Delta D_{t-1} + \varepsilon_t. \tag{16}$$

The advantage of equation (16) is that the variables on the right hand side are not persistent. In this equation $1 - \beta_2$ is the speed of adjustment and thus β_2 measures the degree of smoothness.

In a third variation of the dividend policy model, we test

$$\Delta D_t = \gamma_0 + \gamma_1 E_t + \gamma_2 \times \Delta D_{t-1} + \upsilon_t. \tag{17}$$

Equation (17) is the same as equation (15) except that the lagged change of dividends is used as the regressor. Since this deviates from the Linter's model, our focus is to interpret the persistence parameter γ_2. The higher γ_2 is, the more dividend payout depends on its own lag, and thus the more smoothed is the dividend payout.

One drawback of the variants of Lintner's model is that they do not specify whether the dividend-smoothing behavior can be sustained. Addressing this issue, Marsh and Merton (1987) develop a model in which dividend payouts not only respond to permanent earnings in the short run, but converge to a steady-state target ratio in the long run. The model can be written as

$$\ln\left[\frac{D_{t+1}}{D_t}\right] + \frac{D_t}{P_{t-1}} = \lambda_0 + \lambda_1 \times \ln\left[\frac{P_t + D_t}{P_{t-1}}\right] + \lambda_2 \times \ln\left[\frac{D_t}{P_{t-1}}\right] + \varpi_{t+1}, \tag{18}$$

where λ_1 captures how much dividends respond to permanent earnings changes: a higher λ_1 means less dividend smoothing; λ_2 is supposed to be negative and $-\lambda_2$ captures the speed to converge to long-term target: a higher $-\lambda_2$ (in magnitude) also implies less dividend smoothing.

[6] For equation (15) to be fully consistent with equation (16), β_0 should be zero. In the empirical tests, we find that whether β_0 is zero or not makes little difference on other estimated parameters. In light of this, we estimate all the models with a constant.

We will test these four versions of dividend policy models.

3.2 Evidence on dividend smoothing

We use the annual S&P index data, obtained from Robert Shiller's website, to conduct the dividend policy tests. The data cover 1871-2006. The 1871-1925 sample mainly comes from Cowles (1939), which presumably covers all stocks traded on NYSE during the period; the 1926-2006 sample includes the S&P index firms. The Cowles data have been used by many studies (e.g., Campbell and Shiller (1988, 1998), Wilson and Jones (1987), Schwert (1989, 1990), Goetzmann (1993), Goetzmann and Jorion (1995), Lundblad (2007), and Chen (2009)).

Table 1 reports the summary statistics of the sample. We call 1872-1945 the prewar period and 1946-2006 the postwar period. The average log dividend growth in the prewar period is 1.3% with a standard deviation of 16%; the corresponding postwar growth rate is 5.9% with a standard deviation of 5%. Therefore, the average dividend growth rate has largely increased while the volatility has largely decreased.

The average payout ratio, defined as the ratio of dividends to earnings, is 71.9% in the prewar period and 49.7% in the postwar period. Consistent with previous studies (e.g., Fama and French (2001)) using firm-level data, the aggregate payout ratio has declined in the postwar period. A t-test shows that the reduction of the payout ratio of 22.2% is significant at the 1% level.

Of particular interest is the reduction of dividend volatility compared to the reduction of earnings volatility. If dividends are more smoothed in the postwar period, the reduction of dividend volatility should be larger than the reduction of earnings volatility. To this end, we define the smoothness parameter as

$$S = \frac{\sigma\left(\Delta d\right)}{\sigma\left(\Delta e\right)}, \tag{19}$$

where $\sigma\left(\Delta d\right)$ is the volatility of dividend growth and $\sigma\left(\Delta e\right)$ is the volatility of earnings growth. The smoothness parameter is 0.545 in the prewar period but only 0.295 in the postwar period. The fact that the smoothness parameter has been cut by about half suggests that dividends are indeed much more smoothed in the postwar period. Another piece of supporting evidence is that, for the prewar period, the AR(1) coefficient for the dividend yield is 0.518; the corresponding number for the postwar period is 0.926.

We estimate the four dividend behavior models and report the results in Table 2. Panel A of Table 2 reports the estimates from the standard Lintner model where we find that the speed of adjustment, SA, is 0.373 in the prewar period and only 0.090 in the postwar period, statistically significant at the 1% level in both cases; thus the postwar SA is only about one fourth of the prewar SA. The final column of Panel A reports a Chow test and indicates a significant structural break around 1945. Similarly, in Panel B of Table 2 where we use first differences of the independent variables, the SA coefficient for the postwar period is also about one fourth of that for the prewar period and the Chow test clearly rejects the null of constant parameters in favor of a structural break.

In Panel C of Table 2 we report estimates for the third model. The coefficient on the lagged change of dividends is 0.061 for the prewar period, statistically insignificant from zero. In stark contrast, the coefficient is 0.687 for the postwar period and statistically significant at the 1% level. Therefore, dividend policy has evolved from little dependence on the lagged dividends in the prewar period to heavy dependence in the postwar period. The lagged dividend payout has become the dominant variable explaining current dividend payout. This finding is consistent with the survey by Brav, Graham, Harvey, and Michaely (2005), in which the managers acknowledge the importance of maintaining the level of dividends but show little willingness to change dividends beyond that.

In Panel D, which reports the Marsh and Merton (1987) model, the coefficient that measures the response to permanent earnings change is 0.673 during 1872-1945; the implied convergence coefficient is 0.198, both highly significant. These coefficients say that aggregate dividends respond strongly to permanent earnings changes and converge to some long-term target. In contrast, in the postwar period, the coefficient that measures the response to permanent earnings change is 0.003, statistically indifferent from zero, and the implied convergence coefficient is -0.061 indicating that there is no convergence to the target. The Chow test indicates a strong structural break around 1945. Therefore, irrespective of which model of dividend behavior is employed, the overwhelming evidence is that dividends are much more smoothed in the postwar period than in the prewar period.[7]

To better understand the evolution of dividend policy, Figure 1 plots the rolling-regression coefficients and their *t*-statistics for the three Lintner dividend models, with a rolling window of 30 years. In the first panel for the standard Lintner model, we observe a relatively stable speed-of-adjustment coefficient, around 0.3, between 1872 and the mid 1940s; this coefficient then quickly drops and approaches zero toward the end of the sample. We find a qualitatively similar pattern in the second panel for the second model. In the third panel, the coefficient on the lagged dividend change fluctuates around zero from 1872 until the early 1940s; it then quick jumps up and approaches 0.7 toward the end of the sample.

Figure 2 separately plots the rolling parameters for the Marsh and Merton (1987) model. The response to permanent earnings parameter, λ_1, is between 0.4 and 0.75 from 1872 to the end of 1940s; it then quickly drops to close to zero and stays that way after that. The convergence to long-run target parameter, $-\lambda_2$, is between 0.1 and 0.5 from 1872 to the end of 1940s; it then quickly drops to be lower than zero and stays that way after that, suggesting no convergence.

Figures 1 and 2 are thus highly consistent. What these rolling regressions tell is that the drastically stronger pattern of dividend smoothing in the postwar period is not driven by extreme numbers in some particular years. Rather, it represents a genuine change of aggregate dividend behavior from the prewar to the postwar period.[8]

In sum, aggregate dividends are much more smoothed in the postwar period than earlier. This finding raises the possibility that the dividend smoothing in the postwar period might be the main

[7] We have also tested the four models in log form and find very similar results. For brevity we do not report them.

[8] We note that the dramatically increased dividend smoothing in the postwar period is unlikely to be driven by the changing composition of the S&P index firms. For example, the S&P index contains only 90 stocks from 1926 to 1957, and 500 firms after that; in comparison, the CRSP market portfolio already contains more than 500 firms in 1926, and more than 1000 firms in 1957 (e.g., Chen (2008)). Yet, we find the same change of dividend smoothing from prewar to postwar period if we use the CRSP market portfolio. Therefore, the increase of dividend smoothing appears to be a genuine pattern at the aggregate level that is not driven by certain firms.

reason why dividend growth is not predictable by the dividend yield. To thoroughly understand this issue we need to know how different degrees of dividend smoothing affect predictability. This question is relevant because, even though firms can follow arbitrary dividend policies, such policies might not be sustainable in the long run. Thus, it is not clear how sustainable dividend smoothing affects predictability in a finite sample. We explore this issue in the next section.

4 How does dividend smoothing affects predictability?

Consider a VAR consisting of the log dividend yield (dp_t), the dividend growth rate (g_t), and returns (r_t),

$$dp_{t+1} = a_{dp} + \phi \times dp_t + \varepsilon_{t+1}^{dp} \quad (20)$$

$$g_{t+1} = a_g + b_g \times dp_t + \varepsilon_{t+1}^{g} \quad (21)$$

$$r_{t+1} = a_r + b_r \times dp_t + \varepsilon_{t+1}^{r}. \quad (22)$$

One does not have to estimate all three equations. Cochrane (2006) shows that the VAR coefficients are linked:

$$b_r = 1 - \rho\phi + b_g, \quad (23)$$

where ρ is a linearization parameter (≈ 0.95 for annual data).

Theoretically, b_g is expected to be negative if dividend growth is predictable – a higher dividend yield means that dividends will grow slower. With an increasing degree of dividend smoothing, b_g is expected to be smaller in magnitude. The reason is that when dividend growth is smoothed, it does not adequately reflect the outlook of future cash flows; the latter drives the variation of the dividend yield.

Dividend smoothing also makes the dividend yield more persistent, i.e., ϕ becomes larger. A more persistent dividend yield has two effects on predictability. First, it biases b_g to be more negative and b_r to be more positive in estimation (e.g., Stambaugh (1999) and Boudoukh, Richardson, and Whitelaw (2006)). Second, equation (23) says that, holding all else constant, a higher ϕ makes either b_r or b_g smaller in magnitude, i.e., less predictable.

How does dividend smoothing affect return predictability? From equation (23), since it makes b_g smaller in magnitude but ϕ bigger, the net effect on b_r is not clear. In addition, a higher ϕ biases returns to appear to be more predictable.

In sum, dividend smoothing is likely to make dividend growth less predictable,[9] the dividend yield more persistent, and its impact on return predictability is not clear.

It might appear that we already know how dividend smoothing affects predictability. However, this is not obvious because even though a firm can adopt an extreme dividend policy in the short run, such a policy might not be sustainable in the long run. In other words, the impact of dividend smoothing is likely to be mitigated in a long-enough sample. Therefore, how does a sustainable dividend policy, with different degrees of smoothing, affect predictability in a finite sample is not clear and has been little studied before.

The benchmark Before we investigate how a sustainable dividend policy affects predictability, we report in Panel A of Table 3 the regressions of dividend growth and returns on the lagged dividend yield, for prewar and postwar periods separately. Following Kendall (1954), Stambaugh (1999), and Boudoukh, Richardson, and Whitelaw (2006), we simulate the p-values that consider the contemporaneous correlation between the independent and dependent variables, the persistence of the independent variable, and the overlapping nature of the variables when conducting long-horizon tests. The details of the simulation are provided in the appendix. We boldface the simulated p-values that are smaller or equal to 10%.

Dividend growth is strongly predictable during the prewar period: the one, three, and five-year coefficients are -0.448, -.0596, and -0.406 respectively, highly significant. In comparison, the one-year return coefficients is 0.024 and is insignificant; the three and five-year return coefficient are 0.303 and 0.636 and are significant. Overall, during the prewar period dividend growth is strongly

[9] Dividend smoothing makes dividend yield more persistent, which biases dividend growth to appear to be more predictable, but this is likely to be secondary to the fact that dividends are smoothed and thus less predictable.

predictable and returns are less predictable, especially at the short horizon.[10]

Dividend growth is not predictable in the postwar period: the one, three, and five-year coefficients are all insignificant with the wrong sign: 0.026, 0.076, and 0.088 respectively. We note that these positive coefficients should not be taken seriously because of the lack of statistical power. There is no theoretical reason to believe that these coefficients should be positive. Under the null of no dividend growth predictability, they should be slightly negative due to the estimation bias. What we can conclude from these coefficients is that dividend growth is not predictable in the postwar period.

Stock returns appear to be more predictable at the one-year horizon in the postwar period than in the prewar period, but none of the coefficients for the postwar period are significant. The fact that stock return predictability (by dividend yield) lacks statistical power is well documented (e.g., Stambaugh (1999) and Cochrane (2008)).

Therefore, summarizing the results from the historical data, we find that dividend growth is strongly predictable in the prewar period but is not predictable in the postwar period. Stock returns are less predictable than dividends in the prewar period and the predictability lacks statistical power in the postwar period. The empirical evidence documented above will serve as the benchmark case when we analyze the impact of dividend smoothing below.

Another important piece of evidence is that the dividend yield is much more persistent in the postwar period than in the prewar period. Regressing the log dividend yield on its own lag yields a coefficient of 0.557 for the prewar period and 0.956 for postwar. This finding is expected given our earlier finding that dividends are much more smoothed in the postwar period.

4.1 Three cases of dividend smoothing

We proceed to conduct simulations to study how dividend smoothing affects predictability. We examine three cases in sequence. In all cases we ensure that the dividend policy is sustainable.

[10] Chen (2009) shows that, for 1872-1945, returns are not predictable beyond the five-year horizon. In contrast, dividends are much more predictable at 15-year and 20-year horizons.

4.1.1 First case

In this case we first fit the Marsh and Merton (1987) dividend smoothing model (Equation (18)) for the prewar and postwar periods separately, as shown in Panel D of Table 2. We then simulate dividend growth using the fitted Equation (18). We also simulate returns under the null that returns are not predictable,

$$r_{t+1} = a_r + \varepsilon^r_{t+1}, \tag{24}$$

where a_r is a constant and ε^r_{t+1} the residual. We match the historical means and standard deviations of dividend growth and returns and the covariance between them. We back out stock prices from the simulated total return and dividend series, and then calculate the dividend yield. We also set the maximum and minimum log dividend yields to be -1 and -10 and once these points are reached we adjust the dividends to bring the dividend yield within the range. In this way, we ensure that the dividend policy is sustainable.

In summary, we have constructed a scenario in which the dividend policy is sustainable and the dividend yield is stationary in the long run. In addition, stock returns are not predictable. All the predictability is on the dividend side: Equation (18) implies dividend growth predictability when dividends are not too smoothed, and the correction of the dividend yield, when needed, is through the adjustment of dividends.

We perform 10,000 simulations, each time matching the sample size of the postwar data. For each simulation we regress dividend growth and returns on the lagged dividend yield, for one, three and five years. Panel B of Table 3 reports the results for the dividend smoothing model that fits the prewar data. Similar to the actual data, dividend growth is strongly predictable: the coefficients are -0.460, -0.679, and -0.798 for one, three, and five-year horizons (the historical counterparts are -0.448, -.0596, and -0.406 respectively). Compared to the actual data, the return coefficients are small and insignificant.

Panel B of Table 3 also reports the results for the dividend smoothing model that fits the postwar data. With highly smoothed dividends, dividend growth is not predictable at either one, three, or five-year horizons. Stock returns are not predictable at any horizon.

Therefore, when the dividends are not highly smoothed and when the predictability is on the dividend side, dividend growth predictability can be easily detected, as in the prewar case. In contrast, when dividends are highly smoothed, even though the null is that dividends are predictable, dividend growth might not be predictable in the small samples employed in the literature. Dividend smoothing clearly can affect dividend growth predictability. Our results suggest that dividend growth is not predictable by the dividend yield in the postwar period not necessarily because there is no cash flow news in the stock price variation, but because dividends are highly smoothed. Regressing the simulated log dividend yield on its own lag yields a coefficient of 0.565 for 1872-1945 and 0.983 for 1946-2006. These numbers are close to their empirical counterparts and support the earlier finding that dividends are much more smoothed in the postwar period.

4.1.2 Second case

In this case we start with a "true world" without dividend smoothing. The null is that dividend growth is predictable without smoothing but return is not:

$$g_{t+1} = a_g - 0.1 \times dp_t + \varepsilon^g_{t+1} \quad (25)$$

$$r_{t+1} = a_r + \varepsilon^r_{t+1}, \quad (26)$$

where g_{t+1} is dividend growth rate. The residuals ε^g_{t+1} and ε^r_{t+1} are chosen such that the historical variance-covariance matrix of dividend growth and returns in the prewar period is matched. Given the "true world" without smoothing, we assume that the actual dividend growth is governed by a smoothness parameter λ:

$$g_{t+1} = (1-\lambda)\left(a_g - 0.1 \times dp_t + \varepsilon^g_{t+1}\right) + \lambda \times \left(g_{ave} + \varepsilon^{ave}_{t+1}\right), \quad (27)$$

where g_{ave} is the historical average dividend growth rate and ε^{ave}_{t+1} is a shock to this target. The more smoothed the dividend policy, the higher λ is.

We simulate stock returns under the null of no predictability and simulate dividend growth according to Equation (27). As in the first case, we back out new stock prices from the simulated total return and dividend series. We ensure that prices are always higher than dividends by adjusting dividends. In addition, whenever the dividend yield reaches an upper or lower limit, we adjust the dividends to pull the dividend yield back. In sum, our null is that stock returns are unpredictable, dividends are predictable but are also smoothed, and the dividend policy is sustainable.

We report the results in Table 4. In the scenario of the "true world", dividend growth is strongly predictable at all horizons; stock returns have insignificant but positive coefficients at all horizons. With increasing λ, the dividend yield becomes more and more persistent, as shown by the AR(1) coefficients, and the dividend growth coefficient steadily goes down. When λ is equal to 0.95, the AR(1) coefficient of dividend yield is 0.973, not too far from the 0.956 in the postwar period, the dividend growth coefficient become insignificant at the 5% level for one, three, and five-year horizons.

The impact of dividend smoothing on return predictability is unclear, confirming our prior. When λ increases from zero to 0.5, the return coefficient increases and is more significant. Thus dividend smoothing makes return appear to be more predictable. However, when λ increases more, return becomes slightly less predictable. Overall, the p-values of the return coefficients are always lower than the case of "true world".

In sum, dividend smoothing makes the dividend yield more persistent and dividend growth less predictable. When dividends are sufficiently smoothed, dividends are not predictable even though all the predictability should come from the dividend side. The impact of dividend smoothing on return predictability is not clear, though it seems that some degree of smoothing makes returns appear to be more predictable.

4.1.3 Third case

In this case we first use the prewar data to obtain the following estimated equations:

$$g_{t+1} = -1.315 - 0.447 \times dp_t + \varepsilon^g_{t+1} \quad (28)$$

$$r_{t+1} = 0.142 + 0.025 \times dp_t + \varepsilon^r_{t+1}. \quad (29)$$

This set of equations show strong dividend growth predictability but little return predictability. We ask the following question: if the "true world" without smoothing in the postwar world is actually the same as the prewar world, except that dividends are smoothed, what kind of dividend growth predictability should we expect?

To answer this question, we simulate dividend growth according to different degrees of smoothness:

$$g_{t+1} = (1-\lambda)\left(-1.315 - 0.447 \times dp_t + \varepsilon^g_{t+1}\right) + \lambda \times \left(g_{ave} + \varepsilon^{ave}_{t+1}\right).$$

As before, stock prices are backed out from these simulations. Dividends are adjusted to ensure that the dividend yield is within the range identified earlier.

The results are reported in Table 5. If dividends and returns follow similar processes as in the prewar world, and if dividends are not smoothed, then dividends are strongly predictable at all horizons, returns are not predictable, and the AR(1) coefficient of the log dividend yield is only 0.533. When λ is equal to 0.5, the one-year dividend growth coefficient drops to -0.236, about half of the corresponding number without smoothing; the AR(1) coefficient of the log dividend yield jumps to 0.769. This pattern continues as λ increases. In the extreme case of λ being equal to one, dividends are still supposed to be predictable since by construction we adjust dividends when the dividend yield reaches boundaries. The simulated AR(1) coefficient is 0.970 (compared to 0.956 for the postwar data); the dividend growth coefficient is insignificant at one to five-year horizons. The impact of dividend smoothing on return predictability is similar to that of the second case. As dividends become more smoothed, dividend yields become more persistent and returns may appear to be predictable although they are simulated to be close to random.

Therefore, even if dividend growth were as predictable as in the prewar period without smoothing, severe dividend smoothing can kill this predictability. If this were indeed the case, the persistence of the dividend yield must largely increase from the prewar to the postwar period, which is verified in the data.

4.2 Summary and discussion

We have shown, through three cases of simulation, that, even if dividends are supposed to be predictable without smoothing, dividend smoothing can completely bury this predictability in a finite sample. While such predictability can still be detected at very long horizons, this might not be the case at horizons at which researchers normally run regressions. Therefore, the lack of dividend growth predictability could simply mean severe dividend smoothing rather than anything else.

Earlier, we provided two pieces of evidence indicating that dividends are very smoothed in the postwar period. First, we fit various dividend behavior models, all of which show that dividends have become much more smoothed in the postwar period. Second, the dividend yield has become much more persistent in the postwar period.

The empirical evidence, combined with the simulation exercise, provides a reasonable interpretation on why dividend growth is strongly predictable in the prewar period, but is not predictable in the postwar period. In particular, the lack of dividend growth predictability in the postwar period does not imply that the variation of stock prices contains no information regarding future cash flows; rather, it only means that dividends are severely smoothed. As such, dividends are a poor measure of future cash flows, and it becomes pointless to infer cash flow predictability from dividend predictability. Therefore, the fact that aggregate returns are relatively more predictable than dividends in the postwar period does not mean that stock variations contain little cash flow news. A more likely interpretation is that dividends are smoothed and consequently do not represent well the outlook for future cash flows.

It has been forcefully argued before that, since the dividend yield is never too low or too high, at least one of dividend growth or returns must be predictable by the dividend yield. Our simulations show that this is not necessarily the case in a finite sample. When dividends are severely smoothed, even if the predictability is supposed to be on the dividend side, it is possible to observe that neither dividend growth nor returns are predictable by the dividend yield at normal horizons in a finite sample. As a result, the dividend yield mainly just predicts itself (e.g., Goyal and Welch (2003, 2008)).

Cochrane (2008) argues that the lack of dividend growth predictability – the dog that did not bark – implies strong return predictability. While this seems to be the case if one possesses a long sample, our simulations show that this does not necessarily hold in a finite sample. An alternative interpretation is simply that dividends are severely smoothed.

5 Predictability with alternative cash flow measures

Since dividends, due to smoothness, do not reflect well the variation of future cash flows, it is natural to reexamine the relative cash flow/return predictability with cash flow measures other than dividends. We consider two such measures. First, several studies have suggested adding stock repurchase to dividend payouts (e.g., Boudoukh, Michaely, Richardson, and Roberts (2007) and Skinner (2008)). Skinner (2008) finds that the combined total payout fits the Lintner's model better. Our first measure is thus repurchase-included dividend payout. While this seems a clear improvement over dividends alone, we note that the intuition by Miller and Modigliani (1961) is that *all* payout policies are irrelevant. Stock prices consider the future earnings power of assets. Therefore, to understand price variations, it seems most natural to consider earnings growth as our second measure of cash flow.[11]

To test return and cash flow predictability we employ CRSP data. The reason for this is that,

[11] Skinner (2008), for example, argues that "The fact that I am able to link repurchase to earnings is important in providing evidence that repurchases substitute for dividends." His results can be regarded as efforts to bring total cash flows to resemble earnings better. Logically, it seems to make sense to use earnings growth as the measure for future cash flows.

besides being the more widely used market portfolio, the data allow us to separately consider repurchases and net issues. We will later provide robustness checks using S&P index firms.

5.1 Data construction

We follow Bansal, Dittmar, Lundblad (2005) and incorporate repurchase into dividends to improve the chance of cash flow predictability. In particular, denote n_t the number of shares (after adjusting for splits, stock dividends, etc. using the CRSP share adjustment factor) and P_t stock price. Then repurchases are defined as

$$rp = \frac{P_{t+1}}{P_t} \times \left[1 - \min\left(\frac{n_{t+1}}{n_t}, 1\right)\right]. \tag{30}$$

When there is a repurchase, $\frac{n_{t+1}}{n_t} < 1$ and $\left[1 - \min\left(\frac{n_{t+1}}{n_t}, 1\right)\right]$ is the proportional repurchase; rp then captures the repurchase return. Similarly, stock net issues are defined as

$$si = \frac{P_{t+1}}{P_t} \times \left[1 - \max\left(\frac{n_{t+1}}{n_t}, 1\right)\right]. \tag{31}$$

We calculate dividends, repurchases, and net issues in dollars for each firm month, and sum them across months to get the annual numbers for each firm. We then merge this annual data with the COMPUSTAT annual tape. The COMPUSTAT data are used to calculate book equity following Cohen, Polk, and Vuolteenaho (2003). For earlier years when book equity is not available we use the book equity data from Davis, Fama, and French (2000). Earnings for each firm year are then obtained through the clean surplus formula:

$$E_t = B_t - B_{t-1} + RP_t - SI_t + D_t, \tag{32}$$

where E_t is earning in year t, B_t is book equity, RP is repurchase, SI is share issuance, and D_t is dividend. The equation says that earnings are equal to the change of book equity plus repurchases and minus net issues; retained earnings plus dividends gives total earnings. We take a number of steps to remove outliers. First, we treat the earnings data as missing if they are more negative than the market capitalization of stocks. Second, we winsorize RP (repurchases) and SI (share issuances) at 99.9%. We then aggregate the data to obtain the market portfolio. The final annual data cover the period 1928-2006.

Figure 3 plots the aggregate dividend yield with and without repurchases. It is clear that repurchases are essentially non-existent until the end of the 1970s. From then on repurchases separate total payout from dividends. Between 2000 and 2006, the average dividend yield is 0.016 without repurchases, and 0.031 with repurchases. This pattern is consistent with the findings in Skinner (2008) that repurchases are roughly equal to dividends at the aggregate level.

5.2 Predictability when repurchases are considered

We first examine whether considering repurchases will affect cash flow and return predictability. Table 6 reports results from testing the ability of the dividend yield to predict returns and cash flows from one to five-year horizons. We run the following predictive regression:

$$y_t = \alpha_0 + \alpha_1 \times x_{t-1} + \varepsilon_t, \tag{33}$$

where y_t is either the cumulative log dividend growth without repurchases (Δd_t), with repurchases (Δd_t^{re}), or log returns (r_t); and x_{t-1} is either the log dividend yield without repurchases (dp_{t-1}) or with repurchases (dp_{t-1}^{re}). The regressions are run for the full sample (1928-2006) and the postwar sample (1946-2006). For each regression coefficient, we provide both the Newey-West t-statistics and the simulated p-values, the details of which are provided in the appendix. We boldface the simulated p-values that are smaller or equal to 10%.

Panel A of Table 6 reports the predictability for dividend growth without repurchases. For the full sample, the one-year coefficient on the lagged dividend yield is -0.087 with a p-value of 0.01 and an adjusted R^2 of 9%. At the two-year horizon dividend growth is predictable but the adjusted R^2 falls to 6%. At longer horizons the dividend yield coefficient becomes statistically insignificant. For the postwar period, the coefficient has the wrong (positive) sign from one to five-year horizons and is insignificant according to either the Newey-West t-statistics or the simulated p-values. In comparison, the estimated coefficients on the return predictability regression for the full sample are significant at three to five-year horizons and in the postwar period significant at all horizons using Newey-West t-statistics. However, for both the full sample and the postwar sample the coefficients are insignificant when considering the simulated p-values.

Panel B reports the predictability of dividend growth when repurchases are included in dividends. For the full sample, the one year coefficient jumps to -0.212 (from -0.087 in Panel A) with a p-value of 0.00. The coefficients remain insignificant at longer horizons, but it is clear that including repurchase helps to some extent to find cash flow predictability in the full sample. However, there is still no evidence of predictability in the postwar period. Therefore, including repurchase is slightly helpful in the full sample, but it does not help in the postwar sample.

In comparison, Table 6 shows that, consistent with Boudoukh, Michaely, Richardson, and Roberts (2007), the repurchase-included dividend yield exhibits a stronger ability to predict returns: the coefficients are significant at all horizons according to the p-values. Based on the size of the estimated coefficients and the adjusted R^2, the extent of return predictability is stronger in the postwar period. We note that the improvement in the postwar data arises because repurchases are negligible before that.

In sum, there are two findings in Table 6. First, dividend growth is unpredictable by the dividend yield in the postwar period. This conclusion holds regardless of whether repurchases are included or not. Second, clear evidence of return predictability for the postwar period can be established if repurchases are considered in the dividend yield.

5.3 Predictability by the earnings yield and the payout ratio

Compared to dividends, predictability involving earnings requires additional care. In particular, when we use the log earnings yield (ep_{t-1}) to predict return, we use the return from April of year t to April of year $t+1$. This lag is to ensure that earnings become public information before we count future returns. When predicting log earnings growth (eg_t), we use $ep0_{t-1}$ which uses price at the beginning of year $t-1$. When we predict returns and the payout growth rate we use price at the end of year $t-1$. The use of $ep0_{t-1}$ ensures that, regardless of the fiscal year end, the price we use is way ahead of earnings information. It is conservative and is likely to yield smaller predictive power.[12]

One additional variable we consider is the payout ratio. To see why this variable is interesting, define the payout ratio as

$$DE_t = \frac{D_t}{E_t}. \tag{34}$$

Then dividend growth is

$$\begin{aligned} \Delta d_t &= \ln(E_t \times DE_t) - \ln(E_{t-1} \times DE_{t-1}) \\ &= \Delta e_t + \Delta de_t, \end{aligned} \tag{35}$$

where Δde_t is the growth rate of the payout ratio. If earnings growth is predictable but dividend growth is not because of dividend smoothing, the growth rate of the payout ratio must be predictable. The intuition is clear: to the extent that dividends are smoothed, the variation of the payout ratio is not random; rather, it represents the cash flow news that is not captured by dividends. If stock price variation contains information about future cash flows, it should be able to predict the growth rate of the payout ratio. The more smoothed dividends are, the stronger is this predictability.

Table 7 reports the ability of the earnings yield to predict earnings growth, returns, and payout ratio growth. In contrast with the dividend yield coefficients in Table 6, the earnings yield coefficients are always significant when predicting earnings growth. In particular, for the full sample, the $ep0_{t-1}$ coefficient at one-year horizon is -0.721 with a p-value of 0.00 and an adjusted R^2 of 36%. At horizons greater than one year the estimated coefficients are around -0.85 and are always statistically significant.

The most remarkable feature of the earnings growth estimates is that the results are as strong in the postwar sample as in the full sample: the coefficients in the postwar period are -0.651 at

[12] When the aggregate earning is negative, we set the earnings yield to be 0.0001, which translates to a log earnings yield of -9.21. Negative earnings occur only during 1933 following the great depression. Omitting this observation does not alter our results in any significant way.

one-year horizon with an adjusted R^2 of 32%, and around -0.850 at the remaining horizons with an adjusted R^2 of just over 40%. In all cases the coefficients are statistically significant.

The earnings yield also strongly predicts the payout ratio growth rate. For both the full and the postwar samples, the predictive coefficients are always significant at the 1% level from one to five-year horizons; the R-squared ranges from 32.2% to 46.6%. Intuitively, stock price variation reveals information about future cash flows (earnings) but not about dividends because the latter is heavily smoothed. As a result, the payout ratio growth absorbs the future cash flow variation and becomes predictable at all horizons.

The predictive power of the earnings yield for returns is much weaker than that for earnings growth, consistent with Lamont (1998) and Goyal and Welch (2008). For example, in the full sample the coefficient on ep_{t-1} is significant at the one year horizon and the adjusted R^2 is 2.6%. With the exception of the four-year horizon, the remaining estimates are not statistically significant. The magnitude of the regression coefficient when predicting returns is always much smaller than that when predicting earnings growth. This result suggests that the variation of the earnings yield reveals a lot of news about future cash flows: exactly the opposite of the conclusion reached when predicting dividend growth with the dividend yield.

Summarizing, in the postwar period, dividend growth is unpredictable regardless of whether repurchases are included or not. In contrast, earning growth is highly predictable, suggesting that dividend smoothing plays a crucial role in preventing us from finding cash flow predictability. Consistent with this intuition, the growth rate of the payout ratio is also highly predictable; it would not have been so if dividends were not smoothed.

5.4 Predictability for smooth and volatile portfolios

If it is true that dividend smoothing has played a critical role in preventing us from finding cash flow predictability, then we have the following additional testable hypotheses: for the postwar period, dividend growth should not be predictable for firms that have the most smoothed dividend payout; dividend growth should be relatively more predictable for firms that have the least smoothed dividend payout. In contrast, earnings growth should be predictable for all firms regardless of how much dividends are smoothed.

To test these hypotheses, we sort firms into three portfolios according to the smoothness parameter S $(= \frac{\sigma(\Delta d)}{\sigma(\Delta e)})$ and then repeat the predictive regressions. Panel A of Table 8 reports the results that include the firms with the most smoothed dividend payout. In the full sample we find predictability at the one and two year horizons, as we did when looking at the aggregate portfolio. For the postwar period, the coefficients for predictive dividend growth all have the wrong positive sign and are all statistically insignificant, consistent with the findings for the aggregate portfolio. In comparison, the coefficients for predicting returns have the right positive sign, and are significant at all horizons.

Panel B reports results for firms that have the least smoothed dividend payout. In stark contrast to Panel A, dividend growth is reasonably predictable in the postwar period: the coefficients are all large and negative; they are significant for three out of five horizons according to the simulated p-values. That is, once dividends are much less smoothed, dividend growth becomes strongly predictable. This finding confirms the role of dividend smoothing in negating cash flow predictability. Regarding return predictability, similar to Panel A, returns are strongly predictable by the dividend yield in the postwar period.

While dividend smoothing can affect dividend growth predictability it should not impact on earnings growth predictability. In order to check this, we examine earnings growth predictability for the portfolios formed on the extent that dividends are smoothed. In Panel A of Table 9, we examine, for the most smoothed portfolio, the ability of the earnings yield to predict earnings growth and returns. For both the full sample and the post war sample, the coefficients for predicting earnings growth are negative and highly significant for all horizons. The returns are also predictable at short horizons, but the results are weaker, judged from both the coefficients and the p-values, than the cases for predicting earnings growth. Therefore, for the most smoothed portfolios, once earnings growth is used, cash flow predictability is stronger than return predictability.

We find similar patterns in Panel B for the firms with the least smoothed dividends. In particular, for the postwar period, both earnings growth and returns are predictable by the earnings yield. The results regarding the predictive power of the payout ratio and the predictability of the payout ratio growth are similar to those in earlier tables. For brevity we do not report them.

The evidence from the portfolios sorted by smoothness is revealing. The finding that dividend growth is not predicable for the most smoothed portfolio, but earnings growth is equally predictable for all portfolios, strongly supports our hypothesis that dividend smoothing has imposed a negative impact on finding cash flow predictability. Again, the fact that dividend growth is not predictable for the most smoothed portfolio does not mean that cash flow news is absent in stock price variations. Rather, it means that, due to dividend smoothing, dividend growth is an inappropriate measure for the outlook of cash flows. This result is further emphasized from the analysis of dividend growth predictability for the least smoothed portfolio in the postwar period.

6 Robustness checks

6.1 Actual earnings data

Thus far the earnings data are calculated using the clean surplus formula. This approach has the advantage of allowing for more firms and thus represents the market better. For robustness, we construct the following alternative: starting from 1950 (the starting year of COMPUSTAT data) we only include those firm years with earnings data available from COMPUSTAT; before 1950 we still use the clean surplus formula to calculate earnings.

Table 10 reports the predictive results using earnings yield. For both the full-sample and the postwar periods, the earnings yield does a good job in predicting future earnings growth. The coefficients are significant at all horizons both in the full sample and in the postwar period. The magnitude of the coefficient is smaller than that when earnings are computed using clean-surplus identity. Therefore, using actual earnings data leads to slightly weaker results, presumably due to the smaller number of firms included. Nevertheless, earnings growth is still predictable and significant at each of the five horizons. In comparison, while not reported, we find that the dividend yield does not predict dividend growth, regardless of whether repurchases are included. The predictability of the payout ratio growth is similar to the case of earnings growth. Again, since dividend growth is not predictable, all the predictability of the payout ratio growth comes from earnings growth predictability. In addition, the earnings yield can predict returns in the postwar period.

6.2 S&P index firms in CRSP

Since we have used the S&P index portfolio earlier to establish the results regarding dividend policy, it is useful to also examine the predictability using S&P index firms. We thus construct a market portfolio as earlier but with only CRSP firms belonging to the S&P index. Table 11 reports the predictive results using the earnings yield. As before, earnings yield is a strong predictor of both earnings growth and payout ratio growth, but is a relatively weak predictor of returns. Therefore, our conclusions are robust to the case of S&P index firms.

7 Conclusion

A central issue for financial economists is to understand stock price variations. The current stock price is the sum of discounted expected future cash flows; its variation must reflect the revisions to expected future cash flows or to discount rates. The crucial question is "by how much of each" (Cochrane (2008)).

The answer to this question is usually obtained by comparing the relative predictability of cash flows and returns by the dividend yield. In this regard, the usual finding is that, at the aggregate level, returns are predictable by the dividend yield but dividend growth is not. This leads to the somewhat uncomfortable conclusion that there is little cash flow news in stock price variations.

Chen (2009) shows that dividend growth is strongly predictable in the prewar period, but this predictability completely disappears in the postwar period. It is difficult to imagine that financial market have evolved in such a way that a lot of cash flow news is incorporated in price variations in the prewar period but little is incorporated in the postwar period. Rather, it is natural to suspect that the dramatic change of cash flow predictability has more to do with the cash flow measures than with the way investors evaluate securities.

To verify this conjecture, we first document a significant change of dividend policy at the aggregate level from the prewar to the postwar period. In the postwar period, dividends are much more smoothed and respond much more to their past levels rather than to the outlook of future cash flows.

Our simulated results provide two conclusions regarding dividend smoothing. First, even if dividends are supposed to be strongly predictable without smoothing, dividend smoothing can completely bury this predictability in a finite sample. Second, dividend smoothing leads to a persistent dividend yield, a phenomenon that can be verified in the data.

The finding that dividends are dramatically more smoothed in the postwar period, combined with the finding from the simulations that dividend smoothing can kill predictability, provides a reasonable interpretation on why dividend growth is predictable in the prewar period but not so in the postwar period. The lack of dividend growth predictability in the postwar period does not necessarily mean that there is no cash flow news in stock price variations; rather, a more plausible interpretation is that dividends are severely smoothed in the postwar period.

The findings clearly indicate that, if one wants to compare the relative cash flow/return predictability, one needs to resort to a cash flow measure that is less affected by smoothing. Such a measure is earnings. We find that the earnings yield strongly predicts earnings growth in the postwar period. The earnings yield also strongly predicts payout ratio growth in the postwar period. Naturally, since earnings growth is predictable but dividend growth is not, the variation of cash flows that is not reflected by dividends must be absorbed by the payout ratio growth.

We further sort firms according to the degree of dividend smoothness. For the most smoothed portfolio, dividend growth is not predictable in the postwar period; for the least smoothed portfolio, dividend growth is predictable. In contrast, for both portfolios, earnings growth is predictable in the full sample as well as the postwar sample. Therefore, the lack of cash flow predictability has more to do with dividend smoothness than with cash flow per se.

Our take-away messages are that (i) dividend smoothing can severely affect dividend predictability in a finite sample, (ii) there is significant cash flow news in stock price variations, and (iii) when smoothed, dividends do not represent well the outlook of future cash flows.

A natural follow-up question would ask what is behind the dividend smoothing behavior at the market level in the postwar period. Might this be related to the drastic development of the capital market that made it possible for corporate managers to smooth dividend payouts? Or could it be due to the fact that corporate managers became more and more "professional" and thus are more likely to adopt the strategic dividend smoothing behavior? Or could it be that both management and shareholders became increasingly risk averse and conservative after the Great Depression and WWII so they prefer a less volatile dividend payout? Another possibility is that the US government implemented price controls in 1942 and managers could be more likely to smooth dividends as they expect less volatile revenue in the future. We leave to future research the examination of the causes of dividend smoothing.

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Appendix

The power of predictability tests is frequently questioned because of the persistence of the independent variable and its contemporaneous correlation with the dependent variables (e.g., Kendall (1954), Stambaugh (1986, 1999), and Pastor and Stambaugh (2009)), and the overlapping nature of the dependent variable when conducting long-horizon tests (e.g., Boudoukh, Richardson, and Whitelaw (2006)), compounded with small sample size. We describe below the procedure through which we simulate p-value for each predictive coefficient to take care of the above problems.

Suppose we will run the following predictive regressions:

$$y_t^i = \xi_i + \alpha_i \times x_{t-1} + \varepsilon_{it}, \tag{A1}$$

where y_t^i, $i = 1, 2, ..., 5$, is the cumulative summation of y_t from 1 to horizon i. Also suppose y_t^1 and x_t follow $AR(1)$ processes:

$$y_t^1 = \beta_0 + \beta_1 \times y_{t-1}^1 + \omega_t, \tag{A2}$$

$$x_t = \gamma_0 + \gamma_1 \times x_{t-1} + \upsilon_t, \tag{A3}$$

and the correlation $corr(\omega_t, \upsilon_t) = \rho$. In addition, the sample size is T.

To simulate the p-value for the predictive coefficient α_1, we first conduct OLS regressions for equations A1-A3 and obtain estimates for the coefficients and the residuals. We then jointly simulate time series for y_t^1 and x_t with size T. To preserve the distribution properties of the historical data, we draw from the residuals of the historical data when conducting the simulations. The null is that y_t^1 is not predictable by x_{t-1}. Long-horizon simulates of y_t^i are subsequently constructed by summing the simulated y_t^1. We regress the simulated y_t^i on the simulated x_{t-1}, obtaining the simulated α_i, which we call $\alpha_{sim,i}$. We repeat the exercise 10,000 times to obtain the time series of $\alpha_{sim,i}$. We finally compare the estimated α_i with the time series of $\alpha_{sim,i}$ to obtain the p-value for the estimated α_i.

The above simulations take into consideration the autocorrelation of the variables, the contemporaneous correlation between the variables, the small sample size, and the overlapping data construction. We report the simulated p-values in the paper.

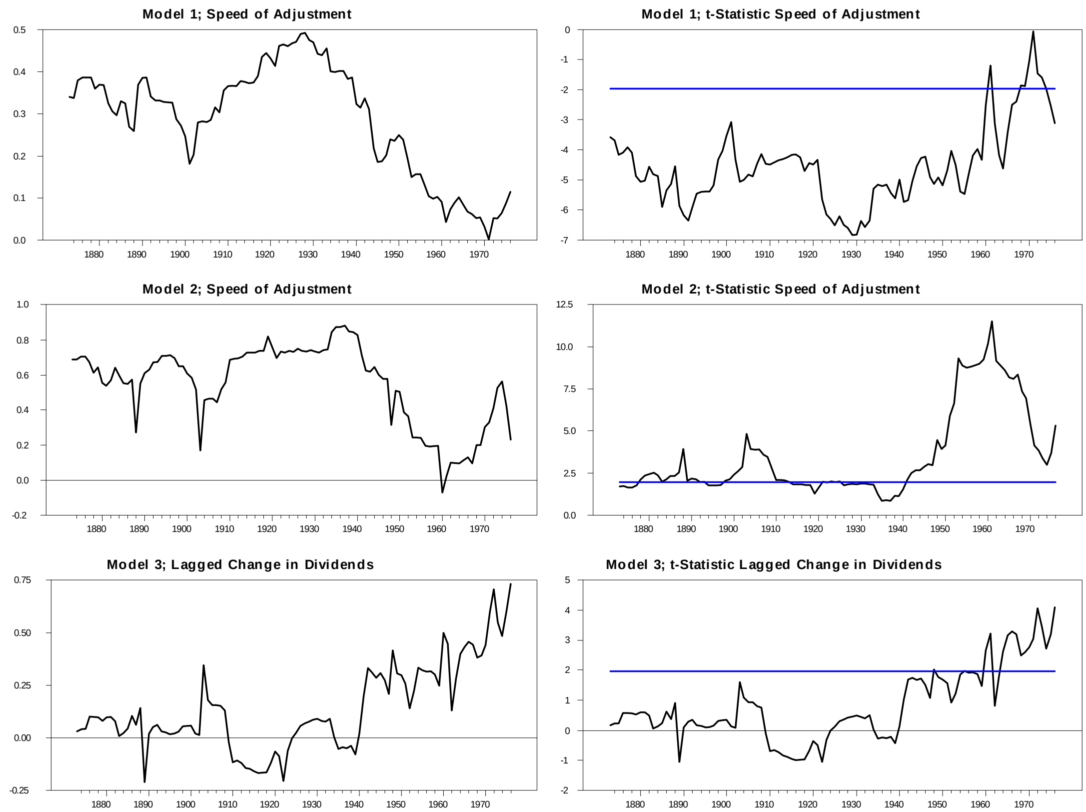

Figure 1. Rolling-Window Regressions for the Lintner Model All panels correspond to variants of Lintner's (1956) model (Equations (15)-(17)). The length of rolling window is 30 years. The first two panels plot the rolling speed-of-adjustment coefficients and their Newey-West t-statistics. The third panel plots the coefficient on the lagged dividend change and its t-statistic.

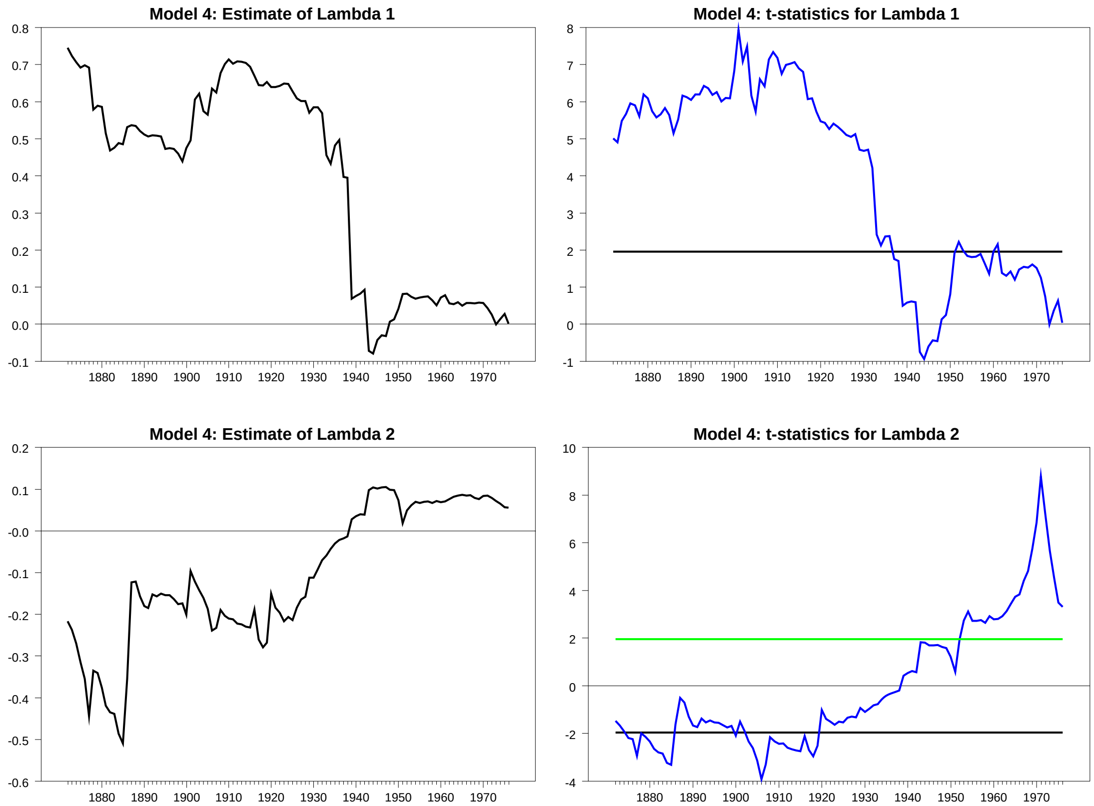

Figure 2. Rolling-Window Regressions for the Marsh-Merton Model The length of rolling window is 30 years. The first panel plots the response-to-permanent-earnings coefficient (λ_1) and its Newey-West t-statistic. A higher coefficient means less dividend smoothing. The second panel plots the implied convergence-to-target coefficient ($-\lambda_2$) and its Newey-West t-statistic. A higher coefficient means less dividend smoothing.

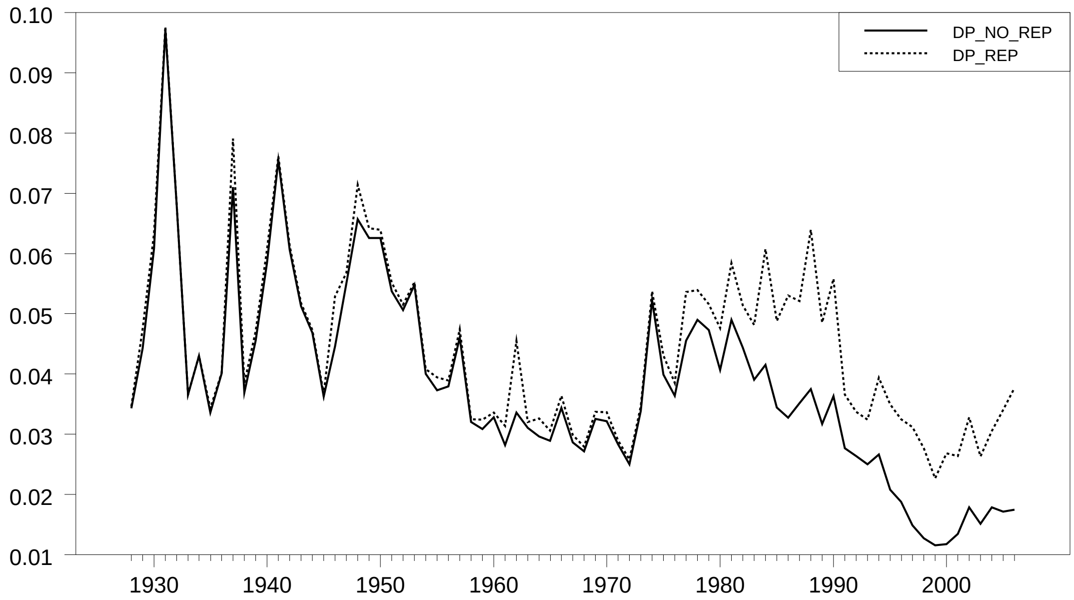

Figure 3. Aggregate Dividend Yield with (dotted line) and without Repurchase (solid line).

Table 1 : Summary Statistics

We summarize the S&P index annual data obtained from Robert Shiller's website. Δd is the log dividend growth rate; Δe is the log earnings growth rate; $\frac{D}{P}$ is the dividend yield; $\frac{E}{P}$ is the earnings yield; $\frac{D}{E}$ is the payout ratio; and S is the standard deviation of dividend growth divided by the standard deviation of earnings growth, which is a measure of dividend smoothing. The data cover 1872-2006.

		Δd	Δe	$\frac{D}{P}$	$\frac{E}{P}$	$\frac{D}{E}$	$S = \frac{\sigma(\Delta d)}{\sigma(\Delta e)}$
	Mean	0.034	0.039	0.045	0.075	0.618	0.500
	(sd)	(0.12)	(0.25)	(0.02)	(0.03)	(0.20)	
1872-2006	AR(1)	0.256	0.024	0.781	0.740	0.632	
	Mean	0.013	0.012	0.053	0.077	0.719	0.545
	(sd)	(0.16)	(0.29)	(0.14)	(0.03)	(0.21)	
1872-1945	AR(1)	0.204	-0.017	0.518	0.621	0.440	
	Mean	0.059	0.073	0.036	0.073	0.497	0.295
	(sd)	(0.05)	(0.18)	(0.01)	(0.03)	(0.09)	
1946-2006	AR(1)	0.473	0.089	0.926	0.832	0.649	

Table 2 : Dividend Policy Models Using Actual Dividends and Earnings

Denote D_t the level of dividends, E_t the level of earnings, and $\triangle$ the change operator. Four dividend behavior models are estimated. The first is the original Lintner (1956) model and the second is estimated using the first differences. For these two models the speed of adjustment (SA) and the target payout ratio (TPR) are implied. The focus of the third models is the coefficient on the lagged $\triangle D_t$, which measures persistence (smoothness). The fourth is the Marsh and Merton (1987) model, in which λ_1 measures response to permanent earnings change and $-\lambda_2$ measures speed of convergence to long-term target. New-West t–values are provided below each coefficient controlling for heteroskadasticity and autocorrelation. We also report the Chow test for structural break around 1945. The full sample is the S&P 500 annual data covering 1872-2006.

Panel A: $\Delta D_t = \alpha_0 + \alpha_1 E_t + \alpha_2 D_{t-1} + u_t$

	c	E_t	D_{t-1}	$\overline{R}^2$	SA	TPR	Chow 1945
1872-2006	0.035 (1.42)	0.052 (10.99)	−0.079 (5.87)	0.73	0.08	0.08	2.656 [0.05]
1872-1945	0.005 (0.32)	0.248 (10.22)	−0.373 (8.93)	0.60	0.37	0.18	
1946-2006	0.120 (1.74)	0.054 (7.69)	−0.090 (4.25)	0.68	0.09	0.05	
$F-Test$		766.43 [0.00]	175.08 [0.00]				

Panel B: $\Delta D_t = \beta_0 + \beta_1 \times \Delta E_t + \beta_2 \times \Delta D_{t-1} + \varepsilon_t$

	c	ΔE_t	ΔD_{t-1}	$\overline{R}^2$	SA	TPR	Chow 1945
1872-2006	0.025 (1.38)	0.037 (7.30)	0.825 (17.25)	0.81	0.17	0.22	3.677 [0.01]
1872-1945	0.001 (0.20)	0.237 (6.09)	0.284 (2.94)	0.35	0.72	0.33	
1946-2006	0.062 (1.47)	0.036 (5.07)	0.808 (10.91)	0.79	0.19	0.19	
$F-Test$		773.78 [0.00]	50.15 [0.00]				

Panel C: $\Delta D_t = \gamma_0 + \gamma_1 E_t + \gamma_2 \times \Delta D_{t-1} + \upsilon_t$

	c	E_t	ΔD_{t-1}	$\overline{R}^2$	Chow 1945
1872-2006	−0.012 (0.57)	0.011 (5.29)	0.652 (8.46)	0.78	1.311 [0.27]
1872-1945	−0.056 (2.90)	0.093 (3.45)	0.061 (0.53)	0.15	
1946-2006	−0.025 (0.47)	0.011 (3.29)	0.687 (4.04)	0.19	
$F-Test$		618.87 [0.00]	30.39 [0.00]		

Panel D: $\ln\left[\frac{D_{t+1}}{D_t}\right] + \frac{D_t}{P_{t-1}} = \lambda_0 + \lambda_1 \times \ln\left[\frac{P_t+D_t}{P_{t-1}}\right] + \lambda_2 \times \ln\left[\frac{D_t}{P_{t-1}}\right] + \varpi_{t+1}$

	λ_0	$\ln\left[\frac{P_t+D_t}{P_{t-1}}\right]$	$\ln\left[\frac{D_t}{P_{t-1}}\right]$	$\overline{R}^2$	Chow 1945
1872-2006	−0.026 (0.33)	0.461 (6.21)	−0.021 (0.89)	0.38	21.24 [0.00]
1872-1945	−0.565 (2.60)	0.673 (9.01)	−0.198 (2.72)	0.62	
1946-2006	0.299 (3.99)	0.003 (0.06)	0.061 (2.87)	0.18	
$F-Test$		176.49 [0.00]	246.24 [0.00]		

Table 3 : Predictability by Dividend Yield in the S&P Sample: Empirical and Simulation Evidence

We examine the S&P 500 annual data covering 1872-2006. In Panel A, we regress cumulative log dividend growth or returns, from one to five years, on the lagged log dividend yield, for 1872-1945 and 1946-2006 separately. For example, dg_t^1 is the annual dividend growth, dg_t^5 is the five-year dividend growth, r_t^1 is annual return, and r_t^5 is the five-year return. We provide the simulated p-values below each coefficients. The simulation considers the biases caused by the persistence of the variables, the contemporaneous correlation between the dependent and independent variables, and the overlapping small sample. See Appendix for more details. We boldface the p-value if it is lower than or equal to 0.10. In Panel B, we regress simulated cumulative log dividend growth or returns, from one to five years, on the lagged simulated log dividend yield. We first fit the Marsh and Merton (1987) dividend smoothing model for 1872-1945 and 1946-2006 separately. We then simulate dividend growth using the fitted model and simulate returns under the null of no predictability. We match the historical means and standard deviations of dividend growth and return and the covariance between them. We back out the stock price from the simulated total return and dividend, and then calculate the dividend yield. We also set the maximum and minimum log dividend yields to be -1 and -10 and adjust dividends (when needed) to ensure that the dividend policy is sustainable. We report the regression coefficients and the associated p-values and the AR(1) coefficient for the log dividend yield.

Panel A: Actual Data							
	dg_t^1	dg_t^3	dg_t^5	r_t^1	r_t^3	r_t^5	AR(1)
1872-1945	-0.448	-0.596	-0.406	0.024	0.303	0.636	0.557
	[**0.00**]	[**0.00**]	[**0.07**]	[0.27]	[**0.07**]	[**0.01**]	[**0.00**]
1946-2006	0.026	0.076	0.088	0.101	0.289	0.505	0.956
	[0.35]	[0.25]	[0.26]	[0.17]	[0.19]	[0.15]	[**0.00**]
Panel B: Simulated Data							
	dg_t^1	dg_t^3	dg_t^5	r_t^1	r_t^3	r_t^5	AR(1)
1872-1945	-0.460	-0.679	-0.798	0.032	0.086	0.135	0.565
	[**0.00**]	[**0.00**]	[**0.00**]	[0.37]	[0.34]	[0.32]	[**0.00**]
1946-2006	-0.033	-0.096	-0.156	0.020	0.058	0.094	0.983
	[0.43]	[0.42]	[0.41]	[0.17]	[0.18]	[0.19]	[**0.00**]

Table 4 : Dividend Smoothing and Predictability by Dividend Yield: Simulation Evidence (Second Case)

We simulate dividend growth rates, returns and dividend yields under the null that dividend growth is predictable without smoothing but return is not:

$$\begin{aligned} g_{t+1} &= a_g - 0.1 \times dp_t + \varepsilon^g_{t+1} \\ r_{t+1} &= a_r + \varepsilon^r_{t+1}, \end{aligned}$$

where g_{t+1} is dividend growth rate and r_{t+1} stock return. The residuals ε^g_{t+1} and ε^r_{t+1} are chosen such that the historical variance-covariance matrix of dividend growth and return in the prewar period is matched. We assume that the actual dividend growth is governed by a smoothness parameter λ:

$$g_{t+1} = (1-\lambda)\left(a_g - 0.1 \times dp_t + \varepsilon^g_{t+1}\right) + \lambda \times \left(g_{ave} + \varepsilon^{ave}_{t+1}\right),$$

where g_{ave} is historical average dividend growth rate and ε^{ave}_{t+1} is a shock to this target. The more smoothed the dividend policy, the higher λ is. We back out new prices from the simulated total returns and dividends. We also set the maximum and minimum log dividend yields to be -1 and -10 and adjust dividends (when needed) to ensure that the dividend policy is sustainable. We regress simulated cumulative log dividend growth or returns, from one to five years, on the lagged simulated log dividend yield. We report the regression coefficients and the associated p-values and the AR(1) coefficient for the log dividend yield. We boldface the p-value if it is lower than or equal to 0.10.

	dg^1_t	dg^3_t	dg^5_t	r^1_t	r^3_t	r^5_t	AR(1)
$\lambda = 0$	-0.124	-0.325	-0.477	0.052	0.146	0.227	0.903
	[**0.00**]	[**0.00**]	[**0.00**]	[0.19]	[0.18]	[0.17]	[**0.00**]
$\lambda = 0.5$	-0.097	-0.272	-0.423	0.053	0.150	0.234	0.946
	[**0.01**]	[**0.01**]	[**0.01**]	[0.11]	[0.11]	[0.12]	[**0.00**]
$\lambda = 0.95$	-0.081	-0.239	-0.389	0.037	0.105	0.164	0.973
	[**0.09**]	[**0.10**]	[**0.10**]	[0.12]	[0.13]	[0.14]	[**0.00**]
$\lambda = 1$	-0.079	-0.233	-0.381	0.033	0.095	0.148	0.976
	[0.15]	[0.15]	[0.16]	[0.13]	[0.14]	[0.15]	[0.00]

Table 5 : Dividend Smoothing and Predictability by Dividend Yield: Simulation Evidence (Third Case)

We simulate dividend growth rates and returns from the fitted equations:

$$\begin{aligned} g_{t+1} &= (1-\lambda)\left(-1.315 - 0.447 \times dp_t + \varepsilon^{g}_{t+1}\right) + \lambda \times \left(g_{ave} + \varepsilon^{ave}_{t+1}\right) \\ r_{t+1} &= 0.142 + 0.025 \times dp_t + \varepsilon^{r}_{t+1}. \end{aligned}$$

The more smoothed the dividend policy, the higher λ is. We match the standard deviations of dividend growth and return and the covariance between them. We back out new prices from the simulated total returns and dividends. We also set the maximum and minimum log dividend yields to be -1 and -10 and adjust dividends (when needed) to ensure that the dividend policy is sustainable. We regress simulated cumulative log dividend growth or returns, from one to five years, on the lagged simulated log dividend yield. We report the regression coefficients and the associated p-values and the AR(1) coefficient for the log dividend yield. We boldface the p-value if it is lower than or equal to 0.10.

	dg_t^1	dg_t^3	dg_t^5	r_t^1	r_t^3	r_t^5	AR(1)
$\lambda = 0$	-0.456	-0.809	-0.882	0.058	0.126	0.170	0.533
	[**0.00**]	[**0.00**]	[**0.00**]	[0.29]	[0.29]	[0.28]	[**0.00**]
$\lambda = 0.5$	-0.236	-0.544	-0.708	0.062	0.150	0.214	0.769
	[**0.00**]	[**0.00**]	[**0.00**]	[0.24]	[0.24]	[0.24]	[**0.00**]
$\lambda = 0.95$	-0.104	-0.305	-0.493	0.051	0.139	0.212	0.955
	[**0.03**]	[**0.03**]	[**0.04**]	[**0.08**]	[**0.10**]	[0.11]	[**0.00**]
$\lambda = 1$	-0.096	-0.284	-0.462	0.039	0.105	0.159	0.970
	[0.14]	[0.14]	[0.15]	[**0.10**]	[0.12]	[0.14]	[**0.00**]

Table 6 : Predictability by Dividend Yield

We regress cumulative log dividend growth or returns, from one to five years, on the lagged log dividend yield. For example, g_t^1 is the annual dividend growth, g_t^5 is the five-year dividend growth, r_t^1 is annual return, and dp_{t-1} is the lagged dividend yield. We provide the New-West (NW) t-value and the simulated (Sim) p-value for each coefficients. The simulation considers the biases caused by the persistence of the variables, the contemporaneous correlation between the dependent and independent variables, and the overlapping small sample. See Appendix for more details. We boldface the p-value if it is lower than or equal to 0.10. The sample is constructed using the merged dataset of CRSP, COMPUSTAT, and Moody's book equity. The final sample covers annual data during 1928-2006.

	1928-2006		1946-2006			1928-2006		1946-2006	
	Dividend Growth					Returns			
	dp_{t-1}	$\overline{R}^2$	dp_{t-1}	$\overline{R}^2$		dp_{t-1}	$\overline{R}^2$	dp_{t-1}	$\overline{R}^2$
Panel A: Without Repurchases									
dg_t^1	-0.087	8.7	0.012	-0.9	r_t^1	0.049	1.2	0.103	6.9
NW	(1.85)		(0.51)			(0.99)		(2.40)	
Sim	[**0.01**]		[0.67]			[0.28]		[0.20]	
dg_t^2	-0.114	5.6	0.033	0.7	r_t^2	0.135	3.2	0.207	15.9
NW	(1.14)		(0.86)			(1.84)		(3.71)	
Sim	[**0.07**]		[0.79]			[0.22]		[0.17]	
dg_t^3	-0.121	3.5	0.033	-0.2	r_t^3	0.199	5.3	0.274	22.8
NW	(1.13)		(0.85)			(3.32)		(16.78)	
Sim	[0.14]		[0.76]			[0.24]		[0.20]	
dg_t^4	-0.097	1.1	0.042	-0.1	r_t^4	0.277	9.9	0.349	29.3
NW	(1.02)		(0.98)			(3.15)		(6.26)	
Sim	[0.27]		[0.78]			[0.22]		[0.20]	
dg_t^5	-0.067	-0.2	0.036	-0.6	r_t^5	0.349	15.7	0.455	36.2
NW	(0.90)		(0.81)			(2.89)		(4.71)	
Sim	[0.38]		[0.74]			[0.21]		[0.17]	
Panel B: With Repurchases									
dg_t^1	-0.212	17.7	-0.027	-1.1	r_t^1	0.128	3.1	0.226	17.0
NW	(2.91)		(0.58)			(1.78)		(4.10)	
Sim	[**0.00**]		[0.44]			[**0.04**]		[**0.00**]	
dg_t^2	-0.236	9.4	0.032	-1.2	r_t^2	0.294	9.36	0.407	30.4
NW	(1.45)		(0.39)			(3.25)		(4.56)	
Sim	[**0.02**]		[0.77]			[**0.02**]		[**0.00**]	
dg_t^3	-0.231	5.1	0.034	-1.5	r_t^3	0.413	13.7	0.519	40.5
NW	(1.37)		(0.32)			(6.08)		(5.54)	
Sim	[**0.08**]		[0.74]			[**0.02**]		[**0.00**]	
dg_t^4	-0.162	1.1	0.067	-0.1	r_t^4	0.523	19.5	0.595	42.2
NW	(1.07)		(0.53)			(5.62)		(5.50)	
Sim	[0.20]		[0.79]			[**0.02**]		[**0.01**]	
dg_t^5	-0.104	-0.3	0.044	-1.5	r_t^5	0.617	27.2	0.752	50.3
NW	(1.11)		(0.55)			(5.91)		(5.68)	
Sim	[0.36]		[0.71]			[**0.02**]		[**0.00**]	

Table 7 : Predictability by Earnings Yield

We regress cumulative log earnings growth (eg), returns (r), and payout ratio growth (deg), from one to five years, on the lagged log earnings yield (ep_{t-1}). For example, eg_t^3 is the three-year earnings growth. When predicting earnings growth, we use ep_{t-1}^0, in which the price is from the beginning (rather than the end) of the year. We provide the New-West (NW) t-value and the simulated (Sim) p-value for each coefficient. The simulation considers the biases caused by the persistence of the variables, the contemporaneous correlation between the dependent and independent variables, and the overlapping small sample. See Appendix for more details. We boldface the p-value if it is lower than or equal to 0.10. The sample is constructed using the merged dataset of CRSP, COMPUSTAT, and Moody's book equity. The final sample covers annual data during 1928-2006.

	1928-2006		1946-2006			1928-2006		1946-2006			1928-2006		1946-2006	
	ep_{t-1}^0	$\overline{R}^2$	ep_{t-1}^0	$\overline{R}^2$		ep_{t-1}	$\overline{R}^2$	ep_{t-1}	$\overline{R}^2$		ep_{t-1}	$\overline{R}^2$	ep_{t-1}	$\overline{R}^2$
eg_t^1	−0.721	36.2	−0.651	32.1	r_t^1	0.037	2.6	0.027	1.9	deg_t^1	0.712	36.9	0.655	32.2
NW	(8.57)		(4.01)			(2.24)		(1.78)			(7.54)		(3.68)	
Sim	[**0.00**]		[**0.02**]			[**0.10**]		[0.12]			[**0.00**]		[**0.02**]	
eg_t^2	−0.855	40.2	−0.827	40.7	r_t^2	0.035	0.4	0.038	2.7	deg_t^2	0.895	49.1	0.856	44.0
NW	(10.18)		(7.14)			(1.26)		(1.54)			(11.48)		(7.05)	
Sim	[**0.00**]		[**0.00**]			[0.19]		[0.13]			[**0.00**]		[**0.00**]	
eg_t^3	−0.839	38.2	−0.849	42.7	r_t^3	0.032	-0.2	0.030	-0.1	deg_t^3	0.838	44.7	0.857	44.1
NW	(8.07)		(6.30)			(1.55)		(0.80)			(8.81)		(6.51)	
Sim	[**0.00**]		[**0.02**]			[0.26]		[0.24]			[**0.00**]		[**0.01**]	
eg_t^4	−0.898	40.4	−0.880	45.3	r_t^4	0.085	5.6	0.037	0.2	deg_t^4	0.891	47.1	0.886	46.6
NW	(8.66)		(6.69)			(1.72)		(0.85)			(9.82)		(6.61)	
Sim	[**0.00**]		[**0.02**]			[**0.08**]		[0.23]			[**0.00**]		[**0.02**]	
eg_t^5	−0.846	37.6	−0.850	43.7	r_t^5	0.071	3.85	0.022	-1.3	deg_t^5	0.854	44.1	0.868	45.6
NW	(9.35)		(8.02)			(1.21)		(0.38)			(10.58)		(7.77)	
Sim	[**0.01**]		[**0.04**]			[0.15]		[0.35]			[**0.00**]		[**0.03**]	

Table 8 : Predictability by Dividend Yield: Smooth versus Volatile portfolios

We sort firms into three portfolios according to the ratio of the standard deviation of dividend growth to the standard deviation of earnings growth. The firms with the lowest (highest) ratios consists the smooth (volatile) portfolio. For the smooth and volatile portfolios respectively, we regress cumulative log dividend growth (dg) and returns (r) on the lagged log dividend yield (dp). For example, dg_t^3 is the three-year dividend growth. We provide the New-West (NW) t-value and the simulated (Sim) p-value for each coefficient. The simulation considers the biases caused by the persistence of the variables, the contemporaneous correlation between the dependent and independent variables, and the overlapping small sample. See Appendix for more details. We boldface the p-value if it is lower than or equal to 0.10. The sample is constructed using the merged dataset of CRSP, COMPUSTAT, and Moody's book equity. The final sample covers annual data during 1928-2006.

	1928-2006		1946-2006			1928-2006		1946-2006	
	Dividend Growth					Returns			
	dp_{t-1}	$\overline{R}^2$	dp_{t-1}	$\overline{R}^2$		dp_{t-1}	$\overline{R}^2$	dp_{t-1}	$\overline{R}^2$
Panel A: Smooth portfolios									
dg_t^1	−0.142	12.1	0.014	-1.4	r_t^1	0.153	4.8	0.211	16.1
NW	(2.16)		(0.43)			(2.23)		(4.21)	
Sim	[**0.01**]		[0.71]			[**0.02**]		[**0.02**]	
dg_t^2	−0.182	7.3	0.042	-0.4	r_t^2	0.346	13.0	0.373	28.6
NW	(1.22)		(0.99)			(4.38)		(4.31)	
Sim	[**0.04**]		[0.81]			[**0.01**]		[**0.02**]	
dg_t^3	−0.145	2.1	0.077	1.2	r_t^3	0.476	18.2	0.476	39.5
NW	(0.94)		(0.95)			(6.15)		(4.57)	
Sim	[0.14]		[0.86]			[**0.00**]		[**0.02**]	
dg_t^4	−0.063	-0.8	0.121	4.5	r_t^4	0.602	25.6	0.576	45.2
NW	(0.46)		(1.37)			(5.76)		(5.47)	
Sim	[0.35]		[0.90]			[**0.01**]		[**0.02**]	
dg_t^5	−0.022	-1.3	0.109	2.3	r_t^5	0.683	32.4	0.715	52.0
NW	(0.22)		(1.94)			(9.66)		(6.88)	
Sim	[0.44]		[0.86]			[**0.01**]		[**0.01**]	
Panel B: Volatile portfolios									
dg_t^1	−0.548	34.4	−0.432	21.5	r_t^1	0.111	2.2	0.182	14.4
NW	(5.29)		(3.92)			(1.62)		(3.65)	
Sim	[**0.00**]		[**0.06**]			[**0.05**]		[**0.00**]	
dg_t^2	−0.484	20.1	−0.308	9.9	r_t^2	0.248	6.8	0.288	22.7
NW	(2.99)		(2.65)			(2.67)		(3.49)	
Sim	[**0.00**]		[**0.09**]			[**0.01**]		[**0.00**]	
dg_t^3	−0.436	12.1	−0.285	7.5	r_t^3	0.319	8.3	0.303	22.1
NW	(2.90)		(3.00)			(4.07)		(2.55)	
Sim	[**0.04**]		[0.31]			[**0.01**]		[**0.00**]	
dg_t^4	−0.358	6.6	−0.322	7.6	r_t^4	0.447	16.5	0.343	25.9
NW	(4.38)		(3.41)			(4.15)		(3.19)	
Sim	[0.14]		[0.23]			[**0.00**]		[**0.01**]	
dg_t^5	−0.370	7.0	−0.475	14.1	r_t^5	0.482	21.9	0.450	32.0
NW	(3.60)		(3.49)			(6.19)		(3.63)	
Sim	[0.17]		[**0.08**]			[**0.00**]		[**0.00**]	

Table 9 : Predictability by Earnings Yield: Smooth versus Volatile portfolios

We sort firms into three portfolios according to the ratio of the standard deviation of dividend growth to the standard deviation of earnings growth. The firms with the lowest (highest) ratios consists the smooth (volatile) portfolio. For the smooth and volatile portfolios respectively, we regress cumulative log earnings growth (eg) and returns (r) on the lagged log earnings yield (ep). For example, eg_t^3 is the three-year earnings growth. We provide the New-West (NW) t-value and the simulated (Sim) p-value for each coefficient. The simulation considers the biases caused by the persistence of the variables, the contemporaneous correlation between the dependent and independent variables, and the overlapping small sample. See Appendix for more details. We boldface the p-value if it is lower than or equal to 0.10. The sample is constructed using the merged dataset of CRSP, COMPUSTAT, and Moody's book equity. The final sample covers annual data during 1928-2006.

	1928-2006		1946-2006			1928-2006		1946-2006	
	Earnings Growth					Returns			
	ep_{t-1}^0	$\overline{R}^2$	ep_{t-1}^0	$\overline{R}^2$		ep_{t-1}	$\overline{R}^2$	ep_{t-1}	$\overline{R}^2$
Panel A: Smooth portfolios									
eg_t^1	-0.779	39.8	-0.714	35.3	r_t^1	0.055	1.4	0.028	4.3
NW	(6.58)		(5.30)			(2.83)		(2.31)	
Sim	[**0.01**]		[**0.01**]			[**0.01**]		[**0.08**]	
eg_t^2	-0.831	40.5	-0.852	42.3	r_t^2	0.056	6.8	0.035	3.5
NW	(22.8)		(9.02)			(3.60)		(2.03)	
Sim	[**0.00**]		[**0.00**]			[**0.03**]		[0.11]	
eg_t^3	-0.613	28.7	-0.848	43.0	r_t^3	0.049	3.5	0.027	0.2
NW	(3.81)		(7.16)			(4.16)		(0.92)	
Sim	[**0.04**]		[**0.01**]			[**0.08**]		[0.23]	
eg_t^4	-0.940	44.9	-0.880	45.6	r_t^4	0.092	13.4	0.035	0.7
NW	(10.12)		(8.18)]			(2.54)		(0.92)	
Sim	[**0.00**]		[**0.02**]			[**0.02**]		[0.21]	
eg_t^5	-0.856	39.4	-0.851	44.7	r_t^5	0.086	12.1	0.017	-1.3
NW	(11.65)		(9.00)			(1.91)		(0.41)	
Sim	[**0.01**]		[**0.03**]			[**0.03**]		[0.37]	
Panel B: Volatile portfolios									
eg_t^1	-0.769	40.5	-0.449	21.1	r_t^1	0.043	1.5	0.106	12.8
NW	(8.66)		(3.04)			(1.32)		(3.68)	
Sim	[**0.00**]		[**0.05**]			[**0.10**]		[**0.00**]	
eg_t^2	-0.512	22.9	-0.590	26.5	r_t^2	0.042	0.1	0.142	17.1
NW	(3.77)		(9.05)			(0.66)		(5.43)	
Sim	[**0.00**]		[**0.01**]			[0.22]		[**0.00**]	
eg_t^3	-0.844	38.1	-0.570	25.6	r_t^3	0.081	2.4	0.152	13.7
NW	(6.43)		(6.32)			(0.96)		(4.33)	
Sim	[**0.00**]		[**0.06**]			[0.11]		[**0.02**]	
eg_t^4	-0.738	31.1	-0.494	22.7	r_t^4	0.151	11.2	0.188	18.5
NW	(7.28)		(6.67)			(2.99)		(6.11)	
Sim	[**0.00**]		[0.15]			[**0.03**]		[**0.01**]	
eg_t^5	-0.737	30.9	-0.518	23.5	r_t^5	0.151	13.9	0.254	27.4
NW	(7.47)		(13.28)			(4.57)		(3.84)	
Sim	[**0.00**]		[0.17]			[**0.04**]		[**0.00**]	

Table 10 : Predictability by Earnings Yield Using Actual Earnings Data

For firm years after 1950 we use earnings data from COMPUSTAT; for firm years before that we use the clean surplus formula to back out earnings. We then regress cumulative log earnings growth (eg), returns (r), and payout ratio growth (deg), from one to five years, on the lagged log earnings yield (ep_{t-1}). For example, eg_t^3 is the three-year earnings growth. We provide the New-West (NW) t-value and the simulated (Sim) p-value for each coefficient. The simulation considers the biases caused by the persistence of the variables, the contemporaneous correlation between the dependent and independent variables, and the overlapping small sample. See Appendix for more details. We boldface the p-value if it is lower than or equal to 0.10. The final sample covers annual data during 1928-2006.

	1928-2006		1946-2006			1928-2006		1946-2006			1928-2006		1946-2006	
	ep_{t-1}^0	$\overline{R}^2$	ep_{t-1}^0	$\overline{R}^2$		ep_{t-1}	$\overline{R}^2$	ep_{t-1}	$\overline{R}^2$		ep_{t-1}	$\overline{R}^2$	ep_{t-1}	$\overline{R}^2$
eg_t^1	−0.645	31.9	−0.099	2.0	r_t^1	0.0639	4.9	0.129	11.0	deg_t^1	0.644	34.8	0.133	6.4
NW	(4.89)		(0.87)			(2.11)		(2.24)			(5.14)		(1.49)	
Sim	[**0.01**]		[**0.07**]			[**0.09**]		[**0.03**]			[**0.00**]		[**0.05**]	
eg_t^2	−0.732	32.1	−0.265	10.1	r_t^2	0.062	1.9	0.201	17.1	deg_t^2	0.796	46.6	0.270	14.3
NW	(6.44)		(3.62)			(0.97)		(4.87)			(7.46)		(3.88)	
Sim	[**0.00**]		[**0.04**]			[0.17]		[**0.03**]			[**0.00**]		[**0.04**]	
eg_t^3	−0.702	28.2	−0.392	18.6	r_t^3	0.076	2.3	0.248	16.6	deg_t^3	0.709	39.7	0.356	21.2
NW	(7.21)		(4.11)			(2.62)		(6.05)			(8.29)		(4.59)	
Sim	[**0.01**]		[**0.04**]			[0.17]		[**0.04**]			[**0.00**]		[**0.05**]	
eg_t^4	−0.788	31.1	−0.486	27.6	r_t^4	0.169	14.4	0.294	18.8	deg_t^4	0.784	42.4	0.432	29.3
NW	(7.07)		(4.81)			(6.00)		(3.31)			(8.94)		(3.81)	
Sim	[**0.00**]		[**0.05**]			[**0.05**]		[**0.05**]			[**0.00**]		[**0.05**]	
eg_t^5	−0.727	27.8	−0.450	25.0	r_t^5	0.170	15.7	0.402	26.3	deg_t^5	0.743	38.4	0.432	31.1
NW	(7.52)		(3.59)			(4.17)		(6.69)			(10.63)		[5.90]	
Sim	[**0.02**]		[**0.10**]			[**0.07**]		[**0.02**]			[**0.00**]		[**0.10**]	

Table 11 : Predictability by Earnings Yield: S&P Firms

The sample is constructed using the merged dataset of the S&P index firms in CRSP, COMPUSTAT, and Moody's book equity. The final sample covers annual data during 1928-2006. We regress cumulative log earnings growth (eg), returns (r), and payout ratio growth (deg), from one to five years, on the lagged log earnings yield (ep_{t-1}). For example, eg_t^3 is the three-year earnings growth. We provide the New-West (NW) t-value and the simulated (Sim) p-value for each coefficient. The simulation considers the biases caused by the persistence of the variables, the contemporaneous correlation between the dependent and independent variables, and the overlapping small sample. See Appendix for more details. We boldface the p-value if it is lower than or equal to 0.10.

	Earnings				Returns					Payout Ratio				
	1928-2006		1946-2008			1928-2006		1946-2006			1928-2006		1946-2006	
	ep_{t-1}^0	$\overline{R}^2$	ep_{t-1}^0	$\overline{R}^2$		ep_{t-1}	$\overline{R}^2$	ep_{t-1}	$\overline{R}^2$		ep_{t-1}	$\overline{R}^2$	ep_{t-1}	$\overline{R}^2$
eg_t^1	−0.746	38.0	−0.594	29.1	r_t^1	0.054	9.2	0.027	2.0	deg_t^1	0.731	37.1	0.596	29.2
NW	(6.21)		(3.08)			(2.17)		(1.98)			(5.77)		(2.88)	
Sim	[**0.01**]		[**0.03**]			[**0.03**]		[0.11]			[**0.00**]		[**0.02**]	
eg_t^2	−0.847	40.5	−0.781	38.2	r_t^2	0.049	3.2	0.039	2.4	deg_t^2	0.906	48.5	0.799	40.8
NW	(11.58)		(5.99)			(1.86)		(1.40)			(15.09)		(5.89)	
Sim	[**0.00**]		[**0.00**]			[**0.08**]		[0.13]			[**0.00**]		[**0.00**]	
eg_t^3	−0.605	27.3	−0.808	40.6	r_t^3	0.039	0.8	0.034	0.1	deg_t^3	0.614	31.6	0.812	41.8
NW	(4.18)		(5.26)			(2.23)		(0.74)			(4.88)		(5.43)	
Sim	[**0.05**]		[**0.01**]			[0.17]		[0.22]			[**0.04**]		[**0.01**]	
eg_t^4	−0.850	39.8	−0.860	44.3	r_t^4	0.082	6.8	0.037	0.0	deg_t^4	0.846	44.6	0.862	45.3
NW	(7.65)		(6.12)			(2.25)		(0.83)			(8.34)		(5.96)	
Sim	[**0.00**]		[**0.03**]			[**0.05**]		[0.25]			[**0.00**]		[**0.01**]	
eg_t^5	−0.896	41.3	−0.824	42.2	r_t^5	0.092	9.2	0.022	-1.3	deg_t^5	0.927	49.5	0.830	43.3
NW	(9.84)		(7.66)			(1.78)		(0.38)			(11.32)		(7.00)	
Sim	[**0.01**]		[**0.04**]			[**0.05**]		[0.36]			[**0.00**]		[**0.02**]	