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Equity duration and predictability

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ABSTRACT

After 1945, expected returns have started to dominate the variation in equity price movements, leaving little room for expected dividend growth. An increase in equity duration can help explain this change. Expected returns vary more for payouts further into the future. Furthermore, because expected returns are more persistent than growth rates, they are more important for longer-duration assets. We provide empirical support for this explanation across three datasets: dividend strips, the long time series for the aggregate market, and the cross-section of stocks. A simple present value model with time-varying duration can largely explain the post-1945 dominance of expected returns.

1. Introduction

Basic economic intuition suggests that changes in expected cash flows, and in particular dividends, should play an important role in equity price movements. Yet, the estimation of classic present value models indicates that changes in expected returns dominate and that dividend growth rates play only a minor role.[1] This is a puzzling finding: it suggests that the main driver for price movements is not changes in companies' fundamentals but changes in investors' risk appetite (Cochrane, 2011) or "animal spirits" (Keynes, 1936; Shiller, 1981).

Even more puzzling, this finding only holds in recent (post-1945) U.S. data, which is most frequently analyzed in the literature. If one goes back in time, dividends play a more prominent role. For example, Golez and Koudijs (2018) show that over the last four centuries, from the beginning of modern stock markets in early 17th century Amsterdam until today, expected returns and dividend growth rates have been equally important, with the dominance of expected returns only emerging after 1945.[2] This seems counter-intuitive. In today's world, investors are better able to diversify and transfer risk than in any other period, suggesting that expected returns should be relatively less important in recent decades, not more. The use of alternative forms of payouts by companies today, such as share repurchases, does not explain this puzzle – the dominance of expected returns pre-dates the general use of repurchases, which only started after 1981.[3]

In this paper, we argue that these puzzling empirical patterns can be explained by the fact that the duration of the equity market as a whole has increased substantially over time. While firms' average payout ratio (dividends over earnings) was close to one before 1945, it has dropped to around 40% in recent decades. Possibly in response to better growth opportunities, firms reinvest more of their earnings (or keep them on

[1] See, for example, Campbell and Shiller (1988a), Fama and French (1988), Cochrane (1992), Lettau and Van Nieuwerburgh (2008), and Binsbergen and Koijen (2010).

[2] Schwert (2003), Goyal and Welch (2003), and Chen (2009) provide similar evidence using U.S. data after 1870.

[3] Firms only started to repurchase shares on a quantitatively important scale after the SEC changed its rules on manipulative trading in 1982 (Fama and French 2001, Grullon and Michaely 2002, Boudoukh et al. 2007). Similarly, cash payout from mergers and acquisitions only became quantitatively important after 1980, see Online Appendix F.

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balance sheet as cash), and payouts to investors are pushed further into the future. As a result, investors today receive most of their returns in the form of capital appreciation; the market's dividend-to-price ratio has fallen, and dividend growth rates have increased. All this implies that the *duration of the equity market* has increased. We show that, as equity duration increases, discount rates become relatively more important for asset price variation. Hence, the dominance of expected returns in the recent period can be seen as a natural consequence of increased equity duration.

We formalize our argument with a simple theoretical framework. Duration affects the relative importance of expected returns through two channels: (i) the relative persistence of expected returns and dividend growth rates and (ii) differences in the variance of expected returns for assets with payouts at different horizons. There is extant evidence that expected returns are more persistent than expected growth rates (Binsbergen and Koijen 2010, Koijen and Van Nieuwerburgh 2011, Golez 2014 and Piatti and Trojani 2017).[4] Intuitively, as duration increases, the more persistent variable, expected returns in this case, becomes more important for the variance in equity prices. The empirical evidence also suggests that expected returns vary more for assets with payouts further into the future, with the importance of expected returns therefore increasing in duration. Giglio and Kelly (2018) find that longer-maturity asset prices are significantly more variable than justified by short maturity prices. Gormsen (2021) shows that expected returns vary more between good and bad states for longer-duration assets. Gonçalves (2021a) estimates the ICAPM model (with reinvestment risk) and shows that time variation in risk aversion generates larger changes in expected returns for longer-maturity assets.

We provide supportive evidence from three datasets: dividend strips, the time series of the aggregate market, and the cross-section of stocks. We start with the motivating case of short-term dividend strips – claims on the market's dividend payments over a given period (e.g., next year). As such, they are a short-duration version of the market itself. A comparison of dividend strips and the market thus provides the most direct way to study the effect of duration. According to present value relations, the short-duration dividend strip price depends on the next-period expected return and dividend growth rate, while the long-duration market depends on the whole stream of future expected returns and growth rates. Our simple model predicts that changes in expected returns are more important for the market than for dividend strips. The empirical evidence confirms this. Analyzing the S&P 500 index between 1996 and 2022, expected returns at most explain 32% of the variation in the dividend-to-price ratio for dividend strips compared to 96% for the market.[5]

Next, we analyze the time series of the aggregate market. We use data from Golez and Koudijs (2018) that spans four centuries, from the beginning of modern markets in the early 17$^{\text{th}}$ century until the end of 2022. Firms' payout ratios were high during the first centuries but significantly dropped after 1945. We show that this drop is contemporaneous with the increased importance of expected returns. As equity duration increased and the market became more growth-oriented, investors' expected returns became more important for stock prices than changes in fundamentals. Between 1629 and 1945, expected returns explain around 35% of the variation in the dividend-to-price ratio. In the post-1945 period, this increases to 90%.

Finally, we look at the cross-section of U.S. stocks since 1945. We sort firms into portfolios according to their payout ratios. Consistent with our argument, the relative contribution of expected returns falls as the payout ratio increases. While expected returns explain around 100% of the price variation in the low payout portfolio, they explain 54% of the variation in the high payout portfolio.[6] The magnitudes from the time series and cross-section are closely aligned, suggesting that the same fundamental mechanism is at play here.

All three pieces of evidence point in the same direction: higher equity duration implies a more prominent role for expected returns. We calibrate a present value model with time-varying duration in which shocks to expected returns (i) are more persistent and (ii) have a higher variance for assets with payouts further into the future. Using the time series between 1871 and 2022, we first estimate how the payout ratio is empirically related to the dividend-to-price ratio and the standard deviation of expected returns. Empirical relations are economically and statistically significant. We then calibrate the model using the dividend-to-price ratio and variance of expected returns that are predicted by either the average pre or post-1945 payout ratios. Finally, we examine how a change in equity duration affects the relative importance of expected returns and growth rates for stock price variation in simulations. We find that the calibrated model can largely explain the rising importance of expected returns after 1945 (the most conservative calibration explains 70%). Our analysis cannot refute alternative explanations, but the results from our calibration do lend credence to our proposed framework.

Throughout the paper, we follow most of the literature and focus on cash dividends as the most important form of cash flow to investors. Dividends have remained a large and important form of payout even with the rise of repurchases and cash payouts from mergers and acquisitions (M&A) after 1980. The percentage of public firms paying dividends today roughly equals that in 1980 (De la O 2022). Moreover, Brav et al. (2005) and De la O (2022) show that firms typically use dividends to pay out permanent earnings. Repurchases are used to pay out transitory shocks. The same holds for cash payouts from M&A. Stock prices should be most sensitive to changes in permanent earnings. This implies that, from an asset pricing point of view, dividends are the most relevant form of payout. In robustness tests, we do consider repurchases and issuances (Boudoukh et al. 2007 and Larrain and Yogo 2008) and cash payouts from M&A (Sabbatucci 2022) in constructing our cross-sectional tests. We show that conclusions do not change. Finally, we redo our time-series tests with smoothed cash payments from mergers and acquisitions. Again, the conclusions are unchanged.

Our paper fits into a fast-growing body of literature analyzing the implications of duration for asset pricing in general. Binsbergen, Brandt, and Koijen (2012), Binsbergen et al. (2013), Binsbergen and Koijen (2017), Gonçalves (2021a), Gormsen (2021), Bansal et al. (2021), Cassella et al. (2023), and Golez and Jackwerth (2024) link the duration of equity claims to their expected returns, showing that there is a time-varying equity term structure. Dechow, Sloan and Soliman (2004), Lettau and Wachter (2007), Da (2009), Weber (2018), Gormsen and Lazarus (2023), Chen and Li (2022), Gonçalves (2021b) and Li and Wang (2019) use the duration of individual stocks to explain cross-sectional differences in returns. In comparison, our paper has a different objective. We abstract away from the term structure of returns and use duration to explain the relative predictability of returns and growth rates.

We contribute to a large (and by now well established) literature on return and dividend growth predictability (see Cochrane 2011 and Koijen and Van Nieuwerburgh 2011 for overviews). The key contribution to this literature is our formalized framework for analyzing the relative importance of expected returns and dividend growth rates. With

[4] Fama and French (1989) already observed that fluctuations in expected returns persist beyond the business cycle while changes in expected dividend growth rates seem much more aligned with the business cycle.

[5] Insofar dividend strip prices contain measurement error (Golez and Jackwerth 2023), our point estimates provide an upper bound for the importance of expected returns for dividend strips. We formalize this point below.

[6] We also construct two portfolios that have approximately constant duration over time; one high, one low. The high duration portfolio looks like the market after 1945, with a large relative contribution of expected returns. The low duration portfolio is closer to the market over the full historical time series, with a more pronounced role for expected dividend growth rates.

this framework, we can explain the puzzling fact that expected returns became much more important after 1945. We show that this is closely related to firms' policies to reduce current payout in favor of retaining earnings to generate future payout. We also shed light on the cross-sectional variation in the relative importance of expected returns and dividend growth rates (Maio and Santa-Clara 2015).

Our paper is related to other work that tries to explain the variation in the relative predictability of returns and dividend growth rates. Menzly, Santos and Veronesi (2004) and Lettau and Ludwigson (2005) note that if shocks to expected returns and dividend growth rates are positively correlated, the dividend-to-price ratio might fail to predict either returns or growth rates. Binsbergen and Koijen (2010) emphasize the importance of the persistence of shocks. In our work, we keep the correlation and persistence of shocks constant but vary the duration of cash flows. We show that the dividend-to-price ratio predicts returns in high- and low-duration environments, whereas growth rates are only predictable when duration is low.

Chen, Da, and Priestley (2012) argue that the limited contribution of expected dividend growth rates in the recent (post-1945) period can be explained by excessive dividend smoothing. Dividend smoothing is complementary to our framework. The lower the payout ratio, the easier it might be for firms to smooth dividends over time. Nevertheless, dividend smoothing in itself is insufficient to reconcile our empirical findings. While it might be able to explain the patterns in the time series, it cannot explain our findings for dividend strips. Since strips are claims on dividends paid out by the market, and companies can smooth dividends over a limited time span, dividend strips are at least as sensitive to smoothing as the market itself. Moreover, in the cross-section, we find that dividend smoothing is relatively constant in our duration-sorted portfolios, or at least does not vary in a way that could explain our results.

Finally, our work has important implications for asset pricing theory in general. We show that equity duration varies over time and matters for how investors price the market. It seems important for macro-finance models to consider (and to possibly match) the empirical variation in duration that we document.

The rest of this paper is organized as follows. Section 2 lays out the simple example of dividend strips to illustrate the relation between duration and the relative contributions of expected returns and dividends. Section 3 provides evidence from the time series and cross-section of stocks. Section 4 formalizes our intuition with a simple model, which we calibrate to illustrate to what extent our framework can quantitatively explain differences in the relative contributions. Section 5 discusses the role of share repurchases and dividend smoothing. Section 6 concludes.

2. Motivating example: dividend strips & the market, 1996-2022

In this section, we compare present value relations for dividend strips and the market to illustrate, in the simplest possible setting, the different sources through which duration can affect the sensitivity of equity prices to expected returns and dividend growth rates.

2.1. Present value relations

Even though the market has a substantially higher duration than a dividend strip, the two share the same dividend growth process. Following Binsbergen and Koijen (2010), we assume this to be AR(1):

$$E_t[\Delta d_{t+1}] = g_t = \gamma_0 + \gamma_1(g_{t-1} - \gamma_0) + \varepsilon_t^g, \tag{1}$$

where Δd_{t+1} and g_t are the actual and expected dividend growth rates, respectively, with γ_0 the long-run average and γ_1 the persistence of the expected growth rate. Motivated by the evidence that expected return shocks to short and long-duration assets can differ (Giglio and Kelly 2018), we allow the expected returns on the market and dividend strip to follow different processes. We assume that the expected market return follows an AR(1) process as well:

$$E_t\left[r_{t+1}^{Mkt}\right] = \mu_t^{Mkt} = \delta_0 + \delta_1\left(\mu_{t-1}^{Mkt} - \delta_0\right) + \varepsilon_t^{\mu,Mkt}, \tag{2}$$

where r_{t+1}^{Mkt} and μ_t^{Mkt} are the actual and expected market returns, respectively, with δ_0 the long-run average and δ_1 the persistence of expected returns. For expected strip returns, we do not impose any specific dynamics:

$$E_t\left[r_{t+1}^{Strip}\right] = \mu_t^{Strip}. \tag{3}$$

For expositional purposes, we assume that shocks to the expected return and growth rate are uncorrelated. Nothing in our empirical analysis relies on this assumption and we relax it in the calibration exercise of Section 4.

Under these assumptions and using the Campbell and Shiller (1988a) decomposition, we can write the logarithm of the market dividend-to-price ratio (dp_t^{Mkt}) as:

$$dp_t^{Mkt} - \overline{dp}^{Mkt} \simeq \left(\frac{1}{1-\rho\delta_1}\right)\left(\mu_t^{Mkt} - \delta_0\right) - \left(\frac{1}{1-\rho\gamma_1}\right)(g_t - \gamma_0) \tag{4}$$

with $\overline{dp}^{Mkt}$ the long-run average and $\rho = exp\left\{-\overline{dp}^{Mkt}\right\}/\left(1+exp\left\{-\overline{dp}^{Mkt}\right\}\right)$ the discount rate. The variance is given by:

$$var\left(dp_t^{Mkt}\right) = \left(\frac{1}{1-\rho\delta_1}\right)^2 var\left(\mu_t^{Mkt}\right) + \left(\frac{1}{1-\rho\gamma_1}\right)^2 var(g_t). \tag{5}$$

We denote the fraction of the variance coming from shocks to the expected return or dividend growth rate as ER^{Mkt} and EDG^{Mkt}:

$$ER^{Mkt} = 1 - EDG^{Mkt} = \frac{1}{(1-\rho\delta_1)^2}\frac{\mathrm{var}\left(\mu_t^{Mkt}\right)}{var\left(dp_t^{Mkt}\right)} = \frac{\chi^{Mkt}}{1+\chi^{Mkt}},\ with\ \chi^{Mkt} = \left(\frac{1-\rho\gamma_1}{1-\rho\delta_1}\right)^2\frac{var\left(\mu_t^{Mkt}\right)}{var(g_t)}. \tag{6}$$

For the dividend strip, the logarithm of the dividend-to-price ratio is given by $dp_t^{Strip} = \mu_t^{Strip} - g_t$, its variance by:

$$var\left(dp_t^{Strip}\right) = var\left(\mu_t^{Strip}\right) + var(g_t), \tag{7}$$

and ER^{Strip} and EDG^{Strip} by:

$$ER^{Strip} = 1 - EDG^{Strip} = \frac{\chi^{Strip}}{1+\chi^{Strip}},\ with\ \chi^{Strip} = \frac{var\left(\mu_t^{Strip}\right)}{var(g_t)}. \tag{8}$$

For the dividend strip, ER and EDG depend on the variance of the expected return and growth rate only. For the market, they also depend on the persistence of shocks. Eqs. (6) and (8) indicate that ER and EDG for the market and the dividend strip will only be the same if two conditions hold simultaneously: (i) expected returns and dividend growth rates are equally persistent, and (ii) the variance of expected returns for the market and the strip are the same.

Empirically, the evidence suggests that expected returns are much more persistent than expected growth rates (Fama and French 1989; Binsbergen and Koijen 2010; Koijen and Van Nieuwerburgh 2011; Golez 2014; Piatti and Troiani 2017). Following Binsbergen and Koijen (2010), we estimate persistence parameters for expected returns and growth rates of 0.895 and 0.445, respectively, for 1629-2022 (Section 3.4). This suggests that expected returns should be more important for the market than for dividend strips.

The evidence also suggests that shocks to long-horizon expected returns have a higher variance. Giglio and Kelly (2018) show that, across a large set of assets, long-term asset prices are far more volatile than justified by the volatility of short-term asset prices given standard modeling assumptions. Gormsen (2021) shows that returns vary much more between good and bad times for the market than for dividend strips. Gonçalves (2021a) estimates the ICAPM model with a varying equity term structure, and his estimates indicate that the variance of expected returns increases with the time horizon.[7]

Taken together, there are at least two reasons why we expect changes in expected returns to be more important for the long duration market than for short duration dividend strips: (i) expected returns are more persistent than expected dividend growth rates, and (ii) long-horizon expected returns have a higher variance.

2.2. Empirical approach

Next, we estimate the importance of expected returns and growth rates for price movements of dividend strips and the market. For the market, as is standard in the literature, we do this through predictive regressions (Campbell and Shiller 1988a, Cochrane 1992). That is, we use the dividend-to-price ratio to predict future returns, dividend growth rates and the dividend-to-price ratio itself:

$$\begin{bmatrix} ret_{t+1} \\ dg_{t+1} \\ dp_{t+1} \end{bmatrix} = \begin{bmatrix} \beta_{ret} \\ \beta_{dg} \\ \beta_{dp} \end{bmatrix} dp_t + \begin{bmatrix} \varepsilon^{ret}_{t+1} \\ \varepsilon^{dg}_{t+1} \\ \varepsilon^{dp}_{t+1} \end{bmatrix}. \tag{9}$$

By approximation, $\beta_{ret} - \beta_{dg} + \rho\beta_{dp} \cong 1$, where ρ is defined below Eqn. (4). Using these coefficients, we can calculate ER and EDG, the relative contributions of expected returns and dividend growth rates fractions for the variance of the dividend-to-price ratio, as:

$$ER = \frac{\beta_{ret}}{(1 - \rho\beta_{dp})} \qquad EDG = -\frac{\beta_{dg}}{(1 - \rho\beta_{dp})} \tag{10}$$

For dividend strips, Eqn. (9) simplifies to

$$\begin{bmatrix} ret_{t+1} \\ dg_{t+1} \end{bmatrix} = \begin{bmatrix} \beta_{ret} \\ \beta_{dg} \end{bmatrix} dp_t + \begin{bmatrix} \varepsilon^{ret}_{t+1} \\ \varepsilon^{dg}_{t+1} \end{bmatrix}, \tag{11}$$

since payouts end after maturity (and the future dividend-to-price ratio is not defined). The relative contributions of expected returns and dividend growth rates are simply given by $ER = \beta_{ret}$ and $EDG = -\beta_{dg}$, respectively. Because $ER + EDG = 1$, we can also calculate implied fractions as one minus the other.

Since dividend strip prices are inferred from highly levered put-call parity positions, there is potential measurement error (Bansal et al. 2021; Boguth et al. 2023; Golez and Jackwerth 2024). In Online Appendix D, we show that this leads to an upward bias in ER. Specifically, measurement error in prices leads to negative autocorrelation in returns, which manifests itself in more predictability for returns and attenuates the predictability of dividend growth rates. Following Golez and Jackwerth (2024), we also consider a system of predictive regressions where we take backward-looking moving averages of the dividend-to-price ratio to smooth out such errors (see also Binsbergen, Brandt, and Koijen 2012 and Golez and Koudijs 2018 among others). This is unlikely to fully resolve bias. As such, if there is measurement error in dividend strip prices, the estimated ER remains an upper bound. Furthermore, if dividends are excessively smoothed, there is little uncertainty about the level of payouts over the short term. As a result, there might be relatively little news about dividends that will affect the dividend strip price. This would imply another upward bias in ER.[8]

2.3. Data

We focus on the S&P 500 index as a proxy for the market. The availability of dividend strip data restricts the time series. We construct returns and growth rates using data on the S&P 500 price index and the total return index from Datastream. The dividend strip data comes from Golez and Jackwerth (2024, henceforth GJ), who estimate dividend strip prices from intra-daily put-call matches for S&P 500 options, in the same way as Binsbergen, Brandt, and Koijen (2012), except that they use implied interest rates from derivative contracts to avoid biases. They also provide data until the end of 2022. We download their dividend strip data for the time period January 1996 to December 2022 from Golez's webpage.[9] The monthly return on the dividend strategy consists of monthly dividends plus the change in the price of the dividend strip. Maturities of dividend strips range from 1.3 to 1.9 years, with rebalancing occurring every January and July. To match the approximate maturity of the return strategy, we use the dividend-to-price ratio for the dividend strip based on 18-month constant maturity dividend strip prices (defined as the 12-month trailing sum of dividends for the S&P 500 index over the price of the dividend strip with a maturity of 18 months). For the matching time period, we also calculate the dividend-to-price ratio for the market, returns on the market, and dividend growth rates.

2.4. Results

We start by testing whether the dividend-to-price ratios for dividend strips and the market predict returns and dividend growth rates. Since dividend strip data is only available from 1996 onward, we restrict the analysis to 1996-2022.

Both dividend-to-price ratios are based on the same underlying asset, the S&P 500 index. The only difference is that strips entitle the owner to dividends over a fixed period, whereas the market entitles the owner to the whole stream of dividends until infinity. Thus, dividend strips and the market represent short and long-duration assets.

Table 1 reports summary statistics for 12-month returns, growth rates, and dividend-to-price ratios Everything is in real (inflation-adjusted) terms. Consistent with GJ, returns on the aggregate market are slightly higher and more volatile than those on the dividend strips. Naturally, the dividend-to-price ratio for dividend strips is much higher.

Table 2 presents the main predictability results. In this analysis, we run regressions at the monthly frequency. We regress 12-month returns, 12-month growth rates, and the current dividend-to-price ratio on the 12-times lagged dividend-to-price ratio. We report t-statistics based on

Table 1
Summary statistics: Market and dividend strips:.

	Market (1)	Dividend strips (2)
ret(%)	6.38	5.25
Std. (%)	17.08	14.22
dg(%)	3.32	
Std. (%)	7.62	
DP(%)	1.82	66.99
Std. (%)	0.38	9.39

This table reports summary statistics for 12-month real returns, real growth rates, and dividend-to-price ratios. Lowercase letters are logs of corresponding capital letters. The first column reports the statistics for the S&P 500 index; the second column reports the statistics for dividend strips on the S&P 500 index. Observations are at a monthly frequency. The period is from January 1996 to December 2022.

[7] See Figure 1 in Gormsen (2021) and Figure 8 in Gonçalves (2021a).

[8] We thank the Editor for pointing this out.

[9] Http://benjamin-golez.com.

Table 2
Return and dividend growth predictability: Market and dividend strips.

	Market (1)	Dividend strips (2)
Dependent variable: $ret_{t,t+12}$		
dp_t	0.39	0.56
t-stat. (N-W)	(3.54)	(6.61)
t-stat. (Non. Overlap.)	[2.84]	[3.40]
R2	0.21	0.26
Dependent variable: $dg_{t,t+12}$		
dp_t	-0.02	-0.40
t-stat. (N-W)	(-0.15)	(-4.31)
t-stat. (Non. Overlap.)	[-0.06]	[-3.59]
R2	0.00	0.45
Dependent variable: dp_{t+12}		
dp_t	0.61	
t-stat. (N-W)	(4.86)	
t-stat. (Non. Overlap.)	[4.08]	
R2	0.37	
ER	0.96	0.56
ER (implied)	0.95	0.60
EDG	0.05	0.40
EDG (implied)	0.04	0.44

This table reports OLS estimates of regressing 12-month real returns, dividend growth rates, and the dividend-to-price ratio on the lagged dividend-to-price ratio. Lowercase letters are logs of corresponding capital letters. The first column reports results for the S&P 500 index; the second column reports results for dividend strips on the S&P 500 index. Below the estimated coefficients (in parentheses) are Newey-West (1987) *t*-statistics with 12 lags. T-statistics based on non-overlapping observations are in brackets, calculated as the mean across 12 alternative non-overlapping samples. For the market, we calculate the fraction of the variation in the dividend-to-price ratio coming from changes in expected returns (*ER*) and expected growth rates (*EDG*) as $\beta_x/(1-\rho\beta_{dp})$, where β_x is the predictive coefficient for expected returns or dividend growth rates and β_{dp} is the predictive coefficient for the dividend-to-price ratio. For dividend strips, these fractions directly correspond to the estimated coefficients. Implied return and growth fractions are inferred from the corresponding growth and return fractions. The period is from January 1996 to December 2022.

Newey and West (1987) with 12 lags or on non-overlapping observations, where we calculate the mean of the t-statistics from the 12 non-overlapping samples.

For the market, we obtain the standard result that the dividend-to-price ratio predicts returns but not dividend growth rates. The coefficients suggest that changes in expected returns explain close to 100% of the variation in the dividend-to-price ratio. In comparison, the dividend-to-price ratio for dividend strips predicts both returns on the dividend strips and dividend growth. Results are highly significant, and the associated R^2 is relatively high. The coefficients suggest that 56% of the variation in dividend strips is due to changes in expected returns, and the rest is due to changes in expected growth rates.[10] Since the sample is relatively short, it is possible that our estimates suffer from Stambaugh (1999) bias. The simulation exercises in Online Appendix E suggest that such a bias is limited.

Next, we take the *k*-month backward-looking moving averages of the dividend-to-price ratio to smooth out errors in dividend strip prices. We vary *k* from 1 to 12 and report results in Table 3. For the market, this makes little difference. However, the differences are substantial for strips, with the share of expected return variation falling to about 30%.[11] Again, measurement error in strip prices is unlikely to be fully resolved by taking backward-looking moving averages, and dividend smoothing might be another source of upward bias. In sum, at least qualitatively, there appears to be a strong relation between duration and the importance of return predictability.

3. Main analysis

Next, we analyze the effects of duration in the time series and the cross-section.

3.1. Measuring duration: a simple model

The typical approach to measuring equity duration involves predicting cash flows with detailed accounting information (e.g., Dechow, Sloan and Soliman 2004, Weber 2018, Gonçalves 2021b). However, because of data availability, that would restrict our analysis to the post-war period. An alternative measure available over a longer period is the dividend-to-price ratio. In fact, in a Gordon growth model with constant returns, this captures the inverse of duration. However, we also use the dividend-to-price ratio to predict returns. Using the same variable as a measure for duration might raise concerns that results are mechanical. Instead, we derive a simple model of firm investment and show that the inverse of the payout ratio captures duration. When firms' growth opportunities improve, they pay out less today, pushing their payouts into the future. The payout ratio is not mechanically related to the predictability regressions and is available over a longer period, so that we can perform the relevant empirical tests.

Consider a simple neoclassical deterministic model of firm investment. Each period, a firm optimally decides how much of its current profits to retain and invest and how much to pay out to investors. The firm will invest up to the point that the marginal investment has zero net present value. The better its growth opportunities, the more it will invest. This means that the payout to investors will shift to the future (higher duration) while the current payout falls.

In particular, we assume that a representative firm makes one-period investments. Each period, it considers how much of its output to pay out to investors, captured by the payout ratio π and how much to invest. Absent frictions, the marginal investment exactly generates the expected return R and the firm only retains earnings if it has positive net present value projects to invest in.

We consider the following Cobb-Douglas production function:

$$Y_{t+1} = A_t K_t^{\alpha} \tag{12}$$

with output Y, productivity A and capital K. For simplicity, we assume that the capital fully depreciates after one period.[12] Further, the output elasticity of capital α is bounded: $\alpha \in (\underline{\alpha}, 1)$. The lower limit ensures that the firm will always want to retain some of its earnings; the upper limit implies decreasing returns to scale. Investing capital has an opportunity cost equal to expected returns R (>1). Further details and proofs are in Online Appendix A.

Proposition 1. *The firm's duration is defined by the growth rate G of output:*

[10] For dividend strips, the coefficients do not sum up to 1 exactly. In part, this is because the return strategy relies on actual dividend prices, whereas the dividend-to-price ratio relies on interpolated values. In addition, the return strategy does not match exactly the maturity of 1.5 years as it is rebalanced every 6-months rather than every month.

[11] Instead of averaging the dividend-to-price ratio, we can alternatively recalculate the dividend-to-price ratio using smoothed prices. Using a 12-month backward-looking mean for strip prices, we obtain *EDG* of 0.69, which implies an *ER* of 0.31. For the market, *EDG* is zero to the second decimal place; hence, *ER* is 1.

[12] We can think of t as spanning multiple years. Consistent with this, we measure the payout ratio over periods of 10 years in data.

Table 3
Return and dividend growth predictability: Market and dividend strips.

	k=1		k=3		k=6		k=12	
	Market (1)	Strip (2)	Market (3)	Strip (4)	Market (5)	Strip (6)	Market (7)	Strip (8)
Dependent variable: $ret_{t,t+12}$								
$\overline{dp}_{t-k+1\rightarrow t}$	0.39	0.56	0.40	0.46	0.42	0.37	0.45	0.32
t-stat. (N-W)	(3.54)	(6.61)	(3.88)	(4.85)	(4.28)	(3.31)	(4.82)	(1.96)
t-stat. (Non. Overlap.)	[2.84]	[3.40]	[3.16]	[2.56]	[3.61]	[1.93]	[4.05]	[1.36]
R2	0.21	0.26	0.22	0.14	0.23	0.08	0.24	0.04
Dependent variable: $dg_{t,t+12}$								
$\overline{dp}_{t-k+1\rightarrow t}$	-0.02	-0.40	-0.02	-0.50	-0.01	-0.56	0.02	-0.57
t-stat. (N-W)	(-0.15)	(-4.31)	(-0.14)	(-5.01)	(-0.08)	(-5.24)	(0.15)	(-5.31)
t-stat. (Non. Overlap.)	[-0.06]	[-3.59]	[-0.05]	[-4.48]	[-0.03]	[-4.89]	[0.14]	[-4.86]
R2	0.00	0.45	0.00	0.56	0.00	0.57	0.00	0.48
Dependent variable: dp_{t+12}								
$\overline{dp}_{t-k+1\rightarrow t}$	0.61		0.59		0.57		0.54	
t-stat. (N-W)	(4.86)		(4.57)		(4.32)		(3.91)	
t-stat. (Non. Overlap.)	[4.08]		[3.85]		[3.62]		[3.29]	
R2	0.37		0.34		0.30		0.25	
ER	0.96	0.56	0.97	0.46	0.96	0.37	0.95	0.32
ER (implied)	0.95	0.60	0.96	0.50	0.98	0.44	1.04	0.43
EDG	0.05	0.40	0.04	0.50	0.02	0.56	-0.04	0.57
EDG (implied)	0.04	0.44	0.03	0.54	0.04	0.63	0.05	0.68

This table reports OLS estimates of regressing 12-month real returns, dividend growth rates, and the dividend-to-price ratio on the *k*-month moving-average of the lagged dividend-to-price ratio. We vary *k* between 1 and 12 months. Lowercase letters are logs of corresponding capital letters. For a given *k*, the first column reports results for the S&P 500 index; the second column reports results for dividend strips on the S&P 500 index. Below the estimated coefficients (in parentheses) are Newey-West (1987) *t*-statistics with 12 lags. T-statistics based on non-overlapping observations are in brackets, calculated as the mean across 12 alternative non-overlapping samples. For the market, we calculate the fraction of the variation in the dividend-to-price ratio coming from changes in expected returns (*ER*) and expected growth rates (*EDG*) as $\beta_{x,k}/(1-\rho\beta_{dp,k})$, where $\beta_{x,k}$ is the predictive coefficient for expected returns or dividend growth rates for a given *k*, and $\beta_{dp,k}$ is the predictive coefficient for the dividend-to-price ratio for the same *k*. For dividend strips, these fractions directly correspond to the estimated coefficients. Implied return and growth fractions are inferred from the corresponding growth and return fractions. The period is from January 1996 to December 2022.

$$G \equiv \frac{Y_{t+1}}{Y_t} = \left(\frac{A_{t+1}}{A_t}\right)^{\frac{1}{1-\alpha}} \tag{13}$$

which depends directly on productivity growth and the output elasticity of capital. Holding R and α constant, π is a sufficient statistic for G:

$$\pi = \frac{D_{t+1}}{E_{t+1}} = \frac{A_t K_t^{\alpha} - K_{t+1}}{A_t K_t^{\alpha} - K_t} = 1 - \frac{\alpha}{R-\alpha}(G-1). \tag{14}$$

If growth and duration increase, payout declines.

3.2. Empirical approach

Our empirical approach is the same as in the previous section. We use the dividend-to-price ratio to predict future returns, dividend growth rates, and the dividend-to-price ratio itself. We then calculate *ER* and *EDG* using the predictive parameters, as in Eqns. (9) and (10).

We follow much of the predictability literature (e.g. Campbell and Shiller 1988a, Cochrane 1992, Binsbergen and Koijen 2010, Jagannathan and Liu 2019) and take the perspective of an investor that holds the market and does not participate in share repurchases and equity issuances. This means that the only payouts to investors we consider are cash dividends. This reflects the fact that firms typically use dividends to pay out permanent earnings, which should be most relevant for asset prices, while repurchases are typically used to pay out transitory shocks (Brav et al. 2005 and De la O 2022).[13]

[13] Boudoukh et al. (2007) and Larrain and Yogo (2008) consider net payout, which includes both repurchases and equity issuances. We further discuss the role of repurchases in Section 5.1.

3.3. Data

3.3.1. Time series, 1629-2022

For the time series between 1629 and 2015, we use stock prices, dividends, and earnings from Golez and Koudijs (2018, hereafter GK). We extend their time series until the end of 2022.

Stock prices and dividends between 1629 and 1812 come from the combined Amsterdam and London stock markets, the most developed markets at the time. GK reconstruct this data from primary sources; their appendix has more details. For the years between 1813 and 1870, the data come from London, which became the global financial center after the Napoleonic Wars. GK reconstruct the data between 1813 and 1825 from primary sources and rely on Acheson, Hickson, Turner and Ye (2009) for the remainder of the period. For the years after 1870, data are for the U.S. stock market, downloaded from Amit Goyal's webpage; for 1871 to 1925, the underlying source is Cowles (1939), for 1925 to 2022, the data are for the S&P 500.[14]

Earnings are only available for 1651-1812 and 1871-2022. For the first period, we rely on GK; details are in their appendix. For the second period, data come from Amit Goyal's webpage. Before 1926, the underlying source is Cowles (1939), after 1926, data are from S&P.

The data on earnings allow us to calculate the payout ratio (dividends/earnings) of the market, which we take as an inverse measure of equity duration. First, we calculate average dividends to earnings over 10-year trailing windows. This is the same window Campbell and Shiller (1988b, 2005) use to calculate the cyclically adjusted price-to-earnings (CAPE) ratio. To characterize the payout policy over a particular period,

[14] For 1926-1957, the S&P index covered only 90 rather than 500 stocks.

we take the mean of this trailing variable.[15]

For comparability across time, we report all variables in real, inflation-adjusted terms. Inflation figures come from several secondary sources that are standard in the literature; details are in the appendix to GK.

3.3.2. Cross-section, 1945-2022

For the cross-section of stocks between 1945 and 2022, we calculate annual dividends and returns for individual securities from the monthly CRSP tapes. As is typical in the literature, we only retain common stocks (share codes 10 and 11). We then merge these data with the earnings data from the annual COMPUSTAT tapes (net income or loss). For the period before 1950, when COMPUSTAT earnings data are not available, we calculate earnings using the "clean surplus" approach as

$$E_t = BE_t - BE_{t-1} + RP_t - SI_t + D_t, \tag{15}$$

where BE is book equity, RP are repurchases, SI are stock issuances and D are dividends. Following Chen, Da, and Priestly (2012), we calculate repurchases and issuances from the CRSP monthly tapes.[16] For book equity, we use the data used by Davis, Fama, and French (2000), downloaded from Kenneth French's website.

3.4. Results

3.4.1. Time series, 1629-2022

We first explore how the duration of the equity market has changed over time. Table 4 reports summary statistics for real (inflation-adjusted) variables. Four things stand out. First, the payout ratio was much higher before 1945, when firms paid out more than 95% of earnings in the form of dividends. After 1945, this dropped to less than 50%.[17] To illustrate more recent developments, Fig. 1, Panel A presents the payout ratio of the U.S. stock market since 1871, where we calculate average dividends over earnings for 10-year trailing windows. Before 1945, the payout ratio fluctuated around 70%, and was as high as 86% right before WWII, after which it steadily declined to approximately 40% today.[18]

Second, dividend growth rates were much higher after 1945 than before, increasing from 0.81% to 2.37%. Third, DY/RET, the fraction of returns investors receive in the form of dividends was much higher before 1945, when investors received approximately 70% of returns in the form of dividends. After 1945, this was approximately 40%. Finally, the dividend-to-price ratio was markedly higher before 1945, falling from approximately 5% to 3.5% more recently. Fig. 1, Panel B presents the 10-year trailing average for the dividend-to-price ratio since 1871.

These results are consistent with increased equity market duration. As firms reinvest more of their earnings or simply hold it in cash, investor payout is pushed into the future. As a result, investors receive more of their returns in the form of capital gains rather than dividends, and the dividend-to-price ratio falls. The stock market becomes more growth-oriented. Consistent with these developments, the co-movement of growth stocks with the market has increased in recent decades (Campbell and Vuolteenaho 2004). In our simple model, duration increases if firms have better growth opportunities. Consistent with this, the average annual logarithmic real earnings growth increased from 0.79% before 1945 to 2.96% after 1945.[19]

Next, we explore the persistence of expected returns and dividend growth rates over the long time series. We take two approaches. First, we estimate the Binsbergen and Koijen (2010) present value model using the Kalman filter. The estimation procedure is the same as in the original paper. Online Appendix B has details. Second, we compare the short and long-run predictability of expected returns and growth rates, from which we can back out the respective persistence parameters. This approach to estimating persistence parameters is appropriate for relatively long data samples. Online Appendix C has details. Following Binsbergen and Koijen (2010), we estimate persistence parameters for expected returns and growth rates of 0.895 and 0.445, respectively, for 1629-2022. This compares to 0.938 and 0.407 for 1945-2022. Comparing short and long-run predictive coefficients, we estimate persistence parameters of 0.882 and 0.600 for 1629-2022. These results confirm that expected returns are substantially more persistent than dividend growth rates regardless of the time period.

In Table 5, we present the predictability results. All regressions are conducted at the annual frequency; t-statistics are based on Newey and

Table 4
Summary statistics: Time-series analysis.

	1945-2022 (1)	1629-1945 (2)	1629-2022 (3)
Payout (%)	47.26	98.41†	86.11†
ret (%)	6.56	5.86	6.00
Std. (%)	16.91	14.12	14.69
DY/RET	0.41	0.69	0.63
dg (%)	2.37	0.81	1.12
Std. (%)	6.67	13.29	12.28
DP (%)	3.24	4.86	4.54
Std. (%)	1.43	1.27	1.45
AR(1)	0.91	0.69	0.79
Smoothing	0.21	0.32†	0.31†

This table reports summary statistics for annual variables in real terms. Column (1) reports statistics for the post-1945 period based on U.S. data. Column (2) reports statistics for 1629-1945 based on the combination of the Netherlands/U.K. (1629-1812), U.K. (1813-1870), and early U.S. data (1871-1945). Annual dividend growth rates and the dividend-to-price ratio before 1700 are based on 10-year trailing averages of real or nominal dividends. Column (3) reports the statistics based on the full sample. Lowercase letters are logs of corresponding capital letters. Payout is the mean of 10-year trailing dividends over earnings. The smoothing parameter is the ratio of the standard deviations of log dividend and log earnings growth. To calculate this, we drop years with negative earnings. The † indicates that the payout ratio and the smoothing parameter data are incomplete because earnings data are not available for the 1812-1870 period. DY/RET is the ratio of the dividend yield (D_t/P_{t-1}) to total returns.

[15] This approach strikes a balance between two extremes. One is to calculate total dividends and earnings over a given period and simply take the ratio. This approach would give disproportionate weight to years in which the dollar amount of earnings and dividends was the highest and might not be representative. The other is to calculate the payout ratio for each individual year and take the mean over all years. Due to short term fluctuations in earnings, such an annual series is highly volatile and can even be negative in some years, leading to bias.

[16] We thank Zhi Da for sharing the code.

[17] The estimate for payouts in the early period is based on data from 1629-1812 and 1871-1945. Even though earnings data is not available between 1813 and 1870, there is suggestive evidence that payout ratios were high then as well. Goetzmann, Ibbotson, and Peng (2001) observe that during the 19th century, stock prices of U.S. firms typically fluctuated around the par (paid-in) value of shares, indicating that firms typically paid out earnings rather than retaining them on balance sheet in the form of equity. Similarly, aggregate data from Acheson, Hickson, Turner and Ye (2009) show that between 1825 and 1870 the average stock price of firms in the U.K. was also close to par.

[18] Fama and French (2001) show that this is both the result of more small and growth oriented firms issuing shares and large, profitable firms cutting payouts and increasing investments.

[19] There are at least two other possible reasons why firms' payout policies have changed. (1) An increase in the personal tax rate (together with a differential treatment of dividends and capital gains), which makes it more tax efficient for firms to re-invest earnings than for individuals to re-invest dividends. (2) An increase in investor protection, in particular the founding of the SEC in 1934 and improved securities legislation in the 1930s, which may have made shareholders less reluctant to have firms invest their earnings for them.

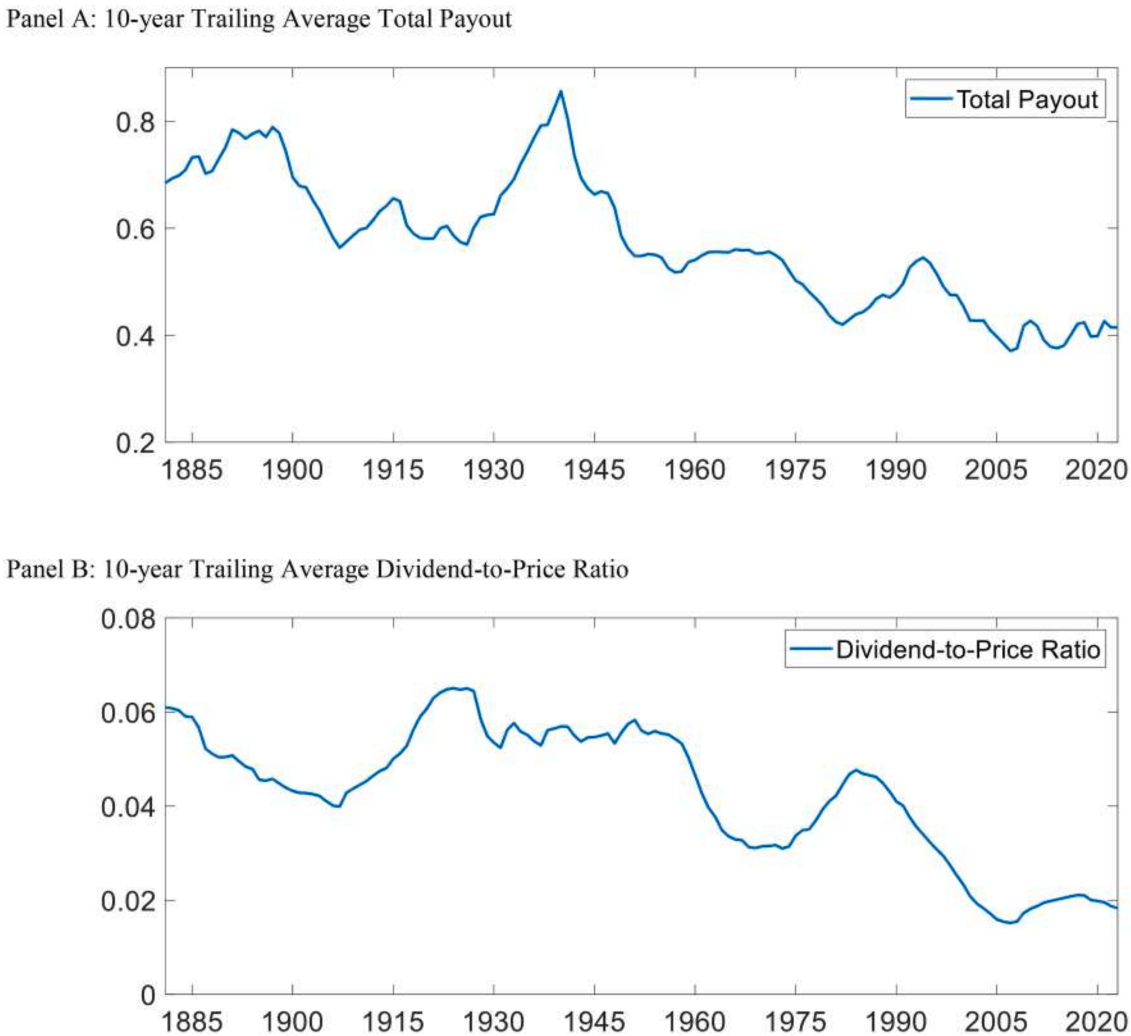

Fig. 1. Total payout, 1871-2022.
Panel A plots the 10-year trailing average payout for the aggregate market, defined as 10-year dividends over 10-year earnings. Panel B plots the 10-year trailing average of the annual dividend-to-price ratio. The period is 1871 to 2017, which yields (trailing) estimates for 1881 to 2022.

West (1987) with one lag. Results show that the change in firms' payout policies is associated with a growing importance of expected returns. There is strong statistical evidence for return predictability going back as far as 1629, but the quantitative importance of expected returns varies considerably over time. The table shows that if one considers 1629-1945, changes in expected returns only explain around 35% of the variation in the dividend-to-price ratio, while for the more recent period this is 90%. In other words, the dominance of expected returns is only a relatively recent phenomenon.

We further explore the relation between duration and expected returns in Fig. 2. We plot *ER*, the relative importance of expected returns for the variance of the dividend-to-price ratio against the payout ratio. *ER* is based on predictive regressions estimated on 75-year trailing windows. For example, the first observation for *ER* comes from the period 1871-1945. We calculate the payout ratio as the mean of the trailing 10-year dividends over earnings over the same 75-year period. The figure shows a strong time-series correlation between payout policies and *ER* – as the payout ratio declines, expected returns become more important.

3.4.2. Cross-section, 1945-2022

In this section, we construct portfolios of stocks with different payout ratios to test whether there is cross-sectional evidence that higher duration is associated with a more important role for expected returns. There is substantial variation in payouts across firms (see Fama and French 2001, among others), making this a meaningful test.

We start with the CRSP universe of listed stocks that we classify as high or low duration based on their average payouts (dividends/earnings) over the last 10 years. We restrict our sample to the stocks of firms that have non-missing earnings. We also require that firms pay non-zero dividends in all 10 preceding years (excluding the current year). The first restriction ensures we can calculate the past payout ratio. The second restriction ensures that predictive regressions are well-defined.[20] We consider dividend payments over the last ten years rather than current (or future) payments to avoid look-ahead bias. Results are robust to restricting the sample to firms that paid non-zero dividends in at least five of the 10 preceding years.[21]

[20] Suppose we construct a low payout portfolio. If this includes many non-dividend-paying firms, the dividend-to-price ratio would be close to zero and would fluctuate wildly in response to the changing dividend policies of only a few firms. The same holds for the dividend growth rate. It is unlikely that predictive regressions on such a portfolio give meaningful results.

[21] The payout ratio is well-defined for positive earnings. In rare cases, a company can have negative earnings on average over the preceding 10 years. We set the payout ratio in these cases to the 99% percentile of all payouts ratios since the company is paying out dividends regardless of negative earnings. Results are almost identical if we instead eliminate such observations.

Table 5
Return and dividend growth predictability: Time-series analysis.

	1945-2022 (1)	1629-1945 (2)	1629-2022 (3)
Dependent variable: ret_{t+1}			
dp_t	0.09	0.11	0.07
t-stat.	(2.10)	(3.22)	(2.70)
Diff. (t-stat.)		[0.42]	
R2	0.05	0.04	0.03
Dependent variable: dg_{t+1}			
dp_t	-0.01	-0.20	-0.09
t-stat.	(-0.41)	(-5.30)	(-4.14)
Diff. (t-stat.)		[-4.29]	
R2	0.00	0.14	0.07
Dependent variable: dp_{t+1}			
dp_t	0.93	0.72	0.87
t-stat.	(21.75)	(15.75)	(27.79)
Diff. (t-stat.)		[-3.46]	
R2	0.86	0.52	0.75
ER	0.91	0.34	0.40
ER (implied)	0.90	0.37	0.45
EDG	0.10	0.63	0.55
EDG (implied)	0.09	0.66	0.60

This table reports OLS estimates of regressing annual real returns and dividend growth rates on the lagged dividend-to-price ratio. Lowercase letters are logs of corresponding capital letters. All regressions include a constant (not reported). Below the estimated coefficients (in parentheses) are Newey-West (1987) *t*-statistics with one lag. In brackets are the *t*-statistics for the difference of the estimated coefficient from the rest of the sample (based on a full-period regression with an interaction term). *ER* and *EDG* are defined in Table 2.

We form portfolios based on stocks' past payout policies (weighted by market capitalization). We calculate annual returns, dividend growth rates, and the dividend-to-price ratio for each portfolio. We rebalance portfolios annually. We consider five different portfolios. First, we place stocks into three buckets depending on where they fall in the *relative* distribution of payouts. For example, in 1946, the first year in our data, we calculate the payout ratio over 1936-1945 for all stocks in the sample. We then determine which stocks fall in the lowest, middle, and highest tercile of the payout distribution, designating them as "Low," "Medium," and "High." In 1947, we repeat this procedure and rebalance our portfolios according to the distribution of payouts over 1937-1946. Second, we divide stocks into low- and high-duration buckets on an *absolute* basis – depending on whether a stock's payout ratio was below or above 0.5 in the preceding 10 years. Because the average level of payouts increased during the period, we limit ourselves to two buckets (having more would lead to portfolios with very few stocks in some years). For each of the five different portfolios, we calculate the actual payout ratio for each year. As in the time series analysis, we calculate annual dividends and earnings for each portfolio and then take the 10-year trailing average.

Table 6 reports summary statistics. As in the previous analysis, everything is in real terms. Column (1) has information for a portfolio that includes all firms that pass our initial filter. The payout ratio, returns, dividend growth rates, and dividend-to-price ratio are similar to the aggregate market (Table 4, Column 2), indicating that our initial filter yields a representative sample. Columns (2) to (4) have information for the "Low," "Medium," and "High" portfolios. Columns (5) and (6) have portfolios of stocks with payout ratios below or above 0.5. Average payout ratios range from 32 to 64%. Online Appendix F shows that, within the portfolios with payout ratios below and above 0.5, the payout ratio is approximately stable over time. We can, therefore, think of these as portfolios with constant duration. In line with Table 4, Table 6 shows that for high payout portfolios, dividend growth rates are lower, a larger fraction of returns comes from dividends, and the dividend-to-price ratio is higher.

Table 7 reports the predictability results. Regressions are at the annual frequency, and t-statistics are based on Newey and West (1987) standard errors with one lag. For the portfolio of all firms that pass our initial filter, *ER* is 84%, close to the 91% we find for the entire market in Table 5. In line with our previous evidence, expected returns are more important for lower payout portfolios with higher duration. On a relative basis, going from the "Low" to "High" portfolio is associated with a decrease in *ER* from 1.04 to 0.54. On an absolute basis, comparing stocks with payout ratios below or above 0.5 leads to an equally substantial decrease in *ER* from 1.00 to 0.59.

Online Appendix F considers two alternative cross-sectional measures for duration: smoothed dividends-to-prices and the equity duration measure from Gonçalves (2021b), where the latter uses 12 state variables to predict future net payouts. These state variables cover four dimensions of firm's characteristics: valuation ratios, growth, profitability, and capital structure. Smoothed dividends-to-prices are available for the entire 1945-2022 period, while Gonçalves' data on equity duration is available for 1973-2022. When sorting on dividends-to-prices, we smooth dividends by taking a ten-year trailing average. This reduces company-level noise that could arise through temporary small or large dividend payouts. Further, as in Table 7, we require that firms pay non-zero dividends in all ten preceding years. This ensures that the predictive regressions are well-defined (see footnote 20). When sorting on Gonçalves' equity duration measure, we do not implement such a filter because this measure does not directly depend on dividend payouts. Consistent with Table 7, *ER* increases monotonically in duration in both exercises. This suggests that our cross-sectional results do not rely on the choice of a specific duration measure.

The cross-sectional results line up well with the time series analysis.

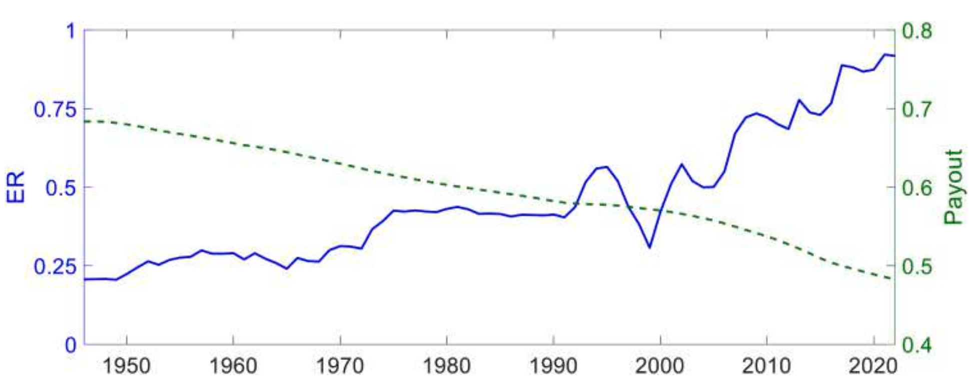

Fig. 2. The relative importance of expected returns and the payout ratio, 1871-2022.
This figure plots trailing-window estimates of the relative contribution of expected returns to the variance of the dividend-to-price ratio coming (*ER*) and average payout. *ER* is defined in Table 2. Payout is defined as the mean of 10-year trailing average dividends over earnings. At each point in time, we calculate the estimates over the matching (trailing) 75-year window. The period is 1871 to 2022, which yields (trailing) estimates for 1946 to 2022.

Table 6
Summary statistics: Cross-sectional analysis.

	All (1)	Low (2)	Medium (3)	High (4)	Below 0.5 (5)	Above 0.5 (6)
No. stocks in a portfolio						
Average	724.78	241.24	241.97	241.56	445.59	279.19
Min	206	68	69	69	12	155
Max	1,211	403	404	404	951	409
Payout (%)	48.70	31.60	47.54	64.18	39.88	63.34
ret (%)	6.49	6.79	6.78	5.79	6.97	6.28
Std. (%)	15.39	17.83	15.75	14.34	16.95	14.24
DY/RET	0.45	0.29	0.42	0.63	0.36	0.59
dg (%)	2.36	3.16	2.78	1.13	3.08	1.73
Std. (%)	6.29	9.23	6.01	9.03	7.06	7.79
DP (%)	3.48	2.44	3.37	4.38	2.98	4.36
Std. (%)	1.26	1.29	1.16	1.35	1.26	1.49
AR(1)	0.88	0.91	0.87	0.84	0.88	0.87
Smoothing	0.32	0.50	0.31	0.18	0.42	0.14

This table reports summary statistics for annual variables in real terms for different stock portfolios. Period: 1945-2022. Column (1) includes all stocks in CRSP that, over the last 10 years, had non-missing earnings and paid out non-zero dividends. In Columns (2) to (4), we create three portfolios that we rebalance after each calendar year. Stocks for which the payout ratio over the last 10 years was in the bottom tercile fall in the “Low” category, the second tercile in “Medium,” and the top tercile in “High.” In Columns (5) and (6), we construct portfolios with stocks for which the payout ratio over the last 10 years was below or above 0.5, again rebalancing after each calendar year. The reported payouts are calculated as the mean of 10-year trailing dividends over earnings at the portfolio level. If a firm had a negative payout over the last 10 years, we count it as a high payout firm and set the payout ratio to the 99th percentile of the sample. The smoothing parameter is the ratio of the standard deviations of log dividend and log earnings growth. If, for a portfolio, earnings in a given year are negative, this year is eliminated from the calculation of the smoothing parameter for all portfolios.

Table 7
Return and dividend growth predictability: Cross-sectional analysis.

	All (1)	Low (2)	Medium (3)	High (4)	Below 0.5 (5)	Above 0.5 (6)
Dependent variable: ret_{t+1}						
dp_t	0.10	0.09	0.11	0.09	0.11	0.08
t-stat.	(2.44)	(2.38)	(2.49)	(1.97)	(2.62)	(1.77)
R2	0.05	0.07	0.05	0.04	0.07	0.04
Dependent variable: dg_{t+1}						
dp_t	-0.02	0.00	-0.03	-0.08	0.00	-0.06
t-stat.	(-0.85)	(0.06)	(-1.22)	(-1.94)	(-0.11)	(-1.97)
R2	0.01	0.00	0.02	0.07	0.00	0.07
Dependent variable: dp_{t+1}						
dp_t	0.91	0.93	0.90	0.87	0.91	0.89
t-stat.	(20.78)	(21.91)	(19.40)	(14.98)	(21.20)	(17.85)
R2	0.82	0.86	0.79	0.75	0.82	0.79
ER	0.84	1.04	0.80	0.54	1.00	0.59
ER (implied)	0.83	1.02	0.79	0.53	0.98	0.57
EDG	0.17	-0.02	0.21	0.47	0.02	0.43
EDG (implied)	0.16	-0.04	0.20	0.46	0.00	0.41

This table reports OLS estimates of regressing annual real returns and dividend growth rates on the lagged dividend-to-price ratio for the portfolios defined in Table 6. Lowercase letters are logs of corresponding capital letters. All regressions include a constant (not reported). Below the estimated coefficients (in parentheses) are Newey-West (1987) *t*-statistics with one lag. *ER* and *EDG* are defined in Table 2. Period: 1945-2022.

Fig. 3 plots the *ER*s from different portfolios against their payout ratios. The estimates from the time series and cross-sectional analyses are closely aligned. The black line provides the best linear fit through both sets of estimates. The economic magnitude is large. For each increase in the payout ratio by 10%, *ER* decreases by roughly 0.10. The corresponding R^2 is 0.93.

In sum, the empirical evidence is consistent with the previous results: higher duration is associated with a more important role for expected returns. Quantitatively, the time series and cross-sectional analyses provide similar conclusions about the impact of the payout ratio on *ER* and *EDG*. The cross-sectional evidence suggests that the increase in *ER* after 1945 can be largely attributed to the contemporaneous increase in duration.

4. Calibration

The results from the time-series and cross-section confirm our hypothesis that duration plays an important role in understanding the relative contributions of expected returns and dividend growth rates for asset prices. In this section, we explore the underlying mechanisms driving this relation. Section 2.1 contrasts short-duration dividends strips with the long-duration market to argue that duration affects the relative importance of expected returns through (i) the relative persistence of expected returns and dividend growth rates and/or (ii) the variance of shocks to short and long-duration assets. For the calibration, we extend the present value framework to infinitely-lived assets with different durations. We then calibrate the model to quantitatively evaluate the importance of the two different mechanisms.

4.1. Extended present value framework

We assume that log expected returns μ_t and dividend growth rates g_t are governed by AR(1) processes, defined by Eqns. (1) and (2) in Section 2.1. The variances of the shocks to expected returns and dividend growth rates ε_t^μ and ε_t^g are given by $\sigma_\mu^2(\pi)$ and σ_g^2. For expositional purposes, we assume that shocks are uncorrelated; in the calibration exercise, we relax this assumption.

In line with Eqns. (4) and (5) in Section 2.1, we log-linearize returns to arrive at an (approximate) expression for the log dividend-to-price ratio dp_t and its variance:

$$dp_t \simeq \left(\frac{1}{1-\rho(\pi)\delta_1}\right)(\mu_t-\delta_0) - \left(\frac{1}{1-\rho(\pi)\gamma_1}\right)(g_t-\gamma_0) - \frac{\kappa}{1-\rho(\pi)} - \frac{\gamma_0-\delta_0}{1-\rho(\pi)}, \tag{16}$$

$$var(dp_t) = \left(\frac{1}{1-\rho(\pi)\delta_1}\right)^2 \frac{1}{1-\delta_1^2}\sigma_\mu^2(\pi) + \left(\frac{1}{1-\rho(\pi)\gamma_1}\right)^2 \frac{1}{1-\gamma_1^2}\sigma_g^2, \tag{17}$$

with δ_1, γ_1, δ_0 and γ_0 the persistence and long-run average of expected returns and dividend growth rates, $\kappa = \log(1 + exp\{-\overline{dp}(\pi)\}) + \rho\overline{dp}(\pi)$ and

$$\rho(\pi) = \frac{exp\{-\overline{dp}(\pi)\}}{1+exp\{-\overline{dp}(\pi)\}} = \frac{1}{1+\overline{DP}(\pi)}, \tag{18}$$

with $\overline{dp}$ the long-run average dp_t.

Compared to Eqn. (5) in Section 2.1, we endogenize ρ as a function of π through $\overline{DP}(\pi)$. Intuitively, if a firm has a high payout today (implying it is investing less), dividends will be relatively large compared to the price and $\overline{DP}$ will be high. By Eqn. (18), this means that $\rho(\pi)$ is decreasing in π or increasing in duration. For example, in the simple model of Section 3.1:

$$DP = \frac{R-\alpha}{\alpha}\pi - \frac{1-\alpha}{\alpha}R. \tag{19}$$

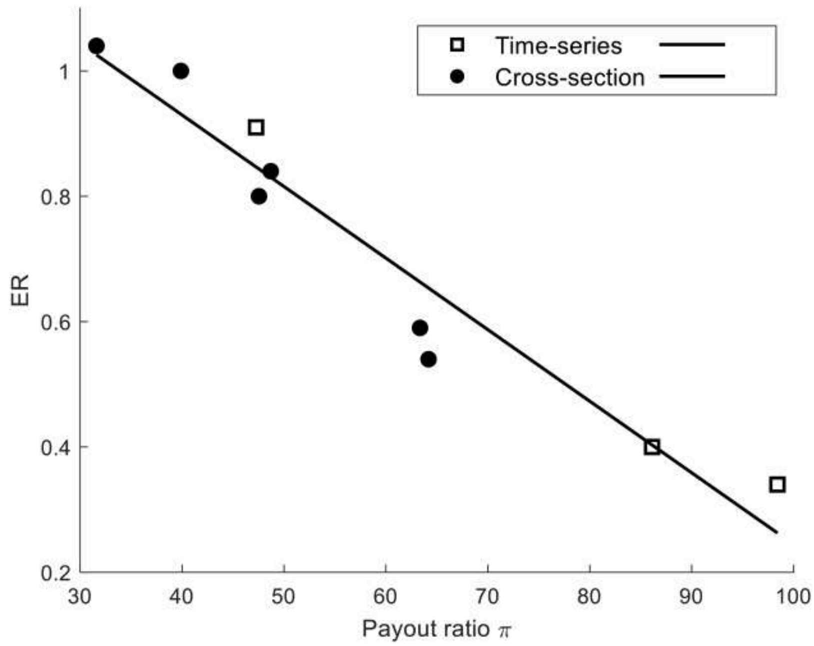

Fig. 3. Summary.
This figure summarizes our main results. It plots the fraction of the variation in the dividend-to-price ratio coming from expected returns (*ER*) for different levels of the payout ratio (π). We do this for our two sets of empirical analyses in the time series and cross-section. The solid line presents the fitted line for the time-series and cross-sectional portfolios jointly. *ER* is defined in Table 2.

Further, we express the variance of expected returns μ_t as a function of π: $\sigma^2_\mu(\pi)$. Intuitively, as payouts are pushed into the future, expected returns will have higher variance. This means that $\sigma^2_\mu(\pi)$ is decreasing in π or increasing in duration.

The relative contributions of expected returns and dividend growth rates are given by:

$$ER = \frac{\chi}{1+\chi};\ EDG = \frac{1}{1+\chi} \text{with } \chi = \left(\frac{1-\rho(\pi)\gamma_1}{1-\rho(\pi)\delta_1}\right)^2 \frac{1-\gamma_1^2}{1-\delta_1^2}\frac{\sigma^2_\mu(\pi)}{\sigma^2_g}. \tag{20}$$

As long as $\delta_1 > \gamma_1$, the *ER* is unambiguously decreasing in π (or increasing in duration) for two reasons. First, holding $\sigma^2_\mu(\pi)$ constant, $\partial\chi/\partial\rho|_{\overline{\sigma^2_\mu}} > 0$. Since $\rho(\pi)$ is decreasing in π, we have that $\partial\chi/\partial\pi|_{\overline{\sigma^2_\mu}} < 0$. This captures the fact that longer duration increases the importance of the variable with the most persistent shocks, in this case, expected returns. Second, holding $\rho(\pi)$ constant, $\partial\chi/\partial\sigma^2_\mu|_{\overline{\rho}} > 0$. Since $\sigma^2_\mu(\pi)$ is decreasing in π, we also have that $\partial\chi/\partial\pi|_{\overline{\rho}} < 0$. This captures the fact that an increase in duration increases the variance of shocks to expected returns.

4.2. Estimation and calibration

The extended model is qualitatively consistent with what we find in the data. Next, we evaluate it quantitatively. We simulate the model under different payout ratios π and run predictive regressions on the simulated series of returns and dividend growth rates. The main quantities of interest are changes in *ER* and *EDG* in response to changes in the long-run dividend-to-price ratio $\overline{dp}(\pi)$ and[22] the standard deviation of shocks to expected returns $\sigma_\mu(\pi)$.

To determine how π affects $\overline{dp}(\pi)$ and $\sigma_\mu(\pi)$, we take a reduced-form approach. In particular, we estimate the following regressions for 1871-2022:

$$\overline{dp}_{t-h\to t+h} = \alpha^{dp}_{<1945} I[t \le 1945] + \alpha^{dp}_{>1945} I[t > 1945] + \beta^{dp}\pi_{t-h\to t+h}, \tag{21}$$

$$log(\sigma_{\mu,t-h\to t+h}) = \alpha^{\mu}_{<1945} I[t \le 1945] + \alpha^{\mu}_{>1945} I[t > 1945] + \beta^{\mu}\pi_{t-h\to t+h}, \tag{22}$$

where $\overline{dp}_{t-h\to t+h}$ is a centered rolling average, $\pi_{t-h\to t+h}$ is the ratio of dividends over earnings between $t-h$ and $t+h$ and $\sigma_{\mu,t-h\to t+h}$ is a centered rolling standard deviation for horizons (in years) $h \in \{15, 20, 25\}$. To estimate the time series of expected returns μ_t, we apply the Kalman filter from Binsbergen and Koijen (2010) on the full data from 1871 to 2022 (estimates are in Online Appendix B). We then calculate $\sigma_{\mu,t-h\to t+h}$; the standard deviation of expected returns over the centered rolling windows. Having separate intercepts for the pre- and post-1945 periods allows *dp* and σ_μ to change over time independent of changes in π.

Estimates of Eqns. (21) and (22) are in Table 8. We take $h = 20$ as the baseline. Results confirm that $\overline{dp}$ is increasing in π (or decreasing in duration). The t-statistic based on Newey-West standard errors with h lags is 4.64. Results also indicate that σ_μ is decreasing in π (or increasing in duration), with a t-statistic of -3.84. Results are robust to using different horizons, with longer horizons increasing β^μ and decreasing β^{dp}. The estimated pre- and post-1945 intercepts do not differ significantly, suggesting that the declines in *DP* and π and the increase in σ_μ largely pick up the same underlying economic dynamics.

Next, we use the reduced form estimates to calibrate the extended model. In particular, we use the pre-war intercepts $\alpha^{dp}_{<1945}$ and $\alpha^{\mu}_{<1945}$ and the slope coefficients β^{dp} and β^μ from Eqns. (21) and (22) to predict $\widehat{dp}(\pi)$ and $\widehat{\sigma}_\mu(\pi)$ under pre- and post-war average payouts ($\pi_{<1945}$ and $\pi_{>1945}$). For average real returns *R*, we rely on 1945-2022 sample estimates. The growth rate G is pinned down by $R - \overline{DP}$. For the persistence of expected returns and growth rates δ_1 and γ_1, and for the (co-)-variance of shocks to expected returns and growth rates as well as realized growth rates, $\{\varepsilon^\mu_{t+1}, \varepsilon^g_{t+1}, \varepsilon^{\Delta d}_{t+1}\}$, we rely on estimates from the Kalman filter, also over 1945-2022 (see Online Appendix B).

For each calibration, we simulate the model 100,000 times. Each

[22] The discount rate (linearization constant) $\rho(\pi)$ is fully determined by the long-run dividend-to-price ratio $\overline{dp}(\pi)$, see Eqn. (18).

Table 8
The relation between the long-run dividend-to-price ratio, the standard deviation of expected returns and the payout ratio.

	h=15	h=20	h=25	h=15	h=20	h=25
	Long-run dividend-to-price ratio			Std. dev of expected returns		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Regression estimates						
	$\overline{dp}_{t-h\to t+h}$			$log(\sigma_{\mu,t-h\to t+h})$		
$I[t\leq 1945]$	-5.12	-4.89	-4.81	-2.87	-2.03	-1.81
t-stat.	(-9.46)	(-11.61)	(-8.74)	(-4.48)	(-3.40)	(-9.00)
$I[t>1945]$	-5.01	-4.81	-4.73	-2.62	-1.96	-1.83
t-stat.	(-11.27)	(-14.43)	(-10.91)	(-5.00)	(-4.37)	(-12.24)
$\pi_{t-h\to t+h}$	3.32	3.01	2.92	-2.44	-3.67	-3.93
t-stat.	(3.89)	(4.64)	(3.36)	(-2.43)	(-3.84)	(-12.49)
R2	0.80	0.84	0.83	0.71	0.83	0.90
Panel B: Predicted values						
	$\widehat{DP}(\pi)$			$\widehat{\sigma}_\mu(\pi)$		
$\pi_{<1945}$	5.55%	5.68%	5.74%	0.0032	0.0033	0.0034
$\pi_{>1945}$	2.43%	2.69%	2.78%	0.0059	0.0081	0.0091

Panel A reports regression estimates of:
$\overline{dp}_{t-h\to t+h} = \alpha^{dp}_{<1945}I[t\leq 1945] + \alpha^{dp}_{>1945}I[t>1945] + \beta^{dp}\pi_{t-h\to t+h}$,
$log(\sigma_{\mu,t-h\to t+h}) = \alpha^{\mu}_{<1945}I[t\leq 1945] + \alpha^{\mu}_{>1945}I[t>1945] + \beta^{\mu}\pi_{t-h\to t+h}$,
with dp the dividend-to-price ratio, π the payout ratio and σ_μ the standard deviation of expected returns, where $\overline{dp}_{t-h\to t+h}$ is a centered rolling average, $\pi_{t-h\to t+h}$ is the ratio of dividends over earnings between $t-h$ and $t+h$ and $\sigma_{\mu,t-h\to t+h}$ is a centered rolling standard deviation for horizons (in years) $h\in\{15, 20, 25\}$. To estimate the time series of expected returns μ_t, we apply the Kalman filter from Binsbergen and Koijen (2010) to the full data from 1871 to 2022 (details are in Appendix B). We then calculate $\sigma_{\mu,t-h\to t+h}$; the standard deviation of expected returns over the centered rolling windows. Below the estimated coefficients (in parentheses) are Newey-West (1987) *t*-statistics with h lags. Panel B uses the pre-war intercepts $\alpha^{dp}_{<1945}$ and $\alpha^{\mu}_{<1945}$ and the slope coefficients β^{dp} and β^{μ} from the two equations to predict $\widehat{dp}(\pi)$ and $\widehat{\sigma}_\mu(\pi)$ under pre- and post-1945 average payouts ($\pi_{<1945}$ and $\pi_{>1945}$).

simulation is 77 years long, matching 1945-2022, with 200 additional years to initialize each simulation. We simulate expected returns and dividend growth rates using Eqn. (1) and (2) with a simulated series for ε^{μ}_{t+1} and ε^{g}_{t+1}. From there, we calculate the dividend-to-price ratio using Eqn. (16). We calculate realized dividend growth rates from directly simulating $\varepsilon^{\Delta d}_{t+1}$, and realized returns from the log-linearized return equation:

$$ret_{t+1} = \kappa + dp_t + \Delta d_{t+1} - \rho dp_{t+1}, \tag{23}$$

where κ is defined under Eqn. (17) and ρ by Eqn. (18). We run predictive regressions for each of the 100,000 different datasets and report the mean coefficients, *ER*, and *EDG*.

Results are in Table 9. We use predicted values $\widehat{dp}(\pi)$ and $\widehat{\sigma}_\mu(\pi)$ for either the pre- or 1945 periods from Table 7, based on $h=15$ (cols 1-3), $h=20$ (cols 4-6) or $h=25$ (cols 7-9). Again, we take $h=20$ as the baseline. We calibrate three different versions of the model. In column (4), we keep $\widehat{dp}$ and $\widehat{\sigma}_\mu$ at their predicted *post-1945* levels. The estimated $\widehat{\sigma}_\mu(\pi_{>1945})$ is lower than the actual σ_μ. The time series of (estimated) expected returns has been falling since the 1970s (see Figure OA.2 in Online Appendix C), such that the variance over the full post-war period is higher than over the shorter rolling windows we use to estimate Eqn. (21). To adjust, we calibrate the standard deviation of shocks to dividend growth rates σ_g such that *ER* is close to 0.91, consistent with the estimate in Table 5. In column (5), we keep $\widehat{dp}$ at its predicted *post*-1945 levels, while we set $\widehat{\sigma}_\mu$ at its predicted *pre*-1945 level. *ER* drops substantially from 0.91 to 0.44 for estimation horizon $h=20$. The change is smaller for $h=15$ (0.62) and larger for $h=25$ (0.40). In column (6), we set both parameters at their predicted *pre*-1945 level. *ER* drops further to 0.35 for estimation horizon $h=20$. Again, the change is smaller for $h=15$ (0.51) and larger for $h=25$ (0.31).

In sum, the calibration of the model suggests that changing duration from its post-war to its pre-war level decreases *ER* from 0.91 to somewhere between 0.31 and 0.51. Quantitatively, this is in line with Table 5, where we estimate an *ER* of 0.34 for the pre-1945 period. Under our

Table 9
Calibration.

	h=15			h=20			h=25		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\widehat{DP}(\pi)$	2.43%	2.43%	5.55%	2.69%	2.69%	5.68%	2.78%	2.78%	5.74%
	$\pi_{>1945}$	$\pi_{>1945}$	$\pi_{<1945}$	$\pi_{>1945}$	$\pi_{>1945}$	$\pi_{<1945}$	$\pi_{>1945}$	$\pi_{>1945}$	$\pi_{<1945}$
$\widehat{\sigma}_\mu(\pi)$	0.0059	0.0032	0.0032	0.0081	0.0033	0.0033	0.0091	0.0034	0.0034
	$\pi_{>1945}$	$\pi_{<1945}$	$\pi_{<1945}$	$\pi_{>1945}$	$\pi_{<1945}$	$\pi_{<1945}$	$\pi_{>1945}$	$\pi_{<1945}$	$\pi_{<1945}$
σ_g	0.0200	0.0200	0.0200	0.0270	0.0270	0.0270	0.0300	0.0300	0.0300
Dependent variable: ret_{t+1}									
dp_t	0.13	0.12	0.13	0.13	0.11	0.11	0.13	0.10	0.10
t-stat.	(2.66)	(2.13)	(2.21)	(2.71)	(1.76)	(1.71)	(2.73)	(1.64)	(1.57)
Dependent variable: dg_{t+1}									
dp_t	-0.02	-0.08	-0.13	-0.02	-0.13	-0.20	-0.02	-0.16	-0.23
t-stat.	(-0.82)	(-2.48)	(-3.56)	(-0.83)	(-3.72)	(-5.08)	(-0.82)	(-4.15)	(-5.60)
ER	0.91	0.62	0.51	0.91	0.44	0.35	0.91	0.40	0.31
ER (implied)	0.91	0.61	0.50	0.91	0.44	0.35	0.91	0.39	0.31
EDG	0.09	0.39	0.50	0.09	0.56	0.65	0.09	0.61	0.69
EDG (implied)	0.09	0.38	0.49	0.09	0.56	0.65	0.09	0.60	0.69

This table reports the results of the calibration exercise described in Section 4.2. For each calibration, we simulate the model 100,000 times. We run predictive regressions for each of the 100,000 different datasets and report the mean coefficients, *ER*, and *EDG*. Each simulation is 77 years long, matching 1945-2022, with 200 additional years to initialize each simulation. We simulate expected returns and dividend growth rates using Eqn. (1) and (2) with a simulated series for ε^{μ}_{t+1} and ε^{g}_{t+1}. From there, we calculate the dividend-to-price ratio using Eqn. (16). We calculate realized dividend growth rates by directly simulating $\varepsilon^{\Delta d}_{t+1}$, and realized returns from Eqn. (23). We use predicted values $\widehat{DP}(\pi)$ and $\widehat{\sigma}_\mu(\pi)$ for either the pre- or post-1945 periods from Table 7, based on $h=15$ (cols 1-3), $h=20$ (cols 4-6) or $h=25$ (cols 7-9). We calibrate the standard deviation of shocks to dividend growth rates σ_g such that *ER* is close to 0.91 in columns (1), (4) and (7), consistent with the estimate in Table 4. We calibrate three different versions of the model. In columns (1), (4) and (7), we keep $\widehat{dp}$ and $\widehat{\sigma}_\mu$ at their predicted *post*-1945 levels. In columns (2), (5), and (8), we keep $\widehat{dp}$ at its predicted *post*-1945 levels, while we set $\widehat{\sigma}_\mu$ at its predicted *pre*-1945 level. In columns (3), (6), and (9), we set both parameters at their predicted *pre*-1945 level.

most conservative estimate ($h = 15$), duration can explain about 70% of the increase in *ER* after 1945.

5. Discussion

In this section, we discuss to what extent alternative forms of payouts (share repurchases and cash payouts from mergers and acquisitions) and dividend smoothing can explain our findings.

5.1. Share repurchases

As it is standard in the literature, we focus on cash dividends only. Share repurchases are more irregular than cash dividends and are typically used to pay out transitory shocks to earnings (Brav, Graham, Harvey, and Michaely 2005, De la O 2022). Also, share repurchases are only a relatively recent phenomenon. Before 1982, the SEC enforced strict rules on manipulative trading that seriously reduced firms' scope to repurchase shares. This means that for much of our time series repurchases are not relevant.

Nevertheless, there is a concern that the increase in share repurchases from 1982 onwards can explain the time-series results in the paper. Repurchases may lead to lower payouts and dividend-to-price ratios and make the market appear to have a higher duration than it actually has.[23] Two pieces of empirical evidence suggest this does not drive our results. First, the average payout ratio dropped before repurchases started to become quantitatively important. Fig. 1 shows that by 1981 the trailing 10-year average payout ratio had already dropped to 42%. Second, when we run predictive regressions on the 1946-1981 period, we find that the estimated *ER* is more than 1.00.[24] In other words, even absent repurchases, the decrease in the payout ratio after 1945 is associated with a (dramatic) increase in the importance of expected returns.

There is a similar concern for the cross-sectional results. If firms substitute dividends for repurchases, then the payout ratio, as we define it, will suggest that firms have higher duration than they actually have. If all firms do this in roughly the same proportions, this will not affect the relative ordering of high and low-duration firms. If, however, firms do this in different proportions, the relative ordering would change and our results might be affected. To check this, we consider two alternative measures of the payout ratio, one where we add repurchases, and another where we both add repurchases and subtract issuances to arrive at "total payout" (Larrain and Yogo 2008). Fama and French (2001) argue that at most half of the repurchases are directly meant to substitute for dividends.[25] The other half simply adds noise to our sorting and we would expect our estimates to be less well behaved. Summary statistics and predictability results are in Online Appendix G. Results are quantitatively similar, suggesting that differences in firms' tendency to substitute dividends for repurchases do not importantly affect our results. Consistent with the idea that we are adding noise to the sorting, the change in estimated coefficients is not always monotonic as we move across portfolios with high and low duration.

5.2. Mergers and acquisitions paid in cash

Investors can also receive payments following a merger or acquisition (M&A), which can affect the duration of the aggregate market. In Online Appendix G we show that cash payments from M&A, similar to repurchases, only started to play an important role after 1980, when *ER* had already become dominant, suggesting they are not driving our time-series results. Further, payouts from M&A are unlikely to drive our cross-sectional results. Similar to liquidation dividends, payouts from M&A are received by investors in M&A target firms (Sabbatucci 2022, p. 3). Before disappearing from the market, these firms therefore have a lower duration than suggested by the backward-looking payout ratio. This means that we might misclassify some firms as high duration. It is not clear why this would artificially lead to higher *ER* in the high-duration portfolio.[26] In Online Appendix G, we test for this by removing firms from the sample 5 years before they disappear. The cross-sectional results are largely unchanged.

Unlike repurchases, cash payments from M&A are received by every shareholder and would have to be taken into account in a variance decomposition. This poses a problem: cash payments from M&A are highly transitory. As pointed out by Nagel (2024), highly transitory shocks to payouts may not be properly captured in a standard VAR-like representation: they can lead to an upward bias in *EDG* and a downward bias in *ER*. Following Golez and Koudijs (2018), we therefore smooth cash payments from M&A. In Online Appendix G, we take 3, 5, or 10-year backward-looking averages of the cash payments from M&A before adding them to regular dividends and calculating the dividend-to-price ratio and growth rates. Results point to similarly high *ER* estimates in post-1945 data with or without including payouts from M&A.

5.3. Dividend smoothing

Depending on how firms smooth dividends, the predictability of dividend growth rates might be attenuated. In a stylized model such as Marsh and Merton (1987), firms pay out a fraction of lifetime earnings and dividends only respond to permanent shocks. As such, dividends are smoother than earnings. Nevertheless, prices will be highly responsive to news about changes in lifetime earnings. If prices respond immediately to this news, but dividends only adjust with a lag, the dividend-to-price ratio will still predict future dividend growth, at least in the short run (Cochrane 1994).[27] If, however, firms smooth dividends above and beyond permanent earnings, for example, because they have a particular target in mind, changes in dividends become uninformative about the underlying fundamentals. This will attenuate the predictability of dividend growth rates (Chen, Da, and Priestley 2012).

To what extent can dividend smoothing explain our results? First, duration and dividend smoothing are complementary. Sticking to a dividend target is easier if the payout ratio is relatively low to begin with. Further, we already argued that dividend smoothing might attenuate dividend growth predictability more for dividend strips than for the market, if anything strengthening the evidence from strips in Section 2. Next, we assess the degree to which dividend smoothing might play a role in our time series and cross-sectional results.

For the time series evidence, dividend smoothing may play a role but is unlikely to be the full story. Chen, Da, and Priestley (2012) measure dividend smoothing by taking the ratio of the standard deviations of dividend and earnings growth: $\text{std}(dg)/\text{std}(eg)$. A lower "smoothing parameter" indicates more smoothing. Chen, Da, and Priestley observe that this ratio was much lower after 1945 than between 1871 and 1945:

[23] We thank John Campbell and Xavier Gabaix for pointing this out.

[24] We estimate $\beta_{ret} = 0.261$ with a t-stat of 3.428, while $\beta_{dg} = 0.043$, with the theoretically wrong sign, and a t-stat of 0.748.

[25] The other half arises from employee stock compensation or are used to finance mergers and acquisitions. Furthermore, Hong and Wang (2008) provide evidence that companies engage in stock buybacks to provide liquidity in times of distress, while Almeida, Fos, and Kronlund (2016) show that companies use repurchases strategically to meet analyst EPS forecasts.

[26] It would need to be the case that adding future targets with current low payout ratios to a portfolio would lead to more return predictability.

[27] In fact, predictive regressions might be more meaningful for firms paying out permanent earnings than for (hypothetical) firms simply paying out (a fixed fraction of) current earnings. In the latter case, transitory shocks to the level of earnings/dividends will mechanically induce predictability even if prices do not respond: a temporarily high (low) dividend-to-price ratio today will predict lower (higher) dividend growth next period.

0.22 vs 0.54. Using the full data from 1629 to 1945, however, we find that the smoothing parameter was 0.32 (see the last row of Table 4). This is closer to the post-1945 period, which suggests that the 1870-1945 period is somewhat of an outlier.[28] Therefore, while the importance of dividend growth rates before 1945 can be partly driven by dividend smoothing, these numbers suggest that it is unlikely to be the whole story.

Our cross-sectional results appear unlikely to be driven by dividend smoothing. We calculate the smoothing parameter for each portfolio in Tables 6 and 7. The last row of Table 6 shows that the smoothing parameter decreases from 0.50 for the low payout portfolio to 0.18 for the high-payout portfolio. In other words, the portfolio with the smallest role for expected dividend growth rates features *less* smoothing. This is the opposite of what one would expect if smoothing was driving our results.

6. Conclusion

We show that there is a strong positive relation between *equity duration* and the relative importance of expected returns in three different samples: (1) dividend strips, (2) the time series of stock markets going back to 1629, and (3) the cross-section of stocks. We present and calibrate a simple present value model suggesting that changing duration from its post-war to its pre-war level can explain a substantial part of the observed increase in the importance of expected returns after 1945 (70% in our most conservative calibration).

Our findings have important implications for how we think about the dominance of expected returns in the U.S. after 1945. This phenomenon is not necessarily a sign of increased fluctuations in investors' risk appetite or an increase in "animal spirits," but appears to be closely related to firms' policies to reduce current payout in favor of retaining earnings to generate future payouts. As the market has become much more growth-oriented, investors' expected returns have become more important for stock prices than changes in fundamentals. More broadly, this suggests that firm decisions can have first-order implications for asset pricing.

Finally, our work has important implications for asset pricing theory. We show that equity duration varies over time and that this matters for pricing. It is likely important for macro-finance models to incorporate the empirical variation in duration that we document.

CRediT authorship contribution statement

Benjamin Golez: Writing – review & editing, Writing – original draft, Visualization, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Peter Koudijs:** Writing – review & editing, Writing – original draft, Visualization, Project administration, Methodology, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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[28] Earnings data for 1813-1870 is unavailable. However, GK (Table 1) show that the volatility of dividend growth rates in this period was very similar to 1629-1812. This suggests that dividend smoothing was not dramatically different between the two periods.

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