Duration-Driven Returns*

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Abstract

We find that most cross-sectional variation in expected stock returns can be summarized by cross-sectional variation in cash-flow duration. We show empirically and theoretically that most firm characteristics that predict high returns also predict a low cash-flow growth and thus a short cash-flow duration. A duration factor therefore explains the return to many equity anomalies, including factors based on valuation, profit, investment, low risk, and payout measures, both in the US and globally. Using a novel dataset of single stock dividend futures, we find evidence that this duration factor predicts returns exactly because it predicts the timing of cash flows and not because it predicts other firm characteristics. A simple theoretical framework can reproduce these findings and is consistent with the empirical properties of the aggregate market portfolio and the equity term structure.

Keywords: asset pricing, cross-section of stock returns, cash-flow growth, duration, survey expectations, dividend strips.
JEL classification: G10, G12, G40.

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Financial assets are claims to future cash flows. A defining characteristic of these assets is their cash-flow duration, which measures how many years into the future the average cash-flow is earned. In this paper, we show that this simple characteristic is key to understanding the zoo of existing equity risk factors. Indeed, while these equity risk factors may appear disparate on the surface, we find that most of them share a similar relation to cash-flow duration: most equity risk factors that predict high returns also predict that the underlying firms have a short cash-flow duration. These risk factors can thus largely be distilled into a single empirical fact: firms with short cash-flow duration have high expected returns.

Figure 1 illustrates our main point. It shows the relation between cash-flow growth rates and stock returns, measured using CAPM alpha, for 60 portfolios sorted on characteristics that are known to predict returns. There is a clear and striking negative relation between CAPM alpha and dividend growth rates for the firms in these portfolios. More importantly, realized dividend growth explains a strong majority of the variation in these portfolios' anomalous returns.

The negative slope in Figure 1 arises because the characteristics that predict high returns also predict a low cash-flow growth and by implication a short cash-flow duration. This strong negative relation may be suprising but it is founded in intuitive relations. Consider for instance firms with low investment and high payout, which are both characteristics that are known to predict high returns. Because both of these characateristics imply that the given firms invest only sparsely in future projects, they also naturally imply that the firms will have a low growth and thus a short cash-flow duration. Similarly, high-profit firms have low future growth because they are in the profitable part of their lifecycle. Low-valuation firms have low valuations partly because the expected growth rates are low. Finally, a low beta is often a symptom of a short cash-flow duration: firms with short cash-flow duration are less exposed to the discount-rate shocks that account for much of the variation in aggregate prices, causing them to comove less with the market and thus have low betas.

The first step in our analysis is to study the relation between duration and the characteristics that predict returns in an off-the-shelf asset pricing model. In the model, we show theoretically that the characteristics that are known to predict high returns – such as profit, value, low investment, and low risk – also predict a short cash-flow duration in line with the arguments above. In addition, we specify our model such that short-duration cash flows are riskier and have a higher expected return than long-duration cash

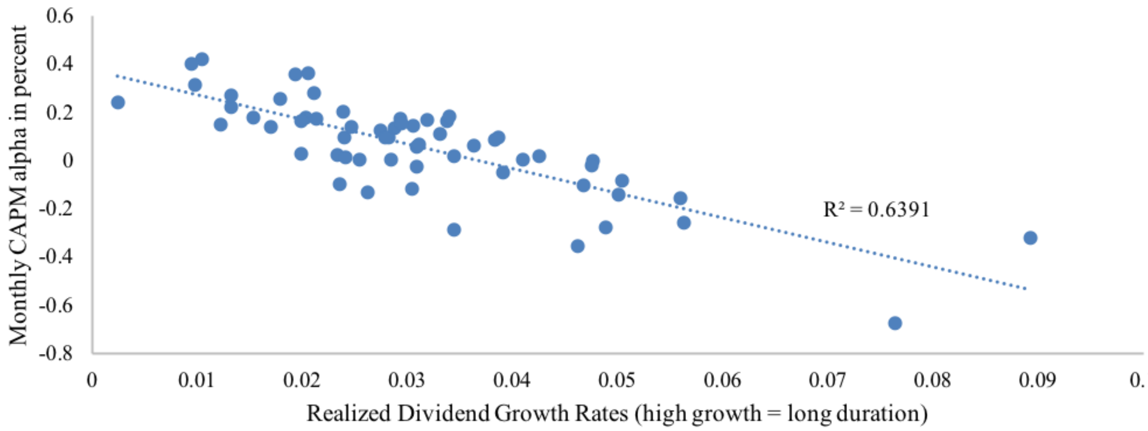

Figure 1: CAPM Alpha and Dividend Growth Rates for Characteristic-Sorted Portfolios

This figure shows the CAPM alpha and dividend growth rates for 60 portfolios sorted on profitability, investment, book-to-market, payout ratio, market beta, and idiosyncratic volatility. Alphas are estimated as the intercept in a monthly regression of excess return on the excess market returns. Alpha are in monthly percent and dividend growth rates are annualized dividend growth rates in the 15 years following portfolio formation. The sample is the US sample from 1963-2018.

flows. Accordingly, equity risk factors based on profitability, investment, valuation, and low-risk all arise endogenously in our model: they are long short-duration stocks, which have higher expected returns than long-duration stocks.

We next verify empirically that the characteristics of profit, value, investment, beta, and payout indeed predict duration as in our model. We first look at ex post realized duration, which we measure using realized dividend growth rates. We verify that the characteristics that predict high returns all predict low dividend growth rates, both in univariate and multivariate regressions. In addition, we look not only at realized dividend growth rates, but also at expected long-run growth rates from the IBES database on analyst expectations. These expectations provide ex ante measures of expected cash flow duration of different stocks. We regress these firm-level expectations on contemporaneous firm-level characteristics. The expected growth rates load negatively on all the characteristics that predict high returns, suggesting that these characateristics all provide incremental information about future growth rates. These results hold in the US, in a international sample of 23 developed countries, and within almost all of these individual countries.

Based on this strong empirical and theoretical relation between duration and the characteristics that predict returns, we next study how much of the cross-section of stock returns that can be explained by duration. To study the relation between duration and expected returns, we need an ex ante measure of duration, which the analyst expectations constitute. However, these analyst expectations are only available for a subset of firms from 1982. We therefore project these expectations onto the characteristics that we found predict growth rates. Based on the resulting parameter estimates, we calculate expected growth rates for all firms in our sample. This procedure allows us to estimate expected growth rates for each firm going back to 1926. We use these expectations as our ex ante measure of duration.

Using our new measure of duration, we create a duration factor that is long stocks with long cash-flow duration and short stocks with short cash-flow duration. As expected, the factor has negative expected returns and a negative CAPM alpha. More importantly, our duration factor helps explain the return to equity risk factors based on profitability, investment, beta, issuance, and book-to-market. These risk factors all load negatively on our duration factor, which is to say that they behave more like short-duration stocks than long-duration stocks, and this negative loading on our duration factor explains most of their CAPM alpha in factor regressions. In cases where there is remaining alpha after controlling for the market and our duration factor, the alpha is generally insignificant or at least substantially reduced relative to the CAPM benchmark. These results hold both in the in the 1963 to 2018 US sample and in a broad global sample covering 23 countries from 1990 to 2018.

The main significant anomalies that remain after we control for duration are: the momentum factor, the short-term reversal factor, and the size factor, which is resurrected once controlling for duration (small firms are long-duration firms, and we would therefore expect them to have low returns). However, we note that the short term reversal factor, and to some extend the size factor, may arise from liquidity issues that our model abstracts from (Nagel, 2012).

We next confirm that the returns to our duration factor is, in fact, driven by cash-flow duration and not by dimensions of our duration characteristic that are unrelated to the timing of cash flows. To do so, we study a novel dataset of single stock dividend futures, which are claims to stock level dividends that are paid out during a given calendar year. These are often referred to as dividend strips and can be thought of as the equity equivalent of a zero coupon bond for an individual firm, only with the face value (dividend) being stochastic. We run panel regressions of expected return and alphas to these claims onto dummies for the maturity of the claim and the duration characteristic for the underlying firm. Doing so, we find a slightly negative relation between expected return and the maturity of the claim. More importantly, we find a significant negative relation between alphas and the maturity of the claim, suggesting that short-maturity cash flows have higher risk-adjusted returns than long-maturity claims. In addition, we find no relation between the duration characteristic of the underlying firm and either expected return or Sharpe ratios, suggesting that the duration characteristic does not influence risk premia on fixed-maturity claims. This latter result helps us rule out the hypothesis that our duration characteristic captures a premium unrelated to duration: varying the characteristic without varying the duration of the cash-flow does not influence risk premia.

As the final part of our paper, we study the relation between our duration characteristic and stock *prices*. Just like duration helps us understand cross-sectional variation in stock returns, duration also helps us understand cross-sectional variation in prices, or book-to-market ratios. Indeed, the book-to-market ratios of duration-sorted portfolios can be interpreted as an equity yield curve: the book-to-market ratio of the short-duration portfolio is the short yield, and the the book-to-market ratio of the long-duration portfolio is the long yield. This equity yield curve should help predict the expected return on the market portfolio and in particular the horizon over which this expected return is expected to be earned. We find empirical evidence somewhat consistent with this and other predictions.

In conclusion, most of the cross-sectional variation in stock returns and prices can be explained by the duration of firms' cash-flows. Focusing on cash-flow duration has two main advantages. First, unlike many of the other charateristics known to predict returns, duration is a tangible economic entity that matters to asset prices in most models. Second, the notion that short-duration stocks have high average returns is consistent with the evidence in our novel dataset of dividend futures and with the previous evidence on the equity term structure of the market portfolio (see Binsbergen, Brandt, and Koijen, 2012; Binsbergen and Koijen, 2017), which shows that short-duration claims have high Sharpe ratios. The question of why short duration cash-flows have high expected returns remains to be answered. Our contribution is to organize the previous zoo of characteristics into one, tangible characteristic, thereby allowing the cross-section of stock returns to be explained by one simple economic mechanism. We do, however, end the paper with a discussion of the possible economic drivers.

Our duration based explanation of the cross-section of stock returns differs from competing models by Fama and French (2015) (FF) and Hou, Xue, and Zhang (2015) (HXZ). Similarly to these authors, we partly use profitability and investment to explain stock returns, but our paper differs on multiple grounds. First, our framework is more general. Indeed, FF and HXZ motivate the investment and profitability characteristics as measures of expected returns: for a given price, higher profitability or lower investment imply a higher rate of return. Empirically, higher profitability or lower investment indeed imply higher returns, but only because the equity term structure is downward sloping: had the equity term structure been upward sloping, higher investment and lower profitability would have lead to lower expected returns, which would come about through lower prices. As such, their models hold as a special case of ours, namely the case where the equity term structure is downward sloping. Second, and relatedly, our framework explains more factors than FF and HXZ. For instance, our framework explains why stocks with high betas, high idiosyncratic volatility, and low payout has low expected return, which FF and HXZ do not.[1] Third, the FF and HXZ factors summarize expected returns, but their frameworks do not explain where these expected returns come from.[2] In contrast, our duration characteristic can be linked to economic drivers of returns and be embedded in a general equilibrium framework that explains the high returns to short-duration stocks. Finally, the FF and HXZ models are inconsistent with the evidence from dividend futures where risk-adjusted returns do not depend on investment and profitability for fixed maturity cash-flows.

Our paper relates to a literature on duration and stock returns. Most of the previous literature has used duration as an explanation of the value premium: Dechow, Sloan, and Soliman (2004) study cash-flow duration in the cross-section of US stock returns, finding that high-duration stocks have low returns and arguing that the duration measure explains the value premium. Lettau and Wachter (2007) provide a theoretical foundation for this claim, and Chen (2017) shows that the growth rates of value firms is higher than that of growth firms in the late US sample.[3] In a similar vein, Hansen, Heaton, and Li (2008) argue that value premium can be explained by the fact that value stocks are more exposed to long run consumption shocks. More recently, Weber (2018) shows that the

[1] Asness, Frazzini, Gormsen, and Pedersen (2018) show that the Fama and French five factor model cannot fully explain the low beta anomaly.

[2] HXZ argue their results are consistent with firms profit maximizing firms that invest less when the cost of capital is high. However, while this relation confirms that firms respond to their cost of capital, it does not explain *why* there are cross-sectional differences in expected returns in the first place (see Cochrane 1991, 1995 for a derivation of the expected return in the investment CAPM).

[3] Chen also finds that the growth rates on value firms are relatively *high* in the early sample, suggesting that value firms were long-duration stocks in the early sample.

relation between duration and stock returns is stronger when sentiment is higher, and Goncalves (2018) and Chen and Li (2018) both argue for a duration-based explanation of the profitability and investment premium. We contribute to the literature by: (1) showing that duration also explains the low beta, high payout, and low ivol premium; (2) more importantly, we explictly link these characteristics to growth rates and duration, both empirically and theorecically, and create a duration factor based on expected growth rates; (3) by studying the direct effect of duration on equity returns in a novel dataset of dividend futures; (4) showing that the above-mentioned risk factors are priced in a simple model of a downward sloping term struture; (5) studying the equity yield curve that arise from book-to-market ratios; and (6) by providing global evidence.

Our paper also relates to a recent literature on taming the factor zoo.[4] The goal of this literature is to determine which characteristics that are most important for predicting stock returns. The literature achieves this goal mainly through statistical analysis. We differ in our approach and shrink the cross-section based on economic intutition: we use basic economic arguments, coupled with analysis of dividend growth rates and novel dividend futures data, to argue that many of the most prominent characteristics are symptoms of cash-flow duration, and that most of the cross-section thus can be explained by a duration characteristic, which in turn is consistent with the evidence on the equity term structure of the market portfolio.

Our paper proceeds as follows. Section 1 studies cross-section of stock returns in the Lettau and Wachter (2007) model and shows that prominent equity risk factors are priced in the model. Section 2 describes data and methodology. Section 3 studies the empirical relation between growth rates and the characteristics that predict returns. Section 4 studies the empirical relation between cash flow duration and expected returns and the ability of the duration sorted portfolio to explain known risk factors. Section 5 studies the return to firm-level dividend futures. Section 6 studies the equity yield curve that arises in the cross-section of stocks. Section 7 discusses the ability of various theories to explain the empirical results. Section 8 concludes

1 Theory

We study the cross-sectional effects of duration on stock returns and prices in the Lettau and Wachter (2007) model.

[4]See, for instance, Feng, Giglio, and Xiu (2017); Giglio, Liao, and Xiu (2018); Harvey and Liu (2017); Harvey, Liu, and Zhu (2016); Freyberger, Neuhierl, and Weber (2017); Kozak, Nagel, and Santosh (2017).

1.1 Model

The economy has an aggregate equity claim with dividends at time t denoted by D_t, where $d_t = \ln(D_t)$ evolves as

$$\Delta d_{t+1} = \mu_g + z_t + \sigma_d \epsilon_{d,t+1} \tag{1}$$

Here $\mu_g \in \mathbb{R}$ is the unconditional mean dividend growth and z_t drives the conditional mean:

$$z_{t+1} = \varphi_z z_t + \sigma_z \epsilon_{z,t+1} \tag{2}$$

where $0 < \varphi_z < 1$. Further, $\epsilon_{d,t+1}$ and $\epsilon_{z,t+1}$ are normally distributed mean-zero shocks with unit variance and σ_d, σ_z are their volatilities.

The risk-free rate r^f is constant and the stochastic discount factor is given by

$$M_{t+1} = \exp\left(-r^f - \frac{1}{2}x_t^2 - x_t \epsilon_{d,t+1}\right) \tag{3}$$

where the state variable x_t drives the price of risk:

$$x_{t+1} = (1 - \varphi_x)\bar{x} + \varphi_x x_t + \sigma_x \epsilon_{x,t+1} \tag{4}$$

The parameter $\bar{x} \in \mathbb{R}^+$ is the long-run average, $0 < \varphi_x < 1$, and $\epsilon_{x,t+1}$ is a normally distributed mean-zero shock with unit variance and σ_x is the volatility. The three shocks have correlations denoted ρ_{dx}, ρ_{dz}, and ρ_{zx}, where $\rho_{zx} = 0$, $\rho_{dx} = 0$, and $\rho_{dz} < 0$, meaning that there is long-run insurance in dividend growth: a negative shock to dividends is over time partly offset by a higher dividend growth.

To understand the stochastic discount factor, note that investors are averse towards shocks to dividends, $\epsilon_{d,t+1}$. A negative shock to dividends increases the marginal utility and thus increases the value of the stochastic discount factor. The effect of a given shock on the stochastic discount factor depends on the price-of-risk variable x_t, which in this sense can be interpreted as a risk aversion variable. In addition, shocks to the price of risk and the conditional growth rate z_t are only priced to the extent that they are correlated with the dividend shock.

1.2 Prices and Returns

The analysis is centered around the prices and returns on n-maturity dividend claims. The price of an n-maturity claim at time t is denoted P_t^n and the log-price is denoted $p_t^n = \ln(P_t^n)$. Since an n-maturity claim becomes and $n-1$ maturity claim next period, we have the following relation for prices:

$$P_t^n = E_t\left[M_{t+1}P_{t+1}^{n-1}\right] \tag{5}$$

with boundary condition $P_t^0 = D_t$ because the dividend is paid out at maturity. To solve the model, we conjecture and verify that the price dividend ratio is log-linear in the state variables z_t and x_t:

$$\frac{P_t^n}{D_t} = \exp\left(A^n + B_z^n z_t + B_x^n x_t\right) \tag{6}$$

The price dividend ratio can then be written as

$$\frac{P_t^n}{D_t} = E_t\left[M_{t+1}\frac{D_{t+1}}{D_t}\frac{P_{t+1}^{n-1}}{D_{t+1}}\right] = E_t\left[M_{t+1}\frac{D_{t+1}}{D_t}\exp\left(A^{n-1} + B_z^{n-1}z_{t+1} + B_x^{n-1}x_{t+1}\right)\right] \tag{7}$$

Matching coefficients of (6) and (7), using (1) and (4), gives

$$\begin{aligned}
A^n &= A^{n-1} - r^f + \mu_g + B_x^{n-1}(1-\varphi_x)\bar{x} + \frac{1}{2}V^{n-1} \\
B_x^n &= B_x^{n-1}\left(\varphi_x - \rho_{dx}\sigma_x\right) - \sigma_d + B_z^{n-1}\rho_{dz}\sigma_z \\
B_z^n &= \frac{1-(\varphi)_z^n}{1-\varphi_z}
\end{aligned}$$

where $B_x^0 = 0$, $A^0 = 0$, and

$$V^{n-1} = \text{var}\left(\sigma_d\epsilon_{d,t+1} + B_z^{n-1}\sigma_z\epsilon_{z,t+1} + B_x^{n-1}\sigma_x\epsilon_{x,t+1}\right),$$

which provides the solution to the model and verifies the conjecture.

The term B_z^n is positive for all values of $n > 0$, meaning that the price increases relative to dividends when the expected growth rate of dividends increases. Similarly, B_x^n is negative for all values of $n > 0$, meaning that the price relative to dividends decrease when the price of risk is higher.

The simple return on the n maturity claim is denoted $R_{t+1}^n = P_{t+1}^{n-1}/P_t^n - 1$ and the log-return is $r^n_{t+1} = \ln\left(1 + R^n_{t+1}\right)$. The expected excess return is

$$
\begin{aligned}
E_t\left[r^n_{t+1} - r^f\right] + \frac{1}{2}\text{var}_t(r^n_{t+1}) \qquad (8)\\
= - \text{cov}_t(r^n_{t+1}; m_{t+1}) \qquad (9)\\
= (\sigma_d + B_z^{n-1}\rho_{dz}\sigma_z)x_t \qquad (10)
\end{aligned}
$$

Because $\rho_{dz} < 0$ and B^n_z is strictly increasing in maturity n, the expected return decreases in maturity. Accordingly, the term structure of expected equity returns is downward sloping.

1.3 The Cross Section of Stock Returns

Following Lettau and Wachter (2007), we introduce a cross section of stocks by assuming the existence of $i = 1, \ldots, N$ firms that each produce a share s^i_t of the aggregate dividends. The share produced by each firm varies deterministically over time as the firms move through their life cycles. The share starts at $\underline{s}$ and grows at g_s each period until the share hits $\bar{s} = \underline{s} \times (1 + g_s)^{N/2}$ after which it decreases by g_s until the share hits $\underline{s}$ and the cycle repeats. The lower bar is set such that the shares sum to one cross-sectionally, meaning that $\underline{s} + \underline{s}(1 + g_s)^{N/2} + \sum_{i=1}^{N/2-1}(1 + g_s)^i\underline{s} = 1$. We assume $N = 200$ firms, meaning each firm has a lifecycle of 50 years. The firms are identical except that they are at different points in their life cycle: the first firm starts at $\underline{s}$, the next firm has grown for one quarter, and so forth.

Given no arbitrage, the price of each firm is its share of future dividends times their present value,

$$P^i_t = \sum_{n=1}^{\infty} s^i_{t+n} P^n_t \qquad (11)$$

and the one-period return is given by end-of-period price plus the share of the aggregate dividend received at the end of the period, divided by beginning of period price:

$$R^i_{t+1} = \frac{P^i_{t+1} + s^i_{t+1} D_{t+1}}{P^i_t} \qquad (12)$$

To construct equity risk factors, we must calculate the book value of equity. We consider book value of equity as a measure of fundamental value that does not account for time-varying discount rates. Accordingly, we calculate book value as the present value of future dividends discounted using the unconditional average market risk premium. We then calculate investment as quarterly changes in book value, we calculate profitability as the dividends currently earned by the firm dividend by lagged bok value of equity, and we calculate book-to-market as the book value divided by market value of equity. In addition, we calculate momentum as the running one-year return (skipping the most recent month), and we calculate betas as rolling three year betas.

1.4 Results in Simulated Data

To study the cross-section of stock returns, we run 1,000 simulations of 700 quarters of artificial data. For each simulation, we sort stocks at each period into equal-weighted quintile portfolios based on profitability, investment, book-to-market, market capitalization, and market beta. We then construct risk factors as long short portfolios based on the first and fifth quintile. For each simulation, we run CAPM regressions and calculate median intercepts and parameter estimates accross the simulations. We also calculate the duration of each factor as the difference between the duration of the long- and the short-leg of the factor. When calculating the duration of the individual firms, we only consider the following 80 quarters of cash-flows – for practical reasons, our firms never die, but when calculating the duration of the cash-flows we want to ensure that we are not including the cash-flows of its subsequent life-cycle, which we would do if looking at all future cash-flows. The duration of a firms cash flows is thus

$$D = \frac{\mathbf{Y}'\mathbf{P}}{\mathbf{e}'\mathbf{P}} \tag{13}$$

where $\mathbf{Y}' = [0.25, \ldots, 80]$ is a column vector of quarters, $\mathbf{P}$ is a row vector of present values of dividends, and $\mathbf{e}'$ is a column vector with $1/80$ in each column.

The CAPM alphas are reported in Table 1. The risk factors based on valuation, profitability, investment, and beta all have positive CAPM alpha of 0.2 to 0.6 percent per month. Accordingly, our model of the downward sloping equity term structure is able to explain the well known CAPM alpha associated with these characteristics.

The factors have positive alpha because they are all long short-duration stocks and short long-duration stocks. Indeed, as can be seen in the bottom row of Table 1, the duration is between -3 and -14 for the above-mentioned factors. This difference between the duration of the long- and the short-leg of the factors is large given that we only use

20 years to calculate duration.

In our model, the links between the risk factors and duration are as follows:

- *Profitability*: In our setting, a high profitability firm has high dividends relative to book value, which summarizes the total value of future dividends. If dividends are high today relative to future dividends, it means that the firm is on the peak of its life cycle and therefore has relatively short duration.
- *Investment*: A high investment firm has large growth in book value, meaning it has a large growth in the value of future dividends. Firms with large growth in the value of future dividends are usually in the beginning of their life cycle, and are therefore long-duration stocks.
- *Book-to-market (value)*: A value firm has a low price of future dividends, meaning their discount rate is high. Discount rates are higher for short-duration claims because the equity term structure is downward sloping. Accordingly, value firms tend to have short cash-flow duration. It is worth noting that value firms have short duration only because the equity term structure is downward sloping. Had it been upward sloping, value firms would have had long duration (as long-duration stocks would have had high discount rates and endogenously become value stocks).
- *Size*: Small firms have long duration because they are at the beginning of their life-cycle and are expected to experience a large growth in dividends.
- *Low beta*: In our model, long-duration stocks have high betas because they are more exposed to the discount rate shock, $\epsilon_{x,t+1}$, and the growth rate shock $\epsilon_{z,t+1}$ as seen in equation 8 (the loading on the shocks, B_x^n and B_z^n, both increase in absolute terms in maturity n, although B_x^n increases non-monothonically). Accordingly, a low-beta stock tends to be a short-duration stock.

While the Lettau and Wachter (2007) model of a downward sloping term structure is proposed to explain the value premium, the model appears better suited to explain the profitability and investment premium for multiple reasons. First, the profit and investment factors have larger alphas in our model than the value factor. In addition, the return to the profit and investment factors are more directly related to the slope of the equity term structure. Indeed, in a hypothetical upward sloping model, the profit and investment factors have negative expected returns, whereas the value factor still has positive expected returns. The positive expected returns to the value factor remains because the factor now goes long the long-duration stocks (the book-to-market ratio now identifies the long-duration stocks as endogenously cheap stocks with high expected returns). In the empirical section, we take care not to use market prices when estimating duration to avoid this problem of endogenously identifying firms with high expected returns as short-duration stocks.

In the last column of Panel A, we study the return to a duration factor. In our model, we define the duration factor as the return to a long-duration claim minus the return to a short-duration claim. Given that the equity term structure is downward sloping, the duration factor has negative alpha.

In conlcusion, many prominent equity risk factors arise from a downward sloping equity term structure. The equity risk factors have positive expected return because they are long short-duration stocks. We next study these predictions empirically.

2 Data and Methodology

We study stocks in a global sample coverying 58.135 stocks in 23 countries between August 1963 and December 2018. The 23 markets in our sample correspond to the countries belonging to the MSCI World Developed Index as of December 31, 2018. Stock returns are from the union of the CRSP tape and the XpressFeed Global Database. All returns are in USD and do not include any currency hedging. All excess returns are measured as excess returns above the US Treasury bill rate.

We study risk factors both in the individual countries in our sample and a in broad global sample. Our broad sample of global equities contains all available common stocks on the union of the CRSP tape and the XpressFeed Global database from 1990 until 2018. For companies traded in multiple markets we use the primary trading vehicle identified by XpressFeed.

2.1 Single Stock Dividend Futures

We obtain single stock dividend futures from Bloomberg. Single stock dividend futures started trading on the Eurex exchange in 2010 and as of 2018, dividend futures existed for 150 firms with up to five year maturity. The dividend futures give the owner the right to the per share dividends that go ex dividend over a business year (each contract is for 1,000 shares). As of mid 2018, the open interest was around 4 million contracts on 1,000 shares, giving a total notional of around 5 billion dollars. The daily volume in the first half of 2018 was around 20,000 contracts.

We download monthly dividend futures prices from Bloomberg. Our sample includes 44,000 observations of firm-month-maturity level prices, from which we exclude all contracts withou open interest. To calculate expected return, we download analyst expected dividend per share from I/B/E/S. We then match each dividend future with the expected dividend per share for the same business year and same firm (ISIN). We consider only stocks with business years that end in December. We use median estimates for the expected return.

2.2 Defining and Measuring Cash-Flow Duration

Macaulay defines cash-flow duration as the weighted-average years to maturity of an assets cash flows discounted by the yield-to-maturity:

$$Dur_t = \sum_{i=1}^{\infty} i \times w_{i,t} \tag{14}$$

where the weight $w_{i,t}$ is the present value of the given cash flow relative to the total value of the assets:

$$w_{i,t} = \frac{E_t[CF_{t+i}]/(1+r)^i}{P_t} \tag{15}$$

where CF_{t+i} is the realized cash flow in period $t+i$, r is the yield-to-maturity on the asset, and P_t is the value of the asset.

To better understand the drivers of cash-flow duration, it is worthwile considering the Gordon Growth Model as an example. In the Gordon Grwoth Model, the expected return and cash-flow growth rates are assumed constant. Under these assumption, the duration of the cash flows is given by:

$$\text{DUR}_{\text{Gordon growth}} = \frac{1}{r-g} \tag{16}$$

where g is the constant growth rates, meaning that the duration is similar to the valuation ratio of the firm.

Equation (16) suggests that assets, or equities, have a long duration if they have a low expected return or a high expected growth rate. As expected returns is the endogenous variable that we are we are ultimately interested in, we use only expected growth rates to estimate the expected duration.

To form our measure of expected duration, we regress expected growth rates onto a set of characteristics, all measured in cross-sectional percentiles:

$$\text{LTG}_t = X_t'\Gamma + e_t \tag{17}$$

where LTG_t is a vector of expected long-term growth rates for I firms at time t and X_t is an $K \times I$ matrix with k time t characteristics of each firm i, and Γ is a row-vector of parameter estimates. The k characteristics are book-to-market, profitability, investment, idiosyncratic volatility, and the payout ratio. The long term growth rates and the characteristics are all measured in cross-sectional percent to account for time fixed effects and mitigate linearity issues. The duration characteristic is then defined as:

$$\text{DUR}_{i,t} = \gamma_{OP}\text{OP}_{i,t} + \gamma_{INV}\text{INV}_{i,t} + \gamma_{BETA}\text{BETA}_{i,t} + \gamma_{IV}\text{IV}_{i,t} + \gamma_{PAY}\text{PAY}_{i,t} \tag{18}$$

where γ_i is the $i'th$ row of Γ. We refrain from using the book-to-market characteristic in calculating expected duration because, as illustrated in the previous section, the relation between the book-to-market characteristic and expected growth rates depend on the slope of the term structure, which may vary over time (as we will find later). In addition, later in the paper we construct an equity yield curve by combining the book-to-market characteristic with the duration characteristic, and the book-to-market characteristic therefore cannot be part of the duration characteristic. We note, however, that including the book-to-market characteristic in our duration characteristic non-surprisingly improves the performance (information ratio) of our duration factor.

We run the regression in (17) in each contry and use the resulting parameter loadings to construct expected duration for all firms in our sample. The LTG variable is available from 1982.

2.3 Measuring Dividend Growth Rates

We calculate realized dividend growth rates for characteristic-sorted portfolios following Chen (2017). Each June, we construct portfolio breakpoints based on the most recent characteristics. We then calculate value-weighted portfolio weights for the subsequent 180 months. Using these weights, we calculate sans and cum dividend returns of the portfolio in each month. Using the sans dividend dividend return, we calculate how the value of a $1 investment in each portfolio develops over time, including delisting returns. Using the value of the portfolio, and the difference between the cum and sans dividend return, we calculate the monthly dividends to the portfolio.

More precisely, the value at time $t+s$ of the portfolio formed at period t is given by:

$$V_{t+s}^{t} = V_{t+s-1}^{t}(1 + retx_{t+s}^{t}) \quad (19)$$

where $retx_{t+s}^{t}$ is the sans dividend return between period $t+s-1$ and $t+s$ to the portfolio formed at time t. The dividends in period $t+s$ of the portfolio formed at period t is then given by:

$$D_{t+s}^{t} = V_{t+s-1}^{t}(ret_{t+s}^{t} - retx_{t+s}^{t}) \quad (20)$$

where ret_{t+s}^{t} is the cum dividend return between period $t+s-1$ and $t+s$ to the portfolio formed at time t.

For each formation period, we calculate the average dividends per $100 initial investment in each year after formation until year fifteen. To calculate the dividend growth rate, we calculate the average dividends per year after formation across the different formation periods, and finally calculate dividend growth rates as the growth in the average dividends over the fifteen years after formation.

When calculate portfolio weights, we may for each of the 180 months use market prices at formation period, which means that the portfolios must be rebalanced. Alternatively, we may use the most recent market price, which is akin to a buy-and-hold portfolio where we end up with large weights on firms that have done the best. Both approaches appear valid, but Chen, Hong, Huang, and Kubik (2004) shows that results for the value premium depends on the choice between buy-and-hold and rebalanced portfolios. For simplicity, we calculate portfolio weights based on both approaches and use the average growth rate between the two.

3 Which Characteristics Predict Growth Rates and Duration?

We start our empirical analysis by studying the relation between growth rates and the major characteristics that have been proven to predict returns in the literature. We create 60 characteristics-sorted portfolios, ten sorted on each of the following: book-to-market, profitability, investment, beta, idiosyncratic volatility, and payout. We calculate the average fifteen year dividend growth rates for these portfolios as explained above. We also calculate the sample average of the above characteristics for each of the portfolios.

This gives us 60 observations of dividend growth rates and characteristics.

Table 2 Panel A shows the parameter estimates and t-statistics from the following regression of average growth rates on average characteristics:

$$\overline{\text{Growth rates}}_i = \beta_0 + \overline{X}_i' B + \epsilon_i \tag{21}$$

where $\overline{\text{Growth rates}}_i$ is the average growth rate for portfolio i and $\overline{X}_i$ is a row vector of the following average characteristics for portfolio i: book-to-market value of equity, operating profitability over book equity, annual growth in total assets times minus one, market beta times minus one, idiosyncratic times minus one, and the payout ratio. These characteristics are all signed such that a higher characteristic implies a higher expected CAPM alpha. All characteristics are measured in cross-sectional percentages.

The results show that the average dividend growth rates loads positively on all of the six characteristics, although the effect is statistically insignificant for some of the parameter estimates. These results suggest that firms that have characteristics that predict high return also have low realized growth rates, which means that they have short duartion.

The regression in (21) relates the average realized dividend growth rates to average characteristics. Ideally, we would relate expected growth rates to contemporaneous charcteristics. In principle, we could regress rolling realized dividend growth rates of the portfolios on ex ante characteristics. However, because we use fifteen years to calculate dividend growth rates, we do not have many non-overlapping observations of divivdend growth rates and characteristics, and we therefore refrain from this exercise here.[5]

Instead, we study the relation between expected growth rates and the contemporaneous firm characteristics by using analyst expectations from IBES. More precisely, we use the long term growth expectations (LTG) from IBES to measure the long term growth expectations. These are defined as the analysts' expected growth rate for the firm over the next business cycle. We transform these into cross-sectional percent and focus on the cross-sectional ranking of growth rates.

Panel B of Table 2 shows the univariate correlation bewteen the LTG and the contemporaneuos characteristics of the same firm. All characteristics are again signed such

[5]In addition, another challenge in using realized dividends is that they may be biased against our result. Indeed, the characteristics that predict returns may partly do so because the given firms have overperformed in sample, which is to say that their dividend growth has been higher than expected. If this was the case, the low future dividend growth of the high-return characteristics would be biased towards zero, meaning that the actual relation between characteristics and growth rates is stronger than what we present here.

that a higher characteristic predicts a higher return (CAPM alpha). LTG is negatively correlated with all the characteristics, again emphasizing that firms with characteristics that predict high returns also have low growth rates.

We next regress the LTG expectations on all the characteristics in a multivariate regression. This regression tells us whether the individual characteristics contain incremental predictive power over LTG expectations, or if one of the characteristics are driven out by the other. We conduct this analysis using a panel regression that includes firm fixed effects. In addition, we measure both growth rates and characteristics in cross-sectional percent, resulting in date fixed effects. The baseline regressions uses number of analysts as regression weights.

Table 2 Panel C shows the results of the panel regressions for the US. The LTG expectations load negatively on all the characteristics that predict returns. This result holds across sample splits, excluding firm fixed effects, and changing the regression weights. In addition, the R^2 are high in all specifications.

In Table 2 Panel D we repeat the multivariate regression of LTG on firm characteristics in the international sample. When weighing by number of estimates of market capitalization, we recover the US results: the characteristics that predict high returns also predict a low growth rates. However, when removing weights or cutting the sample, the effect tend to go away for investment, beta, and idiosyncratic volatility.

Figure 2 shows the parameter estimates in each country in our sample. As can be seen, the parameter estimates are allmost all negative, suggesting that the relations we uncovered in the pooled international sample holds on the country-level. Panel B of Figure 2 zooms in on the eight largest exchanges in our sample, where the parameter estimates are all negative, except in Japan where the parameter estimate on investment (measured by asset expansion) is positive. Figure 3 shows the individual characteristics on their own. The negative relation between growth and characteristics appears most robust for book-to-market and payout ratio.

In conlusion, all of the above mentioned characteristics that predict returns are negatively correlated with growth expectations. This common denominator suggests that these characteristics may all predict returns exactly because they predict duration. To test this hypothesis, we next study the relation between duration and stock returns.

4 Duration and Stock Returns

Having documented that low investment, high profit, low valuation, low beta, high payout, and low idiosyncratic volatility all predict low growth rates and thus short duration, we next turn to studying the relation between duration and stock returns directly. We do so by sorting stocks based on the duration characeristic defined in Section 2.2. This duration characteristic is based on the profit, investment, payout, beta, and idiosyncratic volatility of the individual firms. The weights on these characteristics are extracted from the regression in equation (17), which is similar to the Panel regression from Table 2 Panel C.

Table 4 studies ten portfolios sorted on our measure of ex ante duration. The portfolio breakpoints are based on NYSE firms and refreshed every year, and the portfolio weights are value-weighted and rebalanced each calendar month. As can be seen in the first row, the average monthly excess returns decreases only slightly in duration: the monthly return to the long-short portfolio is -0.26 percent and the t-statistic is -1.15, meaning the effect is statistically insignificant. The table also reports the market betas and CAPM alphas. Consistent with our model, the market betas increase monotonically in duration. Most importantly, the alphas decrease almost monotonically in duration and this decrease is both economically and statistically significant: the mothly alpha of the long-short portfolio is minus 0.84% per month with a t-statistic of -4.85.

We next verify that our ex ante measure of cash-flow duration indeed predicts realized cash-flow duration. To do so, we calculate the realized dividend growth rates as explained in section 2.3. As can be seen in the bottom of Table 4, the dividend growth rates increase as duration increases. The short-duration portfolio has a realized annual dividend growth rate of 0% in real terms. The growth rates steadily increases to the 5% annual growth rate of the high-duration portfolio.

Figure A1 in the appendix plots the CAPM alpha of each portfolio against the realized dividend growth rates. The two are strongly negatively correlated, with and R^2 of 0.96 and a correlation of -0.98. Accordingly, the realized alpha for these portfolios is highly correlated with the timing of the future cash flows.

To put the growth rates in perspective, we calculate realized duration under the assumption that the dividend growth rates continue forever and that the discount rate is 10% per year for all stocks. As shown in the bottom of Table 3, the realized duration varies from 14 years for the short-duration portfolios to 61 years for the long-duration portfolio.

Finally, we also calculate the expected dividend growth rates based on the subset of firms where we have long-term growth expectations. We see a strong negative correlation between expected dividend growth rates and alpha: the correlation between CAPM alpha and expected dividend growth rates is -0.99.

We next study the relation between cash-flow duration and other characteristics known to predict return. To do so, we create equity risk factors for different characteristics based on the Fama and French (1993) method. That is, each June, we sort stocks into six portfolios based on the median market capitalization and the 30th and 70th percentile of the given characteristic. The portfolio breakpoints are unconditional and based on NYSE firms. Portfolio weights are value-weighted and rebalanced at the end of each calendar month. All factors are set up to have positive CAPM alpha, except for our duration factor which is long long-duration stocks and short short-duration stocks and thus have a negative average return.

Panel A and Panel B of Table 4 analyze our Fama and French duration factor in detail in the US and Global sample. The US results in Panel A are largely similar to the results in Table 3: the short duration portfolios have slightly lower average returns than the long duration portfolios, meaning that our duration factor has negative average returns. However, this negative return is statistically insignificant at -0.25 percent per month with a t-statistic of -1.59. More importantly, the factor has a negative alpha of -0.55 percent per month with a t-statistic of -4.59. The effect is neither driven by the short cap firms nor driven by the short-leg of the portfolio.

The two last rows of Panel A in Table 4 shows the expected and realized dividend growth rates of the different portfolios in our duration factor. Both of the long-duration portfolios have realized and expected growth rates above those in the short-duration portfolio. The growth rates for the duration factor is the difference between the growth rates in the long- and the short-leg of the portfolio. This growth rate is 2.6% when measured using survey expectations and 3.9% when measured using realized growth rates.

Finally, Figure 3 shows the cumulative dividend growth for the short- and long-duration portfolio as a function of time after formation period. As can be seen in the figure, the long-duration firms have higher growth rates than the short-duration firms in every year after formation period. After fifteen years, the dividends of the long-duration portfolio has increases by 100 percentage points more than the short-duration portfolio.

Figure 4 shows the excess return and alpha to our duration sorted portfolio. The y-axis is inverted, meaning that a higher value means lower cumulative return to the duration factor. The CAPM alpha is flat for the first twenty years, and afterwards it trends steadily upwards, although its largely flat between 1964 and 1982. Finally, the curve also drops at the peak of the tech bubble, consistent with long-duration tech firms becoming overly expensive in this period.

Panel B of Table 4 reports similar results for the duration sorted portfolio in the global sample. The factor has a negative and statistically significant CAPM alpha of 0.45 % per month.

We next analyze how well our duration factor fairs in explaining well known equity risk factors. Before doing so, we first study the CAPM performance of these risk factors. Panel A in Table 5 reports the CAPM alphas amd betas for the size, value, profitability, and investment factor of Fama and French (2015), a low-beta factor, a low-idiosyncratic volatility factor, and a payout factor. Consistent with previous research, these factors all have positive CAPM alphas and negative market betas.

In Panel B of Table 6, we control for our duration factor on the right hand side. All the risk factors load on our duration factor as predicted by theory. Except for size, the factors all load negatively on our duration factor. Given that the duration factor has negative return on average, the negative loadings on the duration factor helps explain the alpha to these risk factors. For the value, profitability, low-beta, low-ivol, and high-payout factors, the duration factor explains allmost all the alpha, leaving the intercept statistically indistinguishable from zero. For the investment factor, the alpha remains statistically significant after controlling for duration, but because the factor only loads modestly on our duration factor, the alpha is still statistically significant. Regardless, our duration factor explains around 25% of the alpha to the investment factor.

Regarding the size factor, it loads on our duration factor as predicted by the model: small firms have longer duration. However, the size factor has positive and statistically significant alpha once controlling for duration, which is inconsistent with our model. Indeed, in our model we would expect the size factor to have negative CAPM alpha and zero alpha once controlling for duration. The positive alpha could, however, arise from liquidity issues in small cap firms that our model abstracts from.

We next study the effect of duration on stock returns in the global sample. We construct a duration factor in each country in our sample as well as a global duration factor, which is the market capitalization weighted average of the country specific duration factors. Figure 5 shows the CAPM alpha and information ratios by country. The duration factor has positive CAPM alpha in each country in our sample except Spain, Ireland, and

New Zealand.

We next address the global sample in more detail in Table 7. Panel A shows the CAPM regressions for the size, value, profit, investment, beta, ivol, and payout factors. All factors have positive CAPM alphas but the alpha is insignificant for the size factor. As in the US, all factors except size have negative and statistically significant market betas. In Panel B, we again augment the CAPM model with our global duration factor. All factors except size load highly negatively on our duration factor. Accordingly, our duration factor explain most of the CAPM alpha to these factors. The only factors that have alpha after controlling for duration is size, profitability, and investment factor, but they all have a t-statistic below the threshold of three set by Harvey, Liu, and Zhu (2016), although this threshold was set for the US sample.

5 Expected Return on Single Stock Dividend Futures

We next verify that cash-flow duration is in fact the driver of the expected returns to our duration factor. The previous analysis shows that stocks with short cash-flow duration have high risk-adjusted returns. However, one may worry that the high expected returns arise not as a product of the cash-flow duration but because the underlying characteristics capture a return premium unrelated to duration. For instance, profit and investment may predict returns because they capture fundamental risks which are unrelated to duration – but because these characteristics also predict duration, we nonetheless observe a negative relation between expected returns and duration.

It is difficult to separate these two theories by studying equities alone as the two theories are observationally equivalent: we cannot vary duration of stocks without also varying their characteristics. We therefore study single stock dividend futures, which allow us to vary the duration characteristics while keeping the duration (maturity) of cash flows fixed. These futures are explained in detail in section 2.1.

As explained in section 2.1, we calculate the expected annual return to dividend futures with maturity between one and four years by combining futures prices with forecast-expectations of dividends. We calculate CAPM alphas by subtracting the product of the given claims' market beta and an assumed market risk premium of 5 percent. We calculate in-sample betas of a given claim using quarterly returns to account for stale prices. We calculate Sharpe ratios by dividing the expected returns by the in-sample standard deviation of the given dividend claim. We calculate standard deviations by taking the standard deviation of monthly realized returns for the different claims. When calculating in-sample betas and standard deviations, we consider, for instance, the two-year claim a two year claim as long as the maturity is higher than one, i.e. for the full calendar year after the December in which it was a two-year claim.

We regress the expected excess return, CAPM alphas, and Sharpe ratios onto one-, two-, a three-year maturity dummies and the duration characteristic of the underlying firm:

$$E_t[R^n_{t+1,i}] = b_1 D^n_1 + b_2 D^n_2 + b_3 D^n_3 + DUR_{i,t} + e^n_{i,t} \quad (22)$$

controlling for date and currency fixed effects. The included dummies implies that the one-year claims are the benchmark

The results of the panel regression in (22) are presented in Table 7 Panel A. The results indicate a slightly negative relation between expected return and the maturity of the claim, but the significance is dependent on the weights in the regression: when we weigh by the outstanding notional of the futures contract, the significance dissappear. In addition, we find no relation between expected return and the duration characteristic of the underlying firm.

In Panel B we consider risk-adjusted returns. Regression (1)-(4) shows results with CAPM alpha as the left hand side variable. In these regressions, we find a negative monotonically decreasing relation between alpha and the maturity of the claim, as can be seen by the negative maturity-dummies. This effect is statistically significant in 3 out of 4 specifications (it is insignificant when weighing by notional and using one-way clustering).

In addition, there is practically no relation between our duration characteristic and CAPM alpha, meaning that varying our duration characteristics does not influence the return on fixed maturity equity claims. This result suggests that the return associated with our duration characteristic is not driven by a firm-level effect. Rather, expected returns are driven by the maturity of cash-flows, and our duration characteristic predicts returns because it predicts the duration of cash flows.

Panel C of Table 7 shows the average CAPM alpha for different dividend strips with different maturity and firms with different duration characteristics.

6 Duration and Stock Prices: The Equity Yield Curve

We next study the book-to-market ratios of long- and short-duration firms. These book-to-market ratios together constitute the equity yield curve. Indeed, Binsbergen, Hueskes, Koijen, and Vrugt (2013) define equity yields as the hold-to-maturity return minus hold-to-maturity growth rates of dividends with different maturity. Similarly, book-to-market ratios of duration sorted portfolios measures the future expected return and growth rate of firms with different cash-flows duration (Vuolteenaho, 2002).

We calculate the level of the equity yield curve as the average log book-to-market ratio of the four portfolios that constitute the duration factor. Similarly, we calculate the slope of the equity yield curve as the average log book-to-market ratio of the two long-duration portfolios in the duration factor (i.e. its long leg) minus the average log book-to-market ratio of the two short-duration portfolios in the duration factor (i.e. its short leg). Figure 6 plots the slope of the equity yield curve. As can be seen from the figure, the slope is positive in the beginning of the sample, and it is flat from 1960 and forward. These results are consistent with cumulative excess returns to our duration factor in Figure 4: in the early sample, the long-duration stocks have high returns.

Figure 6 further plots the slope of the treasury yield curve, measured as the difference between the five- and the one-year Fama and Bliss (1987) yield. The two series are highly correlated from 1990 and onwards, but largely uncorrelated during the high-inflation paradigm of the 1970s and 1980s.

We next test if the slope of the equity yield curve predict the returns to the duration factor and other risk factors. Table 9 shows the results of predictive regressions. The dependent variables are the future realized one-year return to the equity risk factors and the dependent variable are the ex ante level and slope of the yield curve. We run rolling monthly regressions and use Newey West standard errors corrected for 18 lags. As can be seen in the leftmost column of Table 8, the slope of the yield curve predicts future returns to the duration factor. When the yield curve is more upward sloping, long duration stocks have relatively higher returns and the duration factor thus has higher returns. The effect is statistically significant. The level of the yield curve does not predict the return to duration factor. The R^2 is 0.13.

Accordingly, the long-duration stocks have higher expected return when the yield curve is more upward sloping. We similarly find that the slope of the yield curve predicts negatively the return to value, profit, investment, beta, ivol and payout factors. This notion is consistent with these factors being long short-duration stocks. The effect is, however, insignificant for value and investment. Similarly, the size factor, which is long long-duration stocks, loads positively on the slope of the yield cureve. The R^2 ranges from 0.02 to 0.22.

We next test if the equity yield curve predicts the return to the market portfolio. A higher level of the equity yield curve should ceteris paribus predict a higher return to the market portfolio over the long run. In addition, if the equity yield curve is more upward sloping, it suggests that this return is expected to be earned in the more distant future rather than the closer future.[6] Accordingly, we expect a higher level to predict higher returns and a more upward sloping curve to predict lower returns over short-horizon (less than five years). The results in Panel B of Table 8 are consistent with this conjecture: a higher yield curve predicts higher returns and a more upward sloping yield curve predicts lower returns, but the effect on the slope is statistically insignificant. The R^2 is as high as 31% for the 5-year return.

7 Economic Drivers of Duration Based Asset Pricing

We have presented cash-flow duration as a unifying characteristic for understanding cross-sectional variation in expected stock returns and prices. Focusing on duration has multiple advantages: First, by distilling the cross-section to a single characteristic it becomes easier to write economic models explaining it. Second, and relatedly, duration is a tangible economic characteristic which it is easily incorporated in economic models. Third, the high return to short-duration stocks is consistent with, and easily mapped to, the downward sloping equity term structure documented by Binsbergen, Brandt, and Koijen (2012); Binsbergen and Koijen (2017).

We stress, however, that duration is only the symptom and not the source of cross-sectional variation in expected returns. In the rational framework, expected returns arise due to covariance with the stochastic discount factor, not due to the timing of cash-flows. In our model, it is covariance with the cash-flow shock and not duration that generates expected returns, but duration is a good proxy for this covariance: near-future cash-flows covary more with the cash-flow shock; distant future cash-flows covary less with the cash-flow shock because changes in the long-run growth rate partly offset shocks to the cash-flows.

One can imagine other mechanisms that relate expected returns to the maturity of cash flows. The model we have studied thus far is a general model based on an exogenous stochastic discount factor without a microfoundation. We deliberately chose as general a model as possible to illustrate the generality of our main result: most of the cross-section

[6] Gormsen (2018) discusses the effect of the slope of the equity yield curve on the return to the market portfolio.

of stocks can be explained by a simple model that relates expected returns to duration.

7.1 Potentional Rational Explanations

The results are generally consistent with representative agent models in which the equity term structure is downward sloping. For instance, Hasler and Marfe (2016) model an economy with a disaster with quick recovery. In this economy, the short-maturity cash flows are risky because they are more exposed to disaster risk, which creates a downward sloping term structure.

7.2 Potential Behavioral Mechanisms

The high returns to short-duration firms are conceptually consistent with a behavioral model of overreaction. Diagnostic expectations, for instance, imply that people overestimate the growth rates of high-growth firms and underestimate the growth rates of low-growth firms. In such a setting, realized return to low-growth firms will be high. In addition, the expected return the agents report will be similar for all firms, consistent with the results from dividend futures that rely on survey expected returns. However, this theory cannot explain why the long-maturity claims have lower Sharpe ratios than the short-maturity claims for the dividend futures in Table 8, and similarly the results presented in Binsbergen, Brandt, and Koijen (2012); Binsbergen and Koijen (2017). In conclusion, the results are consistent with diagnostic expectations, but these expectations cannot explain all features of the data.

8 Conclusion

We study the relation between cash-flow duration and stock prices and returns. Accross a broad global sample of 23 countries, stock with short duration have higher average return than stocks with long duration. Other characteristics known to predict returns also predict a short cash-flow duration, and we thus argue that these characteristics only predict returns because they predict a short cash-flow duration. Consistent with this argument, our duration factor explains most of the cross-section of stock returns in both the U.S. and global sample. In addition, using dividend futures, we find evidence that our duration factor predict returns because it predicts a short cash-flow duration, addressing the concern that the return to our duration factor is driven by exposure to other characteristics. Finally, the book-to-market ratios of the duration-sorted portfolios constitute an equity yield curve that intuitively predicts the relative return to long- and short-duration stocks and the timing of the expected return to the market portfolio. These results are all consistent with a simple model of a downward sloping equity term structure.

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Table 1

Theory: Equity Risk Factors in a Model with a Downward Sloping Equity Term Structure

This table show the CAPM alpha and duration of equity risk factors in our asset pricing model. The CAPM alpha is the intercept in a regression of return to the risk factor on the market portfolio. The duration measures the difference in the duration of the long- and the short-leg of the factor. The duration of the long- and the short leg is the equal weighted average of the firms in the portfolio. The duration of an individual firm is the value-weighted years to maturity of the firm's expected cash flows over the subsequent 25 years. The table shows the median estimates of 1000 simulations of 700 quarters of data. Alphas are in monthly percent.

	SMB	HML	RMW	CMA	Low Risk	DUR
Long-leg:	Small firms	High B/M	High profit	Low investment	Low beta	High duration
Short-leg:	Big firms	Low B/M	Low profit	High investment	High beta	Low duration
CAPM alpha	-0.37	0.24	0.64	0.49	0.43	-0.66
Duration (years)	3.3	-3.3	-14.2	-7.5	-5.6	14.7

Table 2
Growth Rates and the Characteristics that Predict Returns

This table show the relation between future growth rates and the characteristics that predict returns. Panel A shows the results of a regression analysis for 70 characteristics sorted portfolios. The dependent variable is the realized 15-year dividend growth rates and the explanatory variables are the average characteristics of the portfolios 70 portfolios. Panel B reports the univariate correlations between the expected growth rates in survey data and firm characteristics. The expected survey growth rates are the median long-term growth (LTG) estimate in IBES. Panel C and D reports results from monthly firm level panel regressions. The dependent variable is the long-term growth rates from survey data and the explanatory variables are contemporaneous firm characteristics. Standard errors are two-way clustered across firm and date. All characteristics and survey growth rates are measured in cross-sectional percentiles.

Panel A: Portfolio level regressions

Dependent variable:	Explanatory variables						
	High value	High profit	Low inv	Low beta	Low IV	High pay	R^2
Realized 15-year dividend growth rate	**-0.02**	-0.00	**-0.03**	**-0.02**	**-0.02**	**-0.02**	.83
	(-3.06)	(-0.05)	(-4.65)	(-3.62)	(-2.38)	(-2.46)	

Panel B: Firm-level univariate correlations between characteristics and survey expectations of growth rates

	High BM	High profit	Low inv	Low beta	Low IV	High pay
Survey growth rates	-0.40	-0.12	-0.26	-0.30	-0.37	-0.37

Panel C: Firm-level regressions of survey expected growth rates on different characteristics

US Only	Dependent variable: survey expected growth rates (LTG)					
	(1)	(2)	(3)	(4)	(5)	(6)
High BM	**-0.485**	**-0.530**	**-0.328**	**-0.304**	**-0.283**	**-0.438**
	(-54.81)	(-23.81)	(-27.79)	(-21.26)	(-35.51)	(-53.96)
High profit	**-0.172**	**-0.230**	**-0.054**	**-0.123**	**-0.076**	**-0.175**
	(-20.42)	(-10.37)	(-5.982)	(-9.266)	(-10.65)	(-21.15)
Low investment	**-0.092**	**-0.090**	**-0.035**	**-0.042**	**-0.042**	**-0.077**
	(-16.37)	(-4.874)	(-7.044)	(-8.217)	(-12.26)	(-14.62)
Low beta	**-0.112**	**-0.230**	**-0.033**	**-0.053**	**-0.050**	**-0.066**
	(-12.30)	(-10.44)	(-3.355)	(-5.042)	(-7.180)	(-7.888)
Low IV	**-0.183**	**-0.144**	**0.012**	**-0.004**	**-0.007**	**-0.203**
	(-25.86)	(-9.738)	(-3)	(-1.283)	(-2.211)	(-29.79)
High payout	**-0.229**	**-0.183**	**-0.120**	**-0.086**	**-0.102**	**-0.202**
	(-30.15)	(-7.655)	(-12.89)	(-8.883)	(-15.76)	(-28.91)
Fixed effect	Firm/Date	Firm/Date	Firm/Date	Firm/Date	Firm/Date	Date
Cluster	Firm/Date	Firm/Date	Firm/Date	Firm/Date	Firm/Date	Firm/Date
Weight	Analysts	Market Cap	Analysts	Analysts	None	None
Sample	Full	Full	Early	Late	Full	Full
Observations	539,290	539,290	269,457	269,731	539,218	539,290
R-squared	0.50	0.46	0.81	0.74	0.68	0.37

Table 2 -- Continued
Growth Rates and the Characteristics that Predict Returns

Panel D: Firm-level regressions of survey expected growth rates on different characteristics – International Evidence

Non-US	Dependent variable: survey expected growth rates (LTG)					
	(1)	(2)	(3)	(4)	(5)	(6)
High value	**-0.169**	**-0.201**	**-0.147**	**-0.137**	**-0.119**	**-0.151**
	(-16.12)	(-9.745)	(-6.156)	(-7.347)	(-9.084)	(-15.87)
High profit	**-0.079**	**-0.097**	**-0.054**	**-0.233**	**-0.126**	**-0.067**
	(-7.579)	(-3.982)	(-2.088)	(-12.24)	(-9.775)	(-7.243)
Low investment	**-0.026**	-0.008	**-0.021**	**0.028**	0.008	**-0.026**
	(-3.473)	(-0.604)	(-2.109)	(-3.62)	(-1.31)	(-3.90)
Low beta	**-0.043**	**-0.108**	0.026	0.011	-0.003	**-0.042**
	(-4.105)	(-6.179)	(-1.46)	(-0.73)	(-0.230)	(-4.342)
Low IV	**-0.063**	**-0.096**	-0.008	0.008	-0.003	**-0.048**
	(-8.366)	(-6.469)	(-1.360)	(-1.51)	(-0.686)	(-7.644)
High payout	**-0.135**	**-0.122**	**-0.048**	**-0.039**	**-0.059**	**-0.123**
	(-14.32)	(-7.282)	(-2.804)	(-2.684)	(-5.984)	(-14.38)
Fixed effect	Firm/Date	Firm/Date	Firm/Date	Firm/Date	Firm/Date	Date
Cluster	Firm/Date	Firm/Date	Firm/Date	Firm/Date	Firm/Date	Firm/Date
Weight	Analysts	Market Cap	Analysts	Analysts	None	None
Sample	Full	Full	Early	Late	Full	Full
Observations	290,418	290,418	103,152	187,157	290,343	290,418
R-squared	0.06	0.10	0.49	0.39	0.35	0.04

Table 3
Risk and Return for Portfolios Sorted on Duration

This table shows the risk and return characteristics for ten long-only portfolios sorted on duration and a long-short portfolio. We sort stocks into ten groups based on our measure of ex ante duration. Portfolio weights are value-weighted and rebalanced monthly and the breakpoints are refreshed each June and based on NYSE firms. CAPM alpha is the intercept in a regression of the excess return to the portfolio on the excess return to the market portfolio. We report *t*-statistics in parenthesis under parameter estimates and statistical significance at the five percent level is marked in bold. Sharpe ratios and information ratios are annualized. Excess return and alphas are in monthly percent. Realized duration is calculated based on the assumption that dividend growth rates of the portfolios continue forever and a constant discount rate of 8% per year for all portfolios. Sample is US 1927-2018.

	Portfolios sorted on duration										Long/short
	1	2	3	4	5	6	7	8	9	10	10 minus 1
Excess return	**0.68**	**0.71**	**0.73**	**0.77**	**0.76**	**0.70**	**0.75**	**0.67**	**0.64**	0.42	-0.26
	(5.40)	(4.69)	(4.26)	(4.03)	(3.69)	(3.25)	(3.28)	(2.83)	(2.41)	(1.42)	(-1.15)
CAPM alpha	**0.21**	**0.13**	0.06	0.03	-0.04	-0.13	-0.13	**-0.22**	**-0.31**	**-0.63**	**-0.84**
	(4.22)	(2.69)	(1.32)	(0.55)	(-0.59)	(-1.95)	(-1.69)	(-2.32)	(-2.44)	(-4.34)	(-4.85)
CAPM beta	**0.72**	**0.90**	**1.02**	**1.13**	**1.23**	**1.28**	**1.35**	**1.37**	**1.47**	**1.61**	**0.90**
	(77.10)	(102.03)	(116.82)	(108.52)	(106.25)	(102.66)	(96.76)	(79.30)	(62.37)	(59.89)	(27.89)
Sharpe ratio	0.56	0.49	0.44	0.42	0.38	0.34	0.34	0.29	0.25	0.15	-0.12
Information ratio	0.44	0.28	0.14	0.06	-0.06	-0.20	-0.18	-0.24	-0.26	-0.45	-0.51
Adjusted-R^2	0.84	0.90	0.92	0.91	0.91	0.90	0.89	0.85	0.78	0.76	0.41
# of observations	1109	1109	1109	1109	1109	1109	1109	1109	1109	1109	1109
Realized dividend growth rates	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.03	0.05	
Survey expected growth rates	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03	
Realized duration	12	13	13	14	14	15	17	20	22	39	

Table 4
The Duration Factor

This table shows the risk and return characteristics for the portfolios that constitute our duration factor. We sort stocks into six portfolios based on ex ante size and duration. The breakpoints are the median market capitalization and the 30th and 70th percentile of duration. Portfolio weights are value-weighted and rebalanced monthly and the breakpoints are refreshed each June and based on NYSE firms. The duration factor is long 50 cent in the two long-duration portfolios and short 50 cent in each of the two short-duration portfolios. CAPM alpha is the intercept in a regression of the risk factor on the excess return to the market portfolio. We report *t*-statistics in parentheses under parameter estimates and statistical significance at the five percent level is marked in bold. Sharpe ratios and information ratios are annualized. Excess return and alphas are in monthly percent. The US sample August 1963 to December 2018 and the Global sample is July 1990 to December 2018.

	Long duration		Short duration		Duration factor
Panel A: US	Large cap	Small cap	Large cap	Small cap	
Excess return	0.37	0.52	**0.53**	**0.86**	-0.25
	(1.46)	(1.86)	(3.66)	(5.30)	(-1.59)
CAPM alpha	**-0.32**	-0.19	**0.14**	**0.45**	**-0.55**
	(-3.76)	(-1.30)	(2.49)	(5.39)	(-4.59)
CAPM beta	**1.39**	**1.43**	**0.79**	**0.82**	**0.61**
	(71.81)	(44.18)	(61.11)	(42.74)	(22.33)
Sharpe ratio	0.20	0.25	0.49	0.71	-0.21
Information ratio	-0.51	-0.18	0.34	0.73	-0.62
Adjusted-R^2	0.89	0.75	0.85	0.73	0.43
# of observations	666	666	666	666	666
Survey expected growth	3.2%	3.8%	0.7%	1.2%	2.6%
Realized dividend growth	5.0%	5.3%	1.6%	0.9%	3.9%

	Long duration		Short duration		Duration factor
Panel B: Global	Large cap	Small cap	Large cap	Small cap	
Excess return	0.32	0.29	**0.48**	**0.67**	-0.27
	(1.01)	(0.88)	(2.40)	(3.21)	(-1.62)
CAPM alpha	**-0.18**	-0.20	**0.17**	**0.36**	**-0.45**
	(-2.31)	(-1.44)	(2.69)	(3.93)	(-3.69)
CAPM beta	**1.28**	**1.24**	**0.80**	**0.78**	**0.47**
	(71.32)	(39.69)	(57.11)	(37.76)	(16.99)
Sharpe ratio	0.19	0.16	0.45	0.60	-0.30
Information ratio	-0.43	-0.27	0.51	0.74	-0.70
Adjusted-R^2	0.94	0.82	0.91	0.81	0.46
# of observations	342	342	342	342	342
Survey expected growth	2.3%	3.3%	0.4%	1.1%	2.0%

Table 5
Explaining Equity Risk Factors with Duration

This table shows the results of factor regressions in the US sample. Each factor is on six portfolios based on ex ante size and the characteristic the portfolio is sorted on. The breakpoints are the median market capitalization and the 30th and 70th percentile of duration. Portfolio weights are value-weighted and rebalanced monthly and the breakpoints are refreshed each June and based on NYSE firms. Each factor is long 50 cent in the two high-characteristic portfolios and short 50 cent in each of the two low-characteristic portfolios. Two-factor alpha is in the intercept in a regression of the given equity risk factor on the market portfolio and the duration factor. CAPM alpha is the intercept in a regression of the risk factor on the excess return to the market portfolio. We report *t*-statistics in parentheses under parameter estimates and statistical significance at the five percent level is marked in bold. Sharpe ratios and information ratios are annualized. Excess return and alphas are in monthly percent. The sample is from 1963-2018.

Panel A: CAPM alpha	SMB	HML	RMW	CMA	BETA	IVOL	PAY
CAPM alpha	0.12	**0.32**	**0.28**	**0.30**	**0.56**	**0.58**	**0.24**
	(1.11)	(2.82)	(3.69)	(4.57)	(4.36)	(4.36)	(3.51)
CAPM beta	**0.20**	**-0.14**	**-0.11**	**-0.15**	**-0.81**	**-0.65**	**-0.32**
	(7.90)	(-5.61)	(-6.17)	(-9.73)	(-28.39)	(-22.00)	(-20.69)

Panel B: Two-factor model	SMB	HML	RMW	CMA	Low Risk	Low TV	Payout
CAPM alpha	**0.43**	0.16	0.06	**0.23**	0.10	0.04	0.04
	(4.75)	(1.43)	(1.04)	(3.52)	(1.26)	(0.64)	(0.75)
Market beta	**-0.14**	0.04	**0.13**	**-0.07**	**-0.31**	**-0.06**	**-0.10**
	(-5.18)	(1.10)	(7.49)	(-3.43)	(-13.23)	(-3.49)	(-6.35)
Duration beta	**0.56**	**-0.30**	**-0.40**	**-0.13**	**-0.80**	**-0.95**	**-0.36**
	(19.29)	(-8.49)	(-20.53)	(-6.32)	(-31.86)	(-51.20)	(-21.20)
Sharpe ratio	0.26	0.29	0.39	0.44	0.12	0.21	0.13
Information ratio	0.65	0.20	0.14	0.48	0.18	0.09	0.10
Adjusted-R^2	0.41	0.14	0.42	0.17	0.83	0.89	0.64
# of observations	666	666	666	666	631	631	666
Survey expected growth	0.5%	-2.5%	-0.8%	-1.4%	-1.8%	-2.4%	-1.5%

Table 6
Explaining Equity Risk Factors with Duration: Global Evidence

This table shows the results of factor regressions in our broad global sample. We construct global factors as the market-cap weighted average of country specific factors. Each country specific factor is based on six portfolios formed on ex ante size and the characteristic the portfolio is sorted on. The breakpoints are the median market capitalization and the 30th and 70th percentile of duration. Portfolio weights are value-weighted and rebalanced monthly and the breakpoints are refreshed each June and based on NYSE firms. Each factor is long 50 cent in the two high-characteristic portfolios and short 50 cent in each of the two low-characteristic portfolios. Two-factor alpha is in the intercept in a regression of the given equity risk factor on the market portfolio and the duration factor. CAPM alpha is the intercept in a regression of the risk factor on the excess return to the market portfolio. We report *t*-statistics in parentheses under parameter estimates and statistical significance at the five percent level is marked in bold. Sharpe ratios and information ratios are annualized. Excess return and alphas are in monthly percent. The sample is from 1990-2018.

Panel A: CAPM alpha	SMB	HML	RMW	CMA	BETA	IVOL	PAY
CAPM alpha	0.08	0.24	**0.35**	**0.23**	**0.47**	**0.55**	**0.24**
	(0.69)	(1.86)	(4.54)	(3.18)	(3.23)	(3.41)	(3.16)
CAPM beta	**0.07**	-0.03	**-0.17**	**-0.09**	**-0.72**	**-0.52**	**-0.20**
	(2.72)	(-1.04)	(-9.63)	(-5.46)	(-22.68)	(-14.90)	(-11.41)
Panel B: Two-factor model	SMB	HML	RMW	CMA	Low Risk	Low TV	Payout
CAPM alpha	**0.26**	0.06	**0.13**	**0.17**	0.05	0.04	0.05
	(2.56)	(0.46)	(2.60)	(2.57)	(0.64)	(0.62)	(0.84)
Market beta	**-0.12**	**0.16**	**0.06**	0.01	**-0.28**	0.00	0.01
	(-3.99)	(4.40)	(4.26)	(0.32)	(-11.56)	(0.13)	(0.30)
Duration beta	**0.40**	**-0.41**	**-0.48**	**-0.20**	**-0.89**	**-1.08**	**-0.43**
	(9.19)	(-7.72)	(-23.00)	(-7.07)	(-25.58)	(-36.77)	(-17.53)
Sharpe ratio	0.17	0.33	0.62	0.58	0.17	0.33	0.34
Information ratio	0.49	0.09	0.50	0.47	0.13	0.13	0.16
Adjusted-R^2	0.21	0.15	0.69	0.17	0.88	0.89	0.62
# of observations	342	342	342	342	307	307	342
Survey expected growth	0.8%	-1.8%	-0.7%	-1.0%	-1.3%	-1.8%	-1.4%

Table 7
Expected Return and Alpha to Single Stock Dividend Futures

This table reports results from panel regressions with expected return and alphas to single stock dividend futures as dependent variables. Single stock dividend futures are the futures prices for the dividend that are paid out in a given year on a given firm. We calculate expected return for each future as the annualized yield to maturity using expected dividends per share from the I/B/E/S database. Alphas are expected returns minus beta times a market risk premium of five percent. Sharpe ratios are expected returns divided by realized variance for the firm/maturity specific claim over the full sample. Regressions are annual using end-of-December prices. The data are from 2010-2018.

Panel A: Returns	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Expected ret	Expected ret	Expected ret	Expected ret	Expected ret	Expected ret
2-year maturity dummy	-0.00173	-0.00573	-0.00432	-0.0191	-0.00173	-0.00573
	(-0.170)	(-0.361)	(-0.402)	(-1.071)	(-0.231)	(-0.718)
3-year maturity dummy	-0.0127	-0.000123	-0.0185*	-0.0217	-0.0127	-0.000123
	(-1.329)	(-0.00541)	(-1.722)	(-0.839)	(-1.806)	(-0.00639)
4-year maturity dummy	-0.0332***	-0.0133	-0.0319***	-0.0326	-0.0332***	-0.0133
	(-3.329)	(-0.534)	(-2.734)	(-1.212)	(-4.380)	(-1.103)
Duration	0.000874	0.00144	0.00143	0.00371	0.000874	0.00144
	(-0.65)	(-1.56)	(-0.87)	(-1.38)	(-0.55)	(-1.07)
Observations	802	801	746	745	802	801
R-squared	0.079	0.105	0.089	0.197	0.079	0.105
Fixed effect	Date	Date	Date/cur	Date/cur	Date	Date
Cluster	Firm	Firm	Firm	Firm	Firm/date	Firm/date
Weight	None	Notional	None	Notional	None	Notional

Panel B: Alphas	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	CAPM alpha	CAPM alpha	CAPM alpha	CAPM alpha	Sharpe ratio	Sharpe ratio
2-year maturity dummy	-0.014	-0.0246	-0.014	-0.0246***	-0.661***	-0.565***
	(-1.220)	(-1.203)	(-1.542)	(-8.666)	(-6.354)	(-5.258)
3-year maturity dummy	-0.0354***	-0.0382	-0.0354***	-0.0382*	-0.811***	-0.650***
	(-3.306)	(-1.190)	(-4.285)	(-2.265)	(-6.983)	(-4.471)
4-year maturity dummy	-0.0411***	-0.0487	-0.0411***	-0.0487***	-0.759***	-0.775***
	(-3.462)	(-1.597)	(-4.690)	(-5.333)	(-5.524)	(-9.719)
Duration characteristic	0.000131	-0.000239	0.000131	-0.000239	-0.011	-0.0133*
	(-0.1)	(-0.171)	(-0.1)	(-0.321)	(-0.909)	(-1.744)
Observations	745	745	745	745	743	743
R-squared	0.087	0.164	0.087	0.164	0.235	0.368
Fixed effect	Date	Date	Date	Date	Date	Date
Cluster	Firm	Firm	Firm/date	Firm/date	Firm	Firm
Weight	None	Notional	None	Notional	None	Notional

Table 7 continued
Alphas to Single Stock Dividend Futures

Panel C: Average CAPM alpha to dividend futures of high- and low-duration firms

	Maturity of dividend strip			
	2 year	3 year	4 year	Average
Low DUR firms	0.065	0.042	0.041	0.049
High DUR firms	0.061	0.046	0.031	0.046
Average	0.063	0.044	0.036	

Table 8
Predicting Returns with the Equity Yield Curve

This table reports the results of predictive regressions. We regress the future realized returns of different risk factors on the ex ante level and slope of the equity yield curve. The level is the equal weighted log book-to-market ratio of the four sub portfolios in the duration factor, and the slope is the average log book-to-market ratio of the long-leg of the two long-duration portfolios in the duration factor minus the average log book-to-market ratio of the two short-duration portfolios in the duration factor. In Panel A, we run monthly regressions of annualized returns. In Panel B, we run monthly regressions with varying holding horizon. We report *t*-statistics based on Newey West standard errors in parentheses under parameter estimates and statistical significance at the five percent level is marked in bold.

Panel A: X-section

	DUR	SMB	HML	RMW	CMA	Low Risk	Low IV	Payout
Level of yield curve	0.00	**0.09**	0.12	0.00	0.04	0.06	0.01	-0.01
	(-0.03)	(2.29)	(1.94)	(-0.12)	(1.22)	(0.71)	(0.08)	(-0.33)
Slope of yield curve	**0.23**	0.05	-0.07	**-0.10**	-0.03	**-0.29**	**-0.33**	**-0.07**
	(3.67)	(1.12)	(-1.11)	(-2.39)	(-0.77)	(-3.53)	(-4.27)	(-2.09)
Adjusted-R^2	0.13	0.09	0.05	0.09	0.02	0.12	0.22	0.05
# of observations	654	654	654	654	654	619	619	654

Panel B: Market

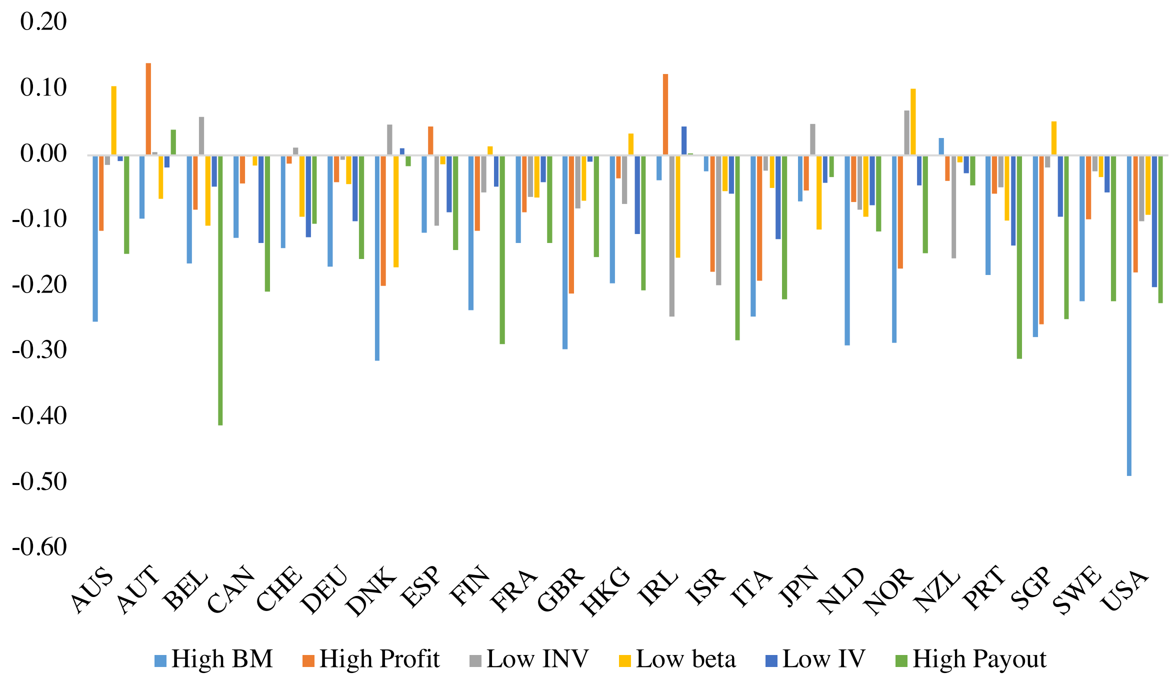
	MKT	MKT	MKT	MKT	MKT
Horizon	1 year	2 years	3 years	4 years	5 years
Level of yield curve	**0.16**	**0.34**	**0.55**	**0.80**	**1.19**
	(2.39)	(3.06)	(4.11)	(5.00)	(6.60)
Slope of yield curve	0.01	-0.12	-0.35	-0.45	-0.56
	(0.18)	(-0.87)	(-1.48)	(-1.39)	(-1.63)
Adjusted-R^2	0.08	0.12	0.17	0.22	0.31
# of observations	654	642	630	618	606

Figure 2

Loadings of Expected Growth Rates on Characteristics That Predict Returns: Global Evidence

This figure shows the loading of expected growth rates on characteristics that predict returns. In each country, we regress the expected growth rates on the below characteristics in multivariate regressions. In almost all cases, the characteristics that predict high returns predict low growth.

Panel A: All countries



Panel B: Eight Largest Exchanges

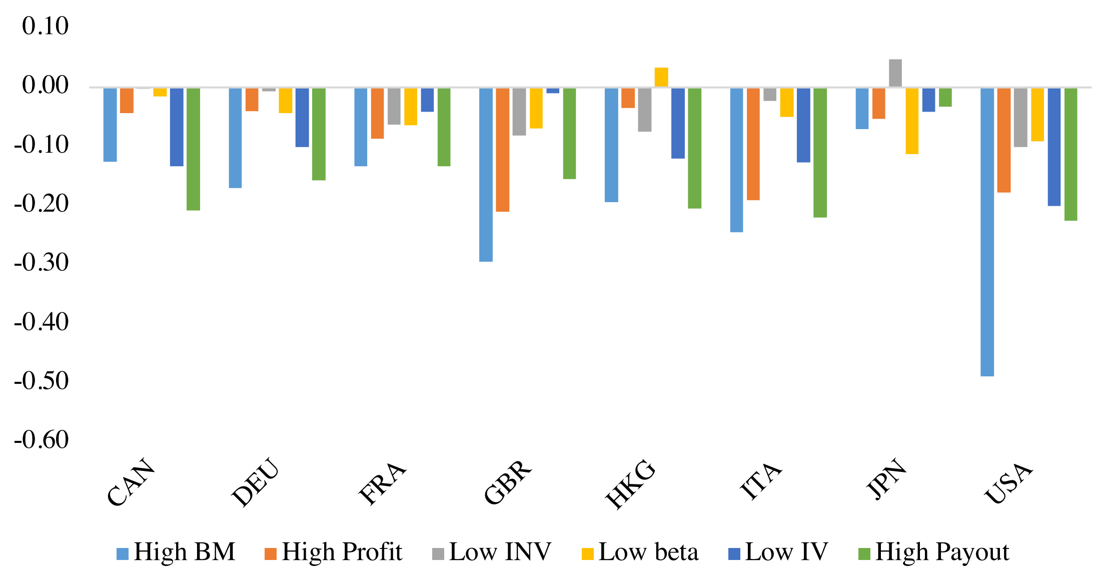


Figure 2 Continued

Loadings of Expected Growth Rates on Characteristics That Predict Returns: Global Evidence

Panel D: Individual Characteristics

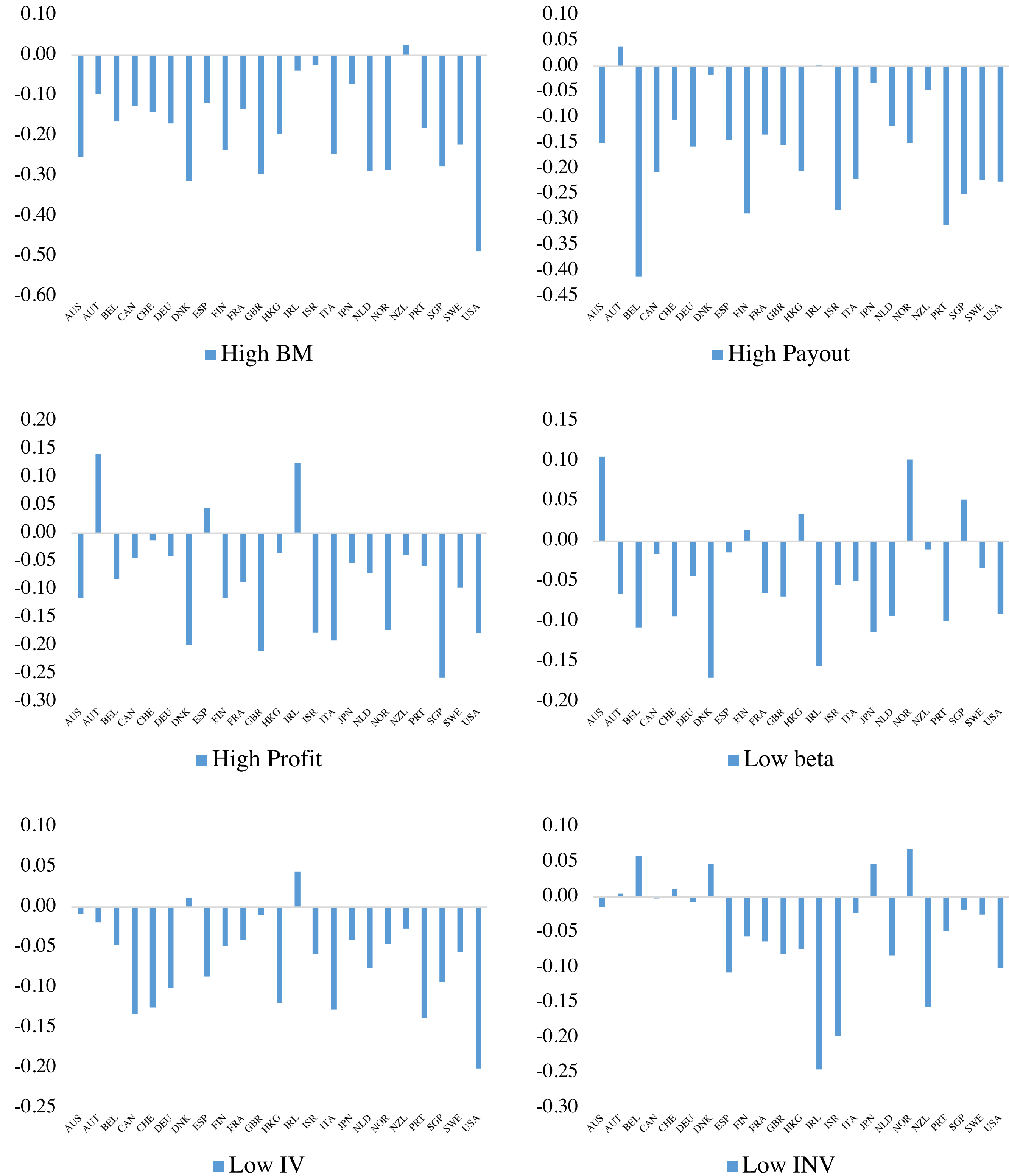


Figure 3

Realized Dividend Growth Rates for Long- and Short-Duration Firms

This figure shows the realized dividend growth rates for the long- and short-leg of our duration factor We sort stocks into six portfolios based on ex ante size and duration. The breakpoints are the median market capitalization and the 30th and 70th percentile of duration. Portfolio weights are value-weighted and rebalanced monthly and the breakpoints are refreshed each June and based on NYSE firms. The duration factor is long 50 cent in the two high-duration portfolios and short 50 cent in each of the two short duration portfolios. The figure shows the average cumulative growth rate of the two high-duration portfolios per year after formation period and the average cumulative real growth rate of the two low-duration portfolios.

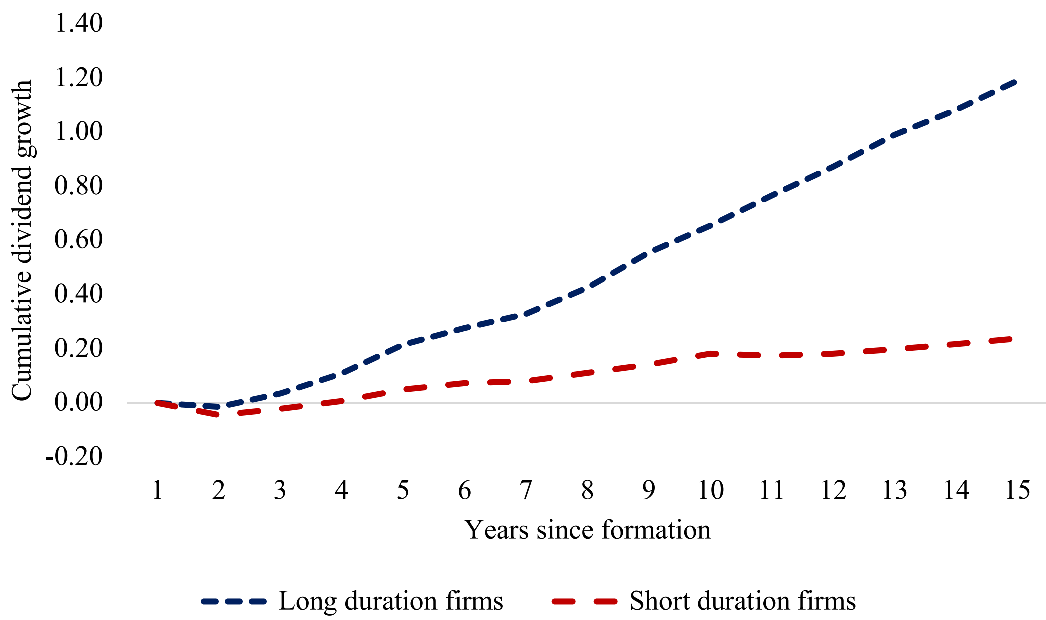


Figure 4

Cumulative return and CAPM alpha to the Duration Factor

This figure shows the cumulative excess return and CAPM alpha to the duration factor. The duration factor is constructed as follows. We sort stocks into six portfolios based on ex ante size and duration. The breakpoints are the median market capitalization and the 30th and 70th percentile of duration. Portfolio weights are value-weighted and rebalanced monthly and the breakpoints are refreshed each June and based on NYSE firms. The duration factor is long 50 cent in the two high-duration portfolios and short 50 cent in each of the two short duration portfolios. The alpha is the return to the duration factor minus the product of duration factor's market beta and the excess return on the market portfolio.

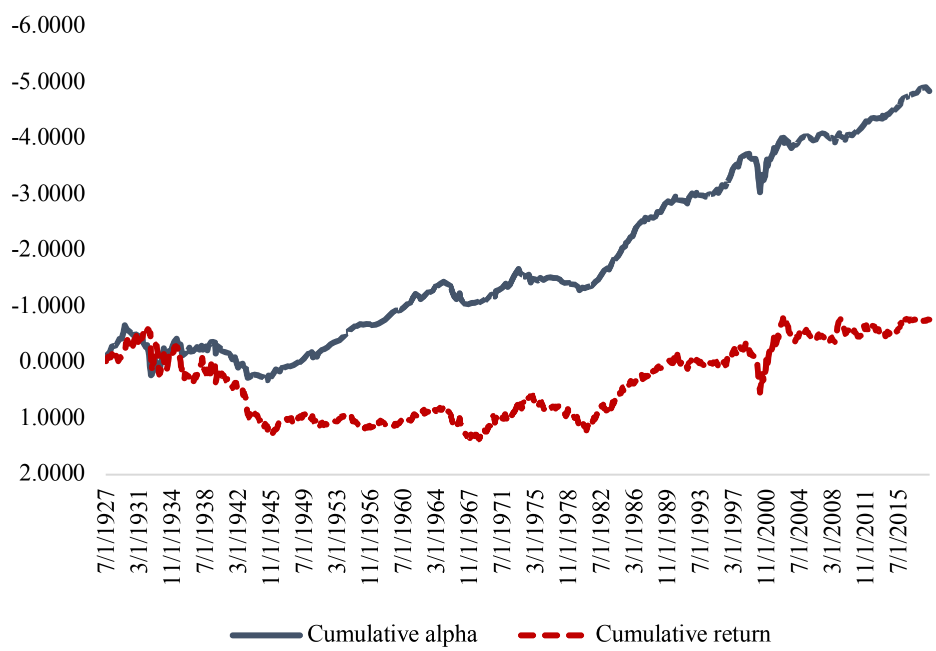


Figure 5

Returns to the Duration Factor around the World

This figure shows the *t*-statistic for the CAPM alpha to the duration factor in different countries. The duration factor is constructed as follows. We sort stocks into six portfolios based on ex ante size and duration. The breakpoints are the median market capitalization and the 30th and 70th percentile of duration. Portfolio weights are value-weighted and rebalanced monthly and the breakpoints are refreshed each June and based on NYSE firms. The duration factor is long 50 cent in the two high-duration portfolios and short 50 cent in each of the two short duration portfolios. The alpha is the return to the duration factor minus the product of duration factor's market beta and the excess return on the market portfolio.

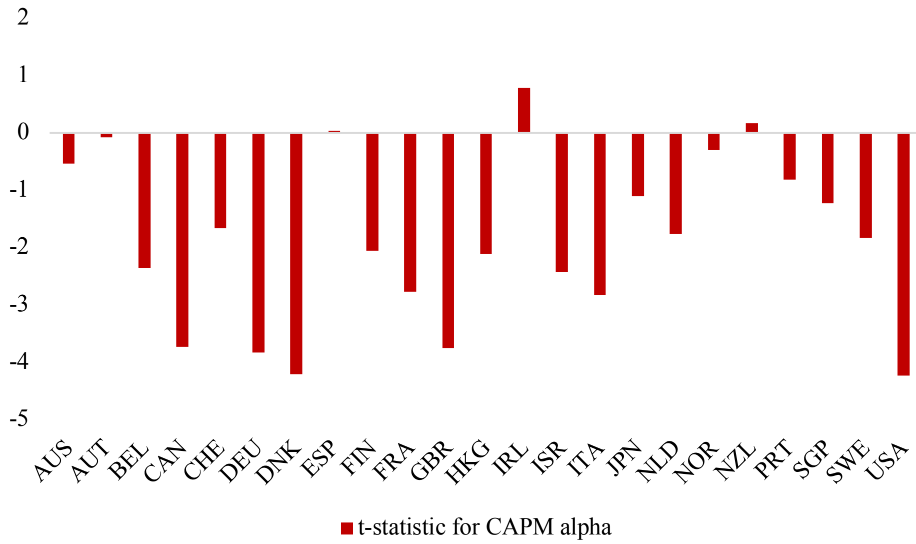


Figure 6

The Slopes of the Equity and Treasury Yield Curves

This figure shows the time series of the slope of the equity yield curve and the slope of the treasury yield curve. The slope of the equity yield curve is the log book-to-market ratio of the long-leg of the duration portfolio minus the log book-to-market ratio of the short-leg of the duration factor. The slope of the treasury yield curve is difference between the five- and one-year Fama & Bliss yield. The equity yield curve is measured on the left hand y-axis and the treasury yield curve is on the right hand side.