Predictability of Returns and Cash Flows

Ralph S.J. Koijen[1,2] and Stijn Van Nieuwerburgh[2,3,4]

[1]Booth School of Business, University of Chicago, Chicago, Illinois 60637; email: ralph.koijen@chicagobooth.edu

[2]National Bureau of Economic Research, Cambridge, Massachusetts 02138

[3]Department of Finance, Stern School of Business, New York University, New York, NY 10012; email: svnieuwe@stern.nyu.edu

[4]Centre for Economic Policy Research, London EC1V 3PZ, United Kingdom

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Abstract

We review the literature on return and cash-flow growth predictability from the perspective of the present-value identity. We focus predominantly on recent work. Our emphasis is on U.S. aggregate stock return predictability, but we also discuss evidence from other asset classes and countries.

1. INTRODUCTION

Stock prices move substantially relative to measures of fundamentals, such as dividends. The question of what moves stock prices has received an enormous amount of attention in the financial economics literature. Time variation in the price-dividend ratio is intimately linked to time variation in expected returns and in expected dividend growth rates. Therefore, the question can alternatively be posed as whether stock returns and dividend growth rates are predictable. The answer is of paramount importance to our understanding of the risk-return relationship, which lies at the core of finance theory.

Until the early 1980s, the standard model assumed constant expected returns for stocks. Then, empirical evidence was uncovered showing that returns were predictable by financial ratios, such as the price-dividend or price-earnings ratio. Later other variables, such as the spread between long-term and short-term bond yields, the consumption-wealth ratio, macroeconomic variables, and corporate decision variables, were also shown to have predictive ability. The literature has expanded its interest to returns on other asset classes, such as government bonds, currencies, real estate, and commodities, and to many countries.

Initially, the finding of predictability was interpreted as evidence against the efficient market hypothesis.[1] Fama (1991) proposed the alternative explanation of time-varying expected returns. In the past 20 years, research in asset pricing has proposed several equilibrium models with efficient markets that generate time variation in expected returns: models with time-varying risk aversion (Campbell & Cochrane 1999), time-varying aggregate consumption risk (Bansal & Yaron 2004, Bansal et al. 2009), time-varying consumption disasters (Gabaix 2009), time variation in risk-sharing opportunities among heterogeneous agents (Lustig & Van Nieuwerburgh 2005), or time-variation in beliefs (Timmermann 1993, Detemple & Murthy 1994). The dominant view today is that predictability of asset returns is no longer *prima facie* evidence of market inefficiency.

A large partial equilibrium literature takes time variation in expected returns as given and asks how it affects optimal asset allocation decisions (see Wachter 2010 for a recent review). Return predictability is of considerable interest to practitioners who can develop market-timing portfolio strategies that exploit predictability to enhance profits, if indeed such predictability is present.

Despite the theoretical developments, return predictability is a subtle feature of the data. A parallel literature developed in the 1990s questioning the strength of the statistical evidence. This literature points out problems such as biased regression coefficients, in-sample instability of estimates indicating periods with and without predictability, and poor out-of-sample performance.

Recently, the literature has turned to the question of whether measures of cash-flow growth, such as dividend growth, are predictable as well. Although interesting in its own right and important for model design, dividend growth directly speaks to return predictability. Through the present-value relationship, which links asset prices today to future returns and future dividend growth, dividend growth and return predictability are two

[1]The efficient market hypothesis states that financial markets are efficient with respect to a particular information set when prices aggregate all available information (see Fama 1965, 1970, 1991; Jensen 1978; Shiller 1984; Summers 1986). Testing the efficient market hypothesis requires a market model that specifies how information gets incorporated into asset prices.

sides of the same coin (Lettau & Van Nieuwerburgh 2008, Cochrane 2008, Binsbergen & Koijen 2010).

In this review, we survey the return and dividend growth predictability debate, with an emphasis on recent developments.[2] The organizing principle is the present-value relationship between asset prices and their cash flows, broadening the discussion from return predictability to include cash-flow growth predictability. Although our emphasis is on U.S. stock return and dividend growth predictability by the price-dividend ratio, we discuss other return forecasters and return predictability in other asset classes as well as in other countries. We conclude by offering some thoughts for future work.

2. U.S. STOCK RETURN AND DIVIDEND GROWTH PREDICTABILITY

We start by revisiting the basic findings on aggregate U.S. stock return predictability.

2.1. Motivating Predictive Regressions

Define the gross return on an investment between period t and period $t+1$ as

$$R_{t+1} = \frac{P_{t+1} + D_{t+1}}{P_t},$$

where P denotes the stock price and D denotes the cash flow, hereafter dividend. Campbell & Shiller (1988b) log-linearize the return to obtain

$$r_{t+1} = k + \Delta d_{t+1} - \rho dp_{t+1} + dp_t. \tag{1}$$

All lower-case letters denote variables in logs; d_t stands for dividends, p_t stands for the price, $dp_t \equiv d_t - p_t$ is the log dividend-price ratio, and r_t stands for the return. The constants $\rho = \exp(-\overline{dp})/(1+\exp(-\overline{dp}))$ and $k = \log(1+\exp(-\overline{dp})) + \rho\overline{dp}$ are a function of the long-run average log dividend-price ratio $\overline{dp}$.

Iterating forward on Equation 1 and by imposing a transversality condition, one obtains

$$dp_t = \overline{dp} + E_t \sum_{j=1}^{\infty} \rho^{j-1}\left[(r_{t+j} - \overline{r}) - (\Delta d_{t+j} - \overline{d})\right]. \tag{2}$$

Because this equation holds both ex post and ex ante, an expectation operator can be added on the right-hand side. This equation is one of the central tenets of the return predictability literature, the so-called present-value equation. As long as the (expected) returns and dividend growth are stationary, the dividend-price ratio is stationary. Deviations of the dividend-price ratio (dp_t) from its long-term mean ($\overline{dp}$) ought to forecast either future returns or future dividend growth rates, or both. One alternative possibility we return to later is low-frequency changes in the long-run mean of the dividend-price ratio $\overline{dp}$. We also discuss the literature that argues that the dp ratio displays (near-) unit root behavior.

[2]Earlier reviews include the special issue in the *Review of Financial Studies* (Spiegel 2008), Koijen & Van Nieuwerburgh (2009), Lettau & Ludvigson (2010), and discussions in Campbell et al. (1997) and Cochrane (2001, 2006).

Equation 2 motivates some of the earliest empirical work in the stock return predictability literature, which regresses returns on the lagged dividend-price ratio, as in Equation 3:

$$(r_{t+1} - \overline{r}) = \kappa_r(dp_t - \overline{dp}) + \tau^r_{t+1} \text{ and} \tag{3}$$

$$(\Delta d_{t+1} - \overline{d}) = \kappa_d(dp_t - \overline{dp}) + \tau^d_{t+1}, \tag{4}$$

where $\overline{r}$ is the long-run mean return and τ^r is a mean-zero innovation. However, the logic of Equation 2 suggests that the dividend-price ratio could predict future dividend growth rates instead of, or in addition to, future returns. Testing for dividend growth predictability would lead one to estimate Equation 4, where $\overline{d}$ denotes the long-run mean log dividend growth.

2.2. Data

The U.S. stock market return is the Center for Research in Security Prices (CRSP) value-weighted market return containing all NYSE, AMEX, and NASDAQ stocks. Our sample is January 1926 to December 2009. We start from monthly cum-dividend and ex-dividend returns. Their difference, multiplied by the lagged ex-dividend price, is the monthly dividend:

$$D_t = \left(R_t^{cum} - R_t^{ex}\right)P_{t-1}.$$

This dividend has a strong seasonal pattern. To de-seasonalize the data, the typical solution is to aggregate the dividends paid out over the year.

One important question, recently highlighted by Chen (2009) and Binsbergen & Koijen (2010), is what to assume about the reinvestment rate on these monthly dividends received within the year. We study three alternatives that have been used interchangeably in the literature. The first option is to reinvest them at a zero rate. This amounts to adding up the dividends in the current month and the past 11 months. The second option is to reinvest the dividends at the risk-free rate. For example, the dividend received in month *t-2* is reinvested at the one-month interest rate prevailing at *t-2* and again reinvested one more month at the one-month rate prevailing at *t-1*. We use the CRSP 30-day T-bill rate as our risk-free rate. The third option is to reinvest the dividends at the cum-dividend stock market return. CRSP computes quarterly or annual return series under the stock market reinvestment assumption.

We believe that this third approach is problematic because it imparts some of the properties of returns to cash flows. To underscore this point, we compute annual returns $(D_t+P_t)/P_{t-12}-1$ and dividend growth rates $D_t/D_{t-12}-1$, where D is the 12-month dividend annualized under each of the three reinvestment assumptions. This generates a time series of 84 observations (December 1926 until December 2009). Although all three approaches generate nearly identical annualized return series, they generate quite different annual dividend growth series and dividend-price series. Although the first two approaches generate dividend growth series with the same mean (5.12%), volatility (11.9% versus 12.0%), and a high correlation of 99.88%, the dividend growth series with market-return reinvestment has a mean of 5.62%, a much higher volatility of 15.1%, and a correlation of only 40% with the other two series. To gauge the discrepancy, it suffices to look at the year 2009: The cash-reinvested dividend growth rate was −17.0%, whereas the market return-reinvested growth rate was +30.5%. In what follows, we use the annual return series constructed from monthly data under the assumption of reinvestment at the risk-free rate as our default, and compare results with those of the market-return reinvestment strategy.

For the return predictability exercises below, we define log returns by Equation 1 above, unless explicitly stated otherwise. Hence, we assume that the approximation is accurate. In addition to the full sample of firms, we also study the universe of firms without NASDAQ (CRSP data).

2.3. Univariate DP-Predictability Evidence

The return predictability (Equation 3) was tested among others by (Rozeff 1984, Campbell & Shiller 1988b, Fama & French 1988, Cochrane 1991a, Hodrick 1992, Goetzmann & Jorion 1993, Lewellen 2004). It generally found statistically significant evidence for return predictability; that is, $\kappa_r > 0$.

We review and update the empirical evidence on U.S. stock return predictability by the dividend-price ratio using the latest available data. The estimation is by ordinary least squares (OLS) with Newey-West t-statistics with one lag. The return predictability coefficient is $\kappa_r = 0.077$ with a t-statistic of 1.31; the R^2 is 2.90%. A high dividend-price ratio at the end of a year predicts a higher return over the following year, as suggested by the present-value equation, but the point estimate suggests that there is no statistically significant evidence for return predictability over the full 1926–2009 sample. See the three left most columns of **Table 1**, first row. The results are very similar if we use actual log returns instead of log-linearized returns (second row of **Table 1**), if we predict log returns in excess of the log risk-free rate (row 2),[3] real returns instead of nominal returns (row 4), and if we exclude NASDAQ stocks (row 5).[4]

The results are quite different if we focus on the post-1945 sample (first observation on dp is 1945; first return is 1946). In the postwar sample, the evidence for stock return predictability is much stronger. Row 6 of **Table 1** shows a point estimate that is almost twice as high as in the full sample, at $\kappa_r = 0.130$, with a t-statistic of 2.56, and an R^2 of 10.84%. One important take-away is that the sample period matters for the evidence on return predictability, using simple predictability regressions with dp as the predictor. We return to the sample specificity and instability of the results in the next section and to a different method in Section 4.

The full sample results stand in sharp contrast with the ones obtained using the market-return reinvestment strategy instead of the risk-free rate-reinvestment strategy. The right columns of **Table 1**, panel A, show that the evidence for predictability is considerably stronger. The point estimate of $\kappa_r = 0.104$ is one-third higher with a t-statistic of 2.08 and a respectable R^2 of 4.82%. The difference between the left and right columns arises because the dividend-price ratio is different across reinvestment methodologies, whereas the return series are almost identical. Thus, the evidence on return predictability in the full sample depends strongly on the reinvestment assumption. Our interpretation is that the stronger evidence of return predictability arises from assigning some of the intrayear

[3]The annual risk-free rate is calculated as the return on rolling over the one-month T-bill rate for 12 months.

[4]NASDAQ stocks enter the sample in 1972 and comprise approximately 15% of the market's capitalization afterward, on average.

Table 1 Return and dividend growth predictability by the dividend-price ratio[a]

		Panel A: Return predictability					
		Div. reinv. at R^f			Div. reinv. at R^m		
		κ_r	t-stat	R^2	κ_r	t-stat	R^2
1	**Benchmark 1926–2009**	0.077	1.31	2.90	0.104	2.08	4.82
2	No approximation	0.075	1.29	2.79	0.102	2.03	4.58
3	Excess returns	0.087	1.51	3.64	0.115	2.30	5.73
4	Real returns	0.085	1.57	3.46	0.105	2.10	4.86
5	No NASDAQ	0.084	1.35	2.92	0.120	2.33	5.24
6	**Benchmark 1945–2009**	0.130	2.56	10.84	0.126	2.58	10.02
		Panel B: Dividend growth predictability					
		Div. reinv. at R^f			**Div. reinv. at R^m**		
		κ_d	t-stat	R^2	κ_d	t-stat	R^2
7	**Benchmark 1926–2009**	−0.078	−1.48	7.64	0.008	0.20	0.05
8	Real div. growth	−0.070	−1.63	7.61	0.009	0.23	0.07
9	No NASDAQ	−0.100	−1.74	10.55	0.008	0.22	0.05
10	**Benchmark 1945–2009**	0.017	0.68	1.13	0.044	1.10	2.03

[a]The table reports ordinary least squares point estimates, Newey-West t-statistics (one lag), and R-squared statistics for regressions of annual log stock returns (panel A) or annual log dividend growth rates (panel B) on the lagged log dividend-price ratio. In the left columns, returns, dividend growth rates, and dividend-price ratios are computed assuming that dividends are reinvested at the risk-free rate within the year, whereas the right columns assume reinvestment at the stock market return. The sample runs from December 1926 until December 2009 (84 annual observations).

movement in prices to dividends (and therefore to the return predictor dp) rather than to cash flows. Because the results are similar across reinvestment strategies in the post-1945 sample, the contamination is concentrated in the pre-1945 era.

To interpret the economic magnitudes of the coefficients, consider the 0.13 point estimate for κ_r in the post-1945 sample. A swing in dp from one standard deviation below its mean to one standard deviation above its mean (a 0.89 change) results in an increase in annual stock market return of 11.5% (or 0.58 return standard deviations). Given an average Sharpe ratio of 36% on the U.S. stock market, Campbell & Thompson (2008) calculate that an annual R^2 of 10.80% corresponds to a doubling in the expected return of a dynamic equity strategy compared to a static one that does not exploit predictability. Or, it corresponds to an increase of 6.7% in expected return for an investor with a relative risk aversion coefficient of two.[5] Return predictability significantly affects an individual's expected portfolio returns, at least in the postwar period.

[5]The proportional/percentage increase in the expected return is $\frac{R^2}{1-R^2}\frac{1+S^2}{S^2}$, where S is the unconditional Sharpe ratio of the asset and R^2 is the R-squared of the return predictability regression. In our case, $S = 0.36$, $R^2 = 0.108$, and we obtain an increase of 105.53%. The additive/percentage point increase in the expected return is $\frac{1}{\gamma}\frac{R^2}{1-R^2}(1+S^2)$, where γ is the coefficient of relative risk aversion of the investor. We note that these calculations assume that the return predictability parameters are known with certainty by the investor.

Dividend growth predictability has received relatively little interest; exceptions are Fama & French (1988) and Lettau & Ludvigson (2005). To the limited extent that it has, the consensus view seems to be that growth rates of fundamentals, such as dividends or earnings, are much less forecastable than returns when using financial ratios as predictors. This view implies that most of the variation in the price-dividend or price-earnings ratio comes from variation in expected returns, not expected future cash-flow growth. We retrieve this result in the right columns of panel B of **Table 1** for the *dp* ratio. Indeed, under the market-reinvestment assumption, the point estimate on κ_d (Equation 4) is not statistically different from zero (right columns). The R^2 is essentially zero, whether we look at the prewar, postwar, or full sample. We have argued that this case suffers from mismeasurement of dividend growth and the dividend-price ratio. Also, Binsbergen & Koijen (2010) show that lagged market returns mechanically predict dividend growth in this case.

In contrast, the evidence for dividend growth predictability by the dividend-price ratio is substantially stronger under the cash- (or no-) reinvestment assumption (left columns of panel B). Indeed, the full sample point estimate is large (as large as the return coefficient) and negative, as suggested by Equation 2. The regression's R^2 is as high as 7.64%, 2.6 times the value for the return equation's R^2. Although the R^2 is high in economic terms, the standard error remains too large for statistical significance at conventional levels, at least when using simple predictive regressions. The results are similar with real dividend growth (row 8) or in the no-NASDAQ sample (row 9). In the post-1945 sample, when we find stronger evidence for return predictability, there is no evidence for dividend growth predictability (row 10). Although based on a short sample, we find strong dividend growth predictability evidence in the 1927–1945 sample. The point estimate for κ_d is -0.642 with a *t*-stat of -6.24 and an R^2 of 74.4% (not reported in the table). These results are consistent with those from Chen (2009), who shows that dividend growth is predictable in the 1871–1945 period. In contrast, he shows that earnings growth is predictable in both eras (implying that the dividend-earnings ratio is predictable postwar). Chen et al. (2010) argue that dividend growth predictability disappears once firms started smoothing dividends in the postwar period. We return to alternative cash-flow measures below.

In sum, when our favorite dividend reinvestment procedure is used, returns do not appear to be predictable, whereas dividend growth rates do (marginally) for the full 1927–2009 sample. These conclusions reverse in the post-1945 sample. In Section 4, we argue that the return and dividend growth predictability results are closely related to one another and explore their link in depth.

3. STATISTICAL ISSUES

Findings regarding the predictability of stock returns, such as the ones presented in the previous section, are controversial because the forecasting relationship of financial ratios and future stock returns exhibits three disconcerting statistical features.

First, correct inference is problematic because financial ratios are extremely persistent. The empirical literature typically augments Equation 3 with an auto-regressive specification for the predictor variable,

$$(dp_{t+1} - \overline{dp}) = \delta(dp_t - \overline{dp}) + \tau_{t+1}^{dp}, \tag{5}$$

where $\overline{dp}$ is the long-run mean of the dividend-price ratio. The estimated autoregressive parameter δ is near unity and standard tests leave the possibility of a unit root open (i.e., $\delta = 1$). Nelson & Kim (1993), Stambaugh (1999), Ferson et al. (2003), Valkanov (2003), and Ang & Bekaert (2007) conclude that the statistical evidence of forecastability is weaker once tests are adjusted for high persistence. Amihud & Hurwich (2004), Lewellen (2004), Torous et al. (2004), Eliasz (2005), Campbell & Yogo (2006), and Ang & Bekaert (2007) derive asymptotic distributions for predictability coefficients under the assumption that the forecasting variable follows a local-to-unit root, yet stationary, process. We note that in our annual 1926–2009 sample, the persistence of the cash-reinvested dividend-price ratio is 0.86, smaller than the 0.93 persistence of the market return-reinvested ratio. Hence, the predictor we advocate is less persistent than the measure that is traditionally considered in the literature.

Second, the forecasting relationship of returns and financial ratios exhibits significant instability over time. The left panel of **Figure 1** shows that in rolling 30-year regressions of annual log CRSP value-weighted returns on lagged log dividend-price ratios, the OLS regression coefficient κ_r varies between zero and 0.5 (solid line). The right panel shows that the corresponding *t*-statistic fluctuates between 0 and 5 (solid line). In other words, for 30-year samples ending between 1965 and 1995, there was evidence for stock return predictability, but this evidence disappeared after 1995. It was absent for the prewar period as well. The figure also investigates how dividend growth predictability evidence depends on the sample (dashed line). In contrast with the return predictability picture, there was considerable evidence for dividend growth predictability for samples ending before 1965. Afterward, the κ_d coefficient is indistinguishable from zero.

Recognizing this instability, Viceira (1996) and Paye & Timmermann (2006) report evidence in favor of breaks in the OLS coefficient in the forecasting regression of returns on the lagged dividend-price ratio, whereas Lettau & Van Nieuwerburgh (2008) report evidence for structural shifts in the mean of the dividend-price ratio. We return to the latter

Figure 1

Parameter instability in the return predictability coefficient. The figure plots estimation results for the equations $r_{t+1} - \overline{r} = \kappa_r(dp_t - \overline{dp}) + \tau^r_{t+1}$ and $\Delta d_{t+1} - \overline{g} = \kappa_d(dp_t - \overline{dp}) + \tau^d_{t+1}$. The left panel shows the estimates for κ_r (*solid line*) and κ_d (*dashed line*) using 30-year rolling windows. The right panel shows (asymptotic) *t*-statistics computed with Newey-West with one lag. The data are annual for 1926–2009. The first rolling window ends in 1957.

idea below. Constantinides & Ghosh (2010) study return predictability in the presence of structural breaks in consumption and dividend growth. Working in a Bayesian setting, Pastor & Stambaugh (2001) estimate structural breaks in the equity premium, whereas Dangl & Halling (2009) and Johannes et al. (2008) consider drifting regression coefficients to address parameter instability.

Third, financial ratios have poor out-of-sample forecasting power, as shown in Bossaerts & Hillion (1999) and Goyal & Welch (2003, 2008). Inoue & Kilian (2004), Campbell & Thompson (2008), and Kelly & Pruitt (2010) have a different take on the out-of-sample tests and evidence. Lettau & Van Nieuwerburgh (2008) attribute most of the poorer out-of-sample performance with the difficulty of estimating the new mean of the *dp* ratio after the economy undergoes a structural break, rather than with detecting the break itself.

3.1. Structural-Break Adjustment

Lettau & Van Nieuwerburgh (2008) report evidence for structural shifts in the mean of the dividend-price ratio $\overline{dp}$ in 1954 and 1994. They advocate using a demeaned *dp* series as a return predictor, where regime-specific means are used in the demeaning procedure. The correspondingly break-adjusted *dp* ratio displays much less persistence. The first-order autocorrelation of the break-adjusted *dp* ratio is 0.502 under the cash-reinvestment assumption and 0.641 under the market return reinvestment assumption. The reduced persistence alleviates the upward small-sample bias in the return predictability coefficient (see Stambaugh 1999). The traditional *dp* ratio's persistence is 0.858 and 0.927, respectively. The break-adjusted *dp* series are also only half as volatile.

Table 2 shows that the adjusted *dp* ratio leads to much stronger return predictability and reduced in-sample coefficient instability. For example, in the 1926–2009 sample, the return predictability coefficient is $\kappa_r = 0.212$, three times higher than the benchmark 0.077 slope in row 1 of **Table 1**. It has a *t*-stat of 2.32 compared to 1.31. The R^2 is 6.2% compared to 2.9%. Panel B shows that dividend growth predictability is now also significantly negative with a point estimate of $\kappa_d = -0.240$, a *t*-statistic of -2.53, and an R^2 of 20.5% per annum. These numbers are almost three times higher than those in the benchmark case without $\overline{dp}$ adjustment.[6] In sum, the low-frequency movements in the unadjusted *dp* ratio mask evidence of return predictability as well as dividend growth predictability.

Low-frequency changes in expected returns or expected dividend growth can reflect a variety of structural changes to the economy. Lettau et al. (2008) argue that a persistent decline in the volatility of aggregate consumption growth leads to a decline in the equity premium. The latter decline also arises in models with persistent improvements in the degree of risk sharing among households or regions, for example, due to developments in the market for housing-collateralized debt (Lustig & Van Nieuwerburgh 2007, 2009; Favilukis et al. 2010), if the tax code changes persistently (McGrattan & Prescott 2005), or if there is a gradual entry of new participants in stock markets (Calvet et al. 2004). Other models argue that there was a persistent increase (or at least a perception thereof) in the long-run growth rate of the economy in the 1990s (Quadrini & Jermann 2007). Either effect lowers the steady-state level of the dividend-price ratio $\overline{dp}$. Other candidates for the nonstationarity in the traditional *dp* measure are persistent changes in firms' payout

[6]Using the market-return reinvested dividend-price ratio (in the right columns of **Table 2**, panel A), the κ_r point estimate is 0.393 compared to 0.103 and the *t*-statistic is 4.29 compared to 2.08. Dividend growth remains unpredictable (**Table 2**, panel B).

Table 2 Structural-break adjusted results[a]

		Panel A: Return predictability					
		Div. reinv. at R^f			Div. reinv. at R^m		
		κ_r	t-stat	R^2	κ_r	t-stat	R^2
1	**Benchmark 1926–2009**	0.212	2.32	6.20	0.393	4.29	14.91
2	No approximation	0.213	2.36	6.36	0.393	4.31	15.00
3	Excess returns	0.195	2.15	5.16	0.365	3.65	12.64
4	Real returns	0.215	2.61	6.33	0.362	3.74	12.57
5	No NASDAQ	0.206	2.28	5.96	0.398	4.42	15.13
6	**Benchmark 1945–2009**	0.322	4.47	17.25	0.357	4.17	17.72
		Panel B: Dividend growth predictability					
		Div. reinv. at R^f			**Div. reinv. at R^m**		
		κ_d	t-stat	R^2	κ_d	t-stat	R^2
7	**Benchmark 1926–2009**	−0.240	−2.53	20.52	0.107	1.37	2.15
8	Real div. growth	−0.237	−3.11	24.42	0.076	1.00	1.12
9	No NASDAQ	−0.255	−2.72	23.23	0.106	1.39	2.26
10	**Benchmark 1945–2009**	−0.021	−0.33	0.42	0.133	1.86	4.08

[a]The table reports ordinary least squares point estimates, Newey-West t-statistics (one lag), and R-squared statistics for regressions of annual log stock returns (panel A) or annual log dividend growth rates (panel B) on the lagged log adjusted dividend-price ratio. The adjusted dividend-price ratio is computed from the raw dividend-price ratio by demeaning, and adding back in a regime-specific mean for 1926–1953, 1954–1994, and 1994–2009. The 1954 and 1994 breakpoints are estimated in Lettau & Van Nieuwerburgh (2008). In the left columns, returns, dividend growth rates, and dividend-price ratios are computed assuming that dividends are reinvested at the risk-free rate within the year, whereas the right columns assume reinvestment at the stock market return. The sample runs from December 1926 until December 2009 (84 annual observations).

policies, including dividend smoothing, discussed above, or share repurchases, discussed below. Although such slow-moving changes are obviously important for long-run asset prices, they mask the time variation in expected returns and expected dividend growth at higher frequencies.

4. THE PRESENT-VALUE RELATIONSHIP

As indicated by the present-value Equation 2, return and dividend growth predictability by the dp ratio are tightly connected to one another. In fact, weaker evidence for dividend growth predictability points to stronger evidence for return predictability and vice versa (Lettau & Van Nieuwerburgh 2008, Cochrane 2008, Binsbergen & Koijen 2010). The two slope coefficients in Equations 3 and 4 are closely connected to each other.

To better understand this connection, we introduce a simple model that assumes that expected returns, μ_t, and expected dividend growth, g_t, each follow AR(1) models.

$$\Delta d_{t+1} - \overline{d} = g_t + \varepsilon^d_{t+1}, \qquad g_{t+1} = \gamma g_t + \varepsilon^g_{t+1}, \tag{6}$$

$$r_{t+1} - \overline{r} = \mu_t + \varepsilon^r_{t+1}, \text{ and } \mu_{t+1} = \delta\mu_t + \varepsilon^\mu_{t+1}. \tag{7}$$

The model has three shocks: an innovation in unexpected dividends ε^d_{t+1}, an innovation in expected dividend growth ε^g_{t+1}, and an innovation in expected returns ε^μ_{t+1}. We assume that all three shocks are serially uncorrelated and have zero cross-covariance at all leads and lags, except for a contemporaneous correlation between expected return and expected dividend growth innovations, $\mathrm{Corr}(\varepsilon^g, \varepsilon^\mu_t) = \rho_{\mu g}$, and a correlation between expected and unexpected dividend growth innovations, $\mathrm{Corr}(\varepsilon^d_t, \varepsilon^\mu_t) = \rho_{\mu d}$.

In steady state, the log dividend-price ratio is a function of the long-run mean return and dividend growth rate $\overline{dp} = \log\left(\frac{\overline{r} - \overline{d}}{1 + \overline{d}}\right)$. The log dividend-price ratio in Equation 2 can then be written as the difference between an expected return and an expected dividend growth term:

$$dp_t - \overline{dp} = \frac{\mu_t}{1 - \rho\delta} - \frac{g_t}{1 - \rho\gamma}. \tag{8}$$

Campbell's (1991) return decomposition implies that the innovation to unexpected returns follows from the three fundamental shocks (i.e., combine Equation 1 with Equations 6–8):

$$\varepsilon^r_{t+1} = \frac{-\rho}{1 - \rho\delta}\varepsilon^\mu_{t+1} + \frac{\rho}{1 - \rho\gamma}\varepsilon^g_{t+1} + \varepsilon^d_{t+1}. \tag{9}$$

Because ρ, δ, and γ are positive, and $\rho\delta < 1$ and $\rho\gamma < 1$, a positive shock to expected returns leads, *ceteris paribus*, to a negative contemporaneous return. Likewise, a shock to expected or unexpected dividend growth induces a positive contemporaneous return.

The simplest case of this setup is considered in Lettau & Van Nieuwerburgh (2008), where the persistence of expected dividend growth is assumed equal to that of expected returns: $\delta = \gamma$. In that case, the log dividend-price ratio in Equation 8 follows an AR(1) process, as in Equation 5, with persistence δ. In the more general case, considered in Binsbergen & Koijen (2010), $\delta \neq \gamma$ and dp follows an ARMA(1,1). Similar models can be derived for financial ratios other than the dividend-price ratio (Vuolteenaho 2000).

4.1. Present-Value Relationship

The second insight from the model is that there is a linear relationship between the three innovations $\tau = (\tau^d, \tau^r, \tau^{dp})$. Starting from the definition of a return in Equation 1, and subtracting the linear projection on dp_t, we can write return innovations in terms of dividend growth and dp innovations:

$$r_{t+1} - E(r_{t+1}|dp_t) = \Delta d_{t+1} - E(\Delta d_{t+1}|dp_t) - \rho\big(dp_{t+1} - E(dp_{t+1}|dp_t)\big),$$

or, equivalently,

$$\tau^r_{t+1} = \tau^d_{t+1} - \rho\tau^{dp}_{t+1}.$$

By the same logic, there is a tight relationship between the predictive coefficients of returns and dividend growth rates, and the persistence of the dividend yield. In the simplest case where the dp ratio is assumed to be an AR(1), this relationship is

$$\kappa_r = \frac{Cov(r_{t+1}, dp_t)}{Var(dp_t)} = \frac{Cov(\Delta d_{t+1} - \rho dp_{t+1} + dp_t, dp_t)}{Var(dp_t)} = \kappa_d - \rho\delta + 1. \tag{10}$$

Evidence that dividend growth is not forecastable is evidence that returns are forecastable: If $\kappa_d = 0$ in Equation 10, then $\kappa_r > 0$ because $\rho\delta < 1$. If estimating Equation 4 uncovers that a high dividend-price ratio forecasts lower future dividend growth ($\kappa_d < 0$), then this is indirect evidence of return predictability. Cochrane (2008) dubs the lack of dividend growth predictability "the dog that did not bark," highlighting that the null hypothesis of no return predictability ($\kappa_r = 0$) is a joint hypothesis, because it implies a negative coefficient in the dividend growth equation ($\kappa_d < 0$). The lack of evidence for $\kappa_d < 0$ is evidence in favor of $\kappa_r > 0$.

4.2. Price Variation

We can use the present-value model to understand why asset prices fluctuate over time. Variation in the price-dividend ratio reflects variation in expected returns (discount rate news), variation in expected dividend growth (cash-flow news), or their covariance:

$$
\begin{aligned}
\mathrm{Var}(pd_t) &= \frac{\mathrm{Var}(\mu_t)}{(1-\rho\delta)^2} + \frac{\mathrm{Var}(g_t)}{(1-\rho\gamma)^2} - \frac{2\mathrm{Cov}(\mu_t, g_t)}{(1-\rho\delta)(1-\rho\gamma)}, \\
&= \frac{\sigma_\mu^2}{(1-\delta^2)(1-\rho\delta)^2} + \frac{\sigma_g^2}{(1-\gamma^2)(1-\rho\gamma)^2} - \frac{2\rho_{\mu g}\sigma_\mu\sigma_g}{(1-\delta\gamma)(1-\rho\delta)(1-\rho\gamma)}, \qquad (11) \\
&= -\frac{\mathrm{Cov}(pd_t, \mu_t)}{1-\rho\delta} + \frac{\mathrm{Cov}(pd_t, g_t)}{1-\rho\gamma}. \qquad (12)
\end{aligned}
$$

Alternatively, we can decompose the variance of the *pd* ratio into the covariance with expected returns and the covariance with expected growth rates (Equation 12). The first covariance equals the first term in Equation 11 plus half the third term, whereas the second covariance equals the second term plus half the third term.

4.3. Long-Horizon Regressions

The evidence favoring return predictability, as measured by the R^2 statistic, tends to be stronger at longer horizons.[7] We investigate long-horizon return R^2 in the context of the present-value model. We start from the h-period stock return:

$$
R_{t+h} = \frac{P_{t+h} + D_{t+h}}{P_t},
$$

and log-linearize as before:

$$
r_{t+h}(h) = k + \sum_{i=1}^{h} \Delta d_{t+i} - \rho dp_{t+h} + dp_t. \qquad (13)
$$

[7]See Fama & French (1988) and Campbell & Shiller (1988b). However, Boudoukh et al. (2008) argue that long-horizon and short-horizon predictability estimators are highly correlated, presenting little independent information on the presence of return predictability. Cochrane (2008) reconciles both views arguing that the power advantage arises from horizons beyond five years.

We compute the R^2 value of the h-period return predictability regression,

$$r_{t+h}(h) = \overline{r}_h + \kappa_{r,h} dp_t + \tau^r_{t+h},$$

$$\text{as} \quad R^2(h) = \kappa^2_{r,h} \mathrm{Var}(dp_t) / \mathrm{Var}\big(r_{t+h}(h)\big).$$

To simplify the exposition, we assume that dividend growth is unpredictable ($\sigma_g = 0$) and that dividend growth shocks are independent of discount rate shocks ($\rho_{\mu d} = 0$). Then the per-period variance of returns is

$$\frac{\mathrm{Var}\big(r_{t+h}(h)\big)}{h} = \underbrace{\sigma^2_d}_{\text{Cash flows}} + \underbrace{\frac{1}{h} \frac{\left(\rho^2 + 1 - 2\rho\delta^h\right)\sigma^2_\mu}{(1-\delta^2)(1-\rho\delta)^2}}_{\text{Discount rates}}.$$

This equation clearly shows that, as $h \to \infty$, all variation in returns reflects cash-flow risk (see Hansen et al. 1991, Lustig & Van Nieuwerburgh 2008).

Returning to the return predictability R^2, we get

$$R^2(h) = \frac{1 + \rho^2\left(\delta^h\right)^2 - 2\rho\delta^h}{h\sigma^2_d / \mathrm{Var}(pd_t) + 1 + \rho^2 - 2\rho\delta^h}. \tag{14}$$

It is easy to see that $\lim_{h\to\infty} R^2(h) = 0$. However, in an intermediate range, the R^2 first increases in h before decreasing. **Figure 2** reports model-implied R^2 for long-horizon return predictability equations. It uses the observed volatility of dividend growth for σ_d, as well as the estimated persistence of expected returns reported below. The return R^2 displays a hump shape and peaks around 35 years.

4.4. Estimation Results

We estimate the present-value model in Equations 6 and 7, following Binsbergen & Koijen (2010). We use the Kalman filter to construct the model's likelihood, maximize that likelihood, and obtain the filtered expected return and dividend growth series $\hat{\mu}_t$ and $\hat{g}_t$ as a by-product.

Table 3 contains the point estimates. The first column uses the raw data (without adjustments for structural breaks) for the full sample. All results in this section assume that dividends are reinvested at the risk-free rate. We find expected returns to be more persistent than expected growth rates ($\delta = 0.93 > \gamma = 0.26$). The volatility of annual expected returns is 4.2%, whereas the volatility of expected dividend growth rates is 12.2%. Expected returns and expected growth rates have a modest positive correlation of 18.5%, consistent with Lettau & Ludvigson (2005) and Menzly et al. (2004).

We estimate the total amount of return predictability, measured as $1-\big(\mathrm{Var}[r_{t+1} - \hat{\mu}_t] / \mathrm{Var}[r_{t+1}]\big)$, to be 3.0% in the full sample. The total amount of dividend growth predictability, measured as $1-\big(\mathrm{Var}[\Delta d_{t+1} - \hat{g}_t] / \mathrm{Var}[\Delta d_{t+1}]\big)$, is estimated to be a very large 46.8% in the full sample. In comparison with the simple predictability results reported in **Table 1**, we see that using the dp ratio as a predictor captures most of the total return predictability (2.9% versus 3.0%), but substantially understates the total dividend growth predictability (7.6% versus 46.8%). This reinforces our conclusion that returns are only

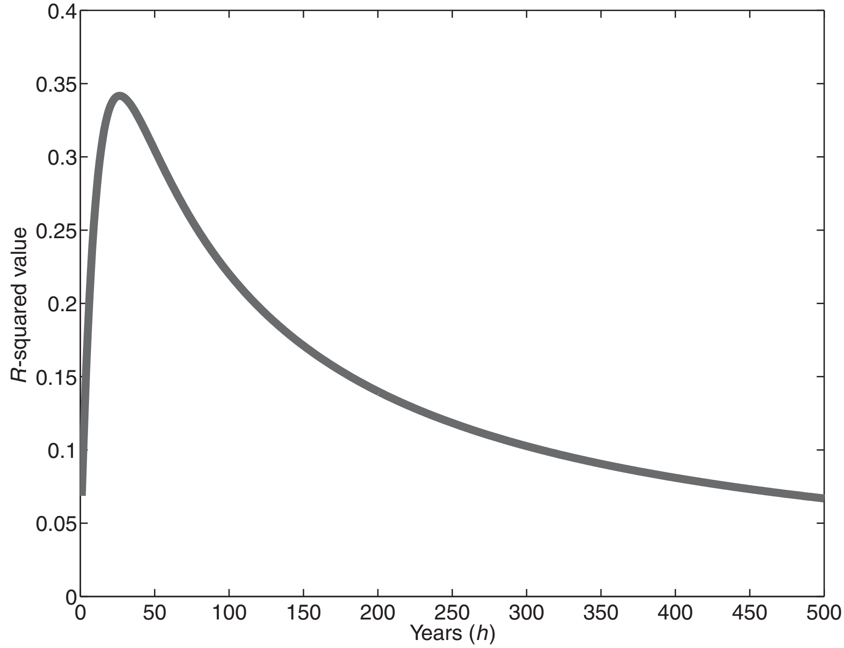

Figure 2

Long-horizon R-squared in present-value model. The figure plots the long-horizon return predictability R^2 from the equations $r_{t+h}(h) = \overline{r}_h + \kappa_{r,h}(dp_t - \overline{dp}) + \tau^r_{t+h}$, as implied by the present-value model. It uses Equation 14. The parameter values are based on the postwar sample. We match $\sigma_d = 0.0688$ to the volatility of dividend growth, $\delta = 0.9112$ to the AR(1)-coefficient of the dividend yield, the variance of the dividend yield equals 18.19%, and the linearization constant equals $\rho = 0.9691$.

modestly predictable over the full sample, whereas dividend growth rates are strongly predictable.

Despite the strong predictability of dividend growth rates, most of the variation in the price-dividend ratio arises from discount rate news. This happens because of the much higher persistence of expected returns (see also Lettau & Ludvigson 2005). Our benchmark full-sample estimates imply a variance decomposition of the price-dividend ratio that assigns 93% of the variability to expected returns, 13% to expected growth rates, and −6% to their covariance (see Equation 11). The last three rows of **Table 3** report these shares. Alternatively, we can think of the variance of dp as coming 90% from covariance with expected returns and 10% from covariance with expected growth rates (see Equation 12). The discrepancy between the amount of dividend growth predictability in simple predictability regressions and in the present-value model is caused by a severe errors-in-variables problem in the standard predictability regression (see also Fama & French 1988, Kothari & Shanken 1992, Goetzmann & Jorion 1995, Binsbergen & Koijen 2010). Indeed, the dividend-price ratio is not a good proxy for the expected dividend growth rate because it mostly captures fluctuations in expected returns.

Column 2 of **Table 3** re-estimates the parameters on the postwar sample. In this sample, the volatility of expected growth rates is only half as big as in the full sample (6.9% versus 12.2%), whereas the volatility of expected returns is similar (4.6% versus 4.2%).

Table 3 Present-value parameter estimates[a]

	Benchmark 1926–2009	Benchmark 1945–2009	Break-adjusted 1926–2009	Break-adjusted 1945–2009
$\overline{r}$	0.0725	0.0824	0.0767	0.0903
δ	0.9338	0.9243	0.6604	0.6424
$\overline{d}$	0.0431	0.0551	0.042	0.0549
γ	0.2564	0.3822	0.2935	0.3453
σ_μ	0.0150	0.0174	0.0585	0.0649
σ_g	0.1182	0.0639	0.1173	0.0638
σ_D	0.0026	0.0012	0.0086	0.0094
$\rho_{\mu g}$	0.1845	0.3395	0.2576	0.3269
$\rho_{\mu D}$	−0.8906	−0.2911	0.8662	0.9394
$Std[\mu_t]$	4.2%	4.6%	7.8%	8.5%
$Std[g_t]$	12.2%	6.9%	12.3%	6.8%
R^2 returns	3.0%	9.1%	6.7%	14.1%
R^2 div. growth	46.8%	18.9%	46.5%	19.9%
$\%CF$	13%	7%	50%	22%
$\%DR$	93%	103%	79%	107%
$-2Cov(CF, DR)$	−6%	−10%	−29%	−30%

[a]This table reports maximum likelihood estimates of the present-value model. The parameters are reported in the first column. Columns 2 and 4 report results for the 1926 to 2009 sample, whereas columns 3 and 5 report results for the 1945 to 2009 sample. Columns 2 and 3 use raw returns and dividend growth rates, whereas columns 4 and 5 use data that are adjusted for structural breaks in the mean *dp* ratio in 1954 and 1994.

Returns are substantially more predictable in the postwar period, with an R^2 of 9.1%. Dividend growth remains strongly predictable as well, with an R^2 of 18.9%. The latter result stands in strong contrast with that in **Table 1**, where we found no return predictability by the *dp* ratio in the postwar sample (1.1% R^2). The discrepancy is again caused by the errors-in-variables problem. The increased volatility and undiminished persistence of expected return raise its contribution to the variation in *dp* to 98% (103% – 5%), leaving only 2% for the covariation of the *dp* ratio with expected dividend growth.

In columns 3 and 4, we adjust the dividend-price ratio for structural breaks, as in Section 3. Because the dividend-price ratio is now less persistent, either expected returns or expected growth rates must be less persistent. We find that it is mostly the persistence of expected returns that is lower (0.66 versus 0.93). At the same time, the volatility of shocks to expected returns (σ_μ) more than triples. The resulting standard deviation of expected returns is 7.8% (8.5%) in the full (postwar) sample, whereas the volatility of expected dividend growth rates is 12.3% (6.8%). Expected returns are much more volatile once the low-frequency component in the *dp* ratio is removed, whereas expected dividend growth rates are unaffected. Consistent with the results in **Table 2**, the predictability of returns increases substantially with the break adjustment, especially in the full sample. In contrast, predictability of dividend growth rates is not affected much. As with the unadjusted data, the total predictability of returns is captured almost completely by the *dp* ratio, whereas the predictability of the dividend growth rates is severely understated. For the full sample, the Campbell-Shiller decomposition assigns 64% of the variation of the break-adjusted *dp* ratio to expected returns and 36% to expected growth rates.

In sum, once a low-frequency component in expected returns is removed, it is clear that both returns and dividend growth rates are strongly predictable in both the full sample and the postwar sample. OLS regressions with the *dp* ratio as the predictor severely underestimate the extent of dividend growth predictability. This problem is so severe that they lead to the wrong conclusion regarding dividend growth predictability in the postwar sample. Dividend growth predictability, however, is more short-lived than that of returns. The higher persistence of expected returns leads the present-value model to assign the bulk of variation in price-dividend ratios (90% before and 64% after removing a low-frequency component in expected returns) to discount rate news.

5. EXTENSIONS

This section discusses extensions beyond U.S. stock return and dividend growth predictability by the dividend-price ratio. We discuss repurchase-adjusting returns, other return predictors, evidence from other countries, and evidence from other asset classes.

5.1. Repurchase Adjustment

A branch of the literature considers returns, dividend growth, and dividend-price ratios that are adjusted for stock repurchases. The idea is that dividends may be too narrow a cash-flow measure because firms can substitute from dividend payments to share repurchases without reducing shareholders' payouts per share. In fact, the fraction of dividend paying firms dropped from 66.5% in 1978 to 20.8% in 1999 (Fama & French 2001), while repurchases gradually rose. The observed low-frequency decline in the traditional dividend-price ratio in the 1990s may be partially attributable to this change in the composition of payouts.

Boudoukh et al. (2007) show that the repurchase-adjusted *dp* ratio more strongly predicts U.S. stock returns. Updating their results to 2009, we find that the (market-reinvested) return predictability coefficient κ_r is 0.188 for the sample 1926–2009, with a *t*-stat of 2.96 and an R^2 of 6.88%.[8] Comparing this to the non-repurchase-adjusted results of **Table 1**, this is indeed higher than the 0.104 slope with a *t*-stat of 2.08 and R^2 of 4.82. In the post-1945 sample, the return predictability coefficient increases from 0.126 (with a *t*-stat of 2.58) to 0.205 (with a *t*-stat of 3.17). Dividend growth remains unpredictable in both samples.

However, we have advocated the use of cash-reinvested dividends. Under that reinvestment assumption, κ_r increases from 0.077 without repurchase adjustment to 0.117,

[8]We thank Itamar Drechsler for making his repurchase-adjusted data available to us.

while the t-statistic increases from 1.31 to 1.47 and the R^2 from 2.90 to 3.27. Hence, we continue to find no evidence for return predictability in the full sample using standard predictability regressions, despite the repurchase adjustment. In the post-1945 sample, we estimate $\kappa_r = 0.194$ (with a t-stat of 3.23), higher than the benchmark coefficient of 0.130 (with a t-stat of 2.56). One important finding is that dividend growth is predictable by the (cash-reinvested) repurchase-adjusted dp ratio in the full sample. The coefficient κ_d is -0.221 with a t-stat of -2.60 and an R^2 of 17.10%. For comparison, without repurchase adjustment, we found that κ_d is -0.078 with a t-stat of -1.48 and an R^2 of 7.64%. Dividend growth in the post-1945 sample continues to be unpredictable.

The reason for these quantitatively and qualitatively different findings is that the repurchase adjustment makes the dp series less persistent. This alleviates some of the statistical issues reviewed above.[9] At a mechanical level, the repurchase adjustment works similarly to the break adjustment we discussed above. Put differently, changes in firms' payout policies may well be an important contributor to the nonstationarity in the traditional dp ratio.[10] Finally, whether a repurchase adjustment is appropriate or not depends on the question at hand: Does one consider an investor who always holds one share of the stock or an investor who participates in every stock repurchase? Yet another alternative is to consider an investor who participates both in stock repurchases and in all initial public offerings (see Larrain & Yogo 2008, Bansal et al. 2005). Larrain & Yogo (2008) show that approximately half of the variation in the price-dividend ratio is due to variation in expected growth rates, once repurchases and issuances are included in the cash-flow measure.

5.2. Other Predictors

There is a voluminous literature documenting stock return predictability by other variables than the dividend-price ratio. They can be grouped in four categories: other financial ratios, term structure variables, macroeconomic quantity variables, and corporate decision variables. Some of the financial ratios are the earnings-price ratio (Campbell & Shiller 1988a,b; 2003), the book-to-market ratio (Kothari & Shanken 1997, Pontiff & Shall 1998), the dividend-payout ratio (Lamont 1998), the variance risk premium (Bollerslev et al. 2009, Drechsler & Yaron 2011), and a linear combination of dp ratios of various stock portfolios (Kelly & Pruitt 2010). Some of the interest rate variables are the term and default spreads on bonds and the short-term interest rate (Fama & Schwert 1977, Campbell 1987, Fama & French 1989, Hodrick 1992, Ang & Bekaert 2007). Some of the macroeconomic variables are the investment rate (Cochrane 1991b, Lamont 2000), the consumption-wealth ratio (Lettau & Ludvigson 2001), the labor income-to-consumption

[9]The first-order autocorrelation of the repurchase-adjusted dp ratio is 0.680 under the cash-reinvestment assumption and 0.825 under the market return reinvestment assumption. The traditional dp ratio's persistence is 0.858 and 0.927, respectively. The repurchase-adjusted dp series are approximately one-third less volatile.

[10]However, there is evidence that it is not the only, or maybe even not the main, determinant of the nonstationarity. Lettau & Van Nieuwerburgh (2008) find evidence for structural breaks in the repurchase-adjusted dividend-price ratio. Break-adjusting this series further strengthens return predictability under market reinvestment of dividends. Under the cash-reinvestment assumption, the return predictability coefficient also increases, but is still not statistically significant at the 10% level. Because repurchase adjustment intensities are higher among NASDAQ firms, another (cruder) way to repurchase-adjust the data is to omit these firms. As we showed above, the results are similar with or without these firms.

ratio (Menzly et al. 2004), the housing collateral ratio (Lustig & Van Nieuwerburgh 2005), and the housing to nonhousing consumption ratio (Piazzesi et al. 2007). Finally, some of the corporate decision variables are the equity share in total new equity and debt issues (Baker & Wurgler 2000) and IPO activity.[11]

The multitude of predictors naturally leads to the question of whether a few factors effectively summarize the dynamics of expected returns. Using dynamic factor analysis, Ludvigson & Ng (2007) summarize the information of 172 financial series into a volatility factor and a risk premium factor. The R^2 of a regression of quarterly excess stock market returns (from 1960 to 2002) on these two lagged factors is 9%. Adding cay increases the R^2 to 16%. The first common factor of 209 macroeconomic series is especially useful for predicting the conditional volatility of excess stock returns.[12] A different approach to deal with the multitude of possible predictors is a Bayesian averaging approach, which takes into account the uncertainty that investors may have about the right return predictors (e.g., Avramov 2002, Cremers 2002). Finally, Pastor & Stambaugh (2009) incorporate various return predictors in a predictive system. They specify realized and expected returns as in Equation 7, but augment the measurement equation of the system with a vector-autoregression for observables. Compared to the standard predictability regressions, this recognizes that a linear combination of these observables is an imperfect proxy for expected returns. An interesting extension would be to integrate their approach with the present-value model.

5.3. International Evidence

Predictability of stock returns does not only arise for the United States. Studies by Ferson & Harvey (1993), Harvey (1995), Campbell (2003), Paye & Timmermann (2006), Ang & Bekaert (2007), and Hjalmarsson (2010) analyze a large cross section of countries. Generally, they find evidence in favor of predictability by financial ratios in some countries but not others and more robust results for the predictive ability of term structure variables. In recent work, Plazzi (2009) uses the present-value identity in a two-country predictability framework for the United States and the United Kingdom. He finds evidence for increasing real and financial integration between the two economies.

5.4. Other Asset Classes

Although the focus of this review is on aggregate stock returns, there is a large literature on predictability in the cross-section of stock returns as well as predictability of other asset classes. In the cross-section of stock returns, Cohen et al. (2003) show that the expected return difference between value stocks (with high book-to-market ratios) and growth stocks (with low book-to-market ratios) is especially high when the lagged book-to-market ratio difference between value and growth is high. The latter is high in

[11]In addition, there is a large literature predicting the stock returns of individual firms using firm-level variables such as the market-value-to-replacement cost (Q) or book-to-market ratio, the investment rate, the labor hiring rate, past returns, earnings surprises, accruals, corporate events, etc.; see, for example, Zhang (2005) and Bazdrech et al. (2009).

[12]Ludvigson & Ng (2007) find a robust positive correlation between expected returns and volatility of returns using this methodology, clarifying a mixed bag of results in the prior literature on the risk-return relationship (see also Brandt & Kang 2004, Guo & Whitelaw 2006, and Pastor et al. 2008 on the risk-return trade-off).

recessions. Using the structure of a present-value model, they argue that the cross-sectional variance in book-to-market ratios mostly reflects variation in expected cash-flow growth rather than variation in expected returns. This result stands in contrast to the typical time series result that most of the variation in valuation ratios reflects expected return variability.

Among other asset classes, government bond returns of various maturities are predictable by the term spread, for example, the difference between the five-year and the one-year yield (Campbell & Shiller 1991), or by a linear combination of forward rates (Fama & Bliss 1987, Stambaugh 1988, Cochrane & Piazzesi 2005). In the language of the term structure literature, Cochrane & Piazzesi (2005) is consistent with a price of level risk that varies with the Cochrane-Piazzesi factor (Cochrane & Piazzesi 2008). In related work, Joslin et al. (2010) find that the price of both level and slope risk moves around with real economic activity, for example, industrial production. Koijen et al. (2009) connect bond return predictability to the cross section of stock returns by showing that value stocks' returns are more sensitive to innovations in the Cochrane-Piazzesi factor than growth stocks' returns. This sensitivity differential can be traced back to value stocks' dividend growth, which falls much more in recessions than growth stocks' dividend growth. Such joint treatment of bond and stock returns suggests consistent risk pricing between both markets. The connection with the business cycle suggests that the value premium is consistent with rational asset pricing theories.

As with bond markets, the expectations hypothesis (EH) has been rejected for foreign currency markets. High interest rate currencies do not appreciate as much as predicted by the EH theory, leading to return predictability.[13] Bekaert & Hodrick (1992) show that dividend-price ratios, forward premiums, and lagged excess stock returns all predict currency returns. More recently, Lustig et al. (2010) show that interest rates, exchange rates, and U.S. industrial production strongly predict returns on portfolios of currencies and that currency expected returns are countercyclical. Binsbergen et al. (2011b) relate fluctuations in the net foreign asset position to currency return predictability. Several structural models have been shown to generate predictable (and countercyclical) currency returns (e.g., Gabaix & Farhi 2009, Bansal & Shaliastovich 2010, Verdelhan 2010).

Present-value models have been used to explore return predictability in residential real estate (Campbell et al. 2009) and commercial real estate (Plazzi et al. 2010). Commodity returns are also predictable by interest rates, the yield spread, the forward premium, and by capital flows into commodity markets measured as open interest (see Hong & Yogo 2010, and the references therein). Finally, Binsbergen et al. (2011a) study the risk-return properties of equity dividend strips. They find that the prices of short-term dividend strips are more volatile than their subsequent realization. This implies that the returns on short-term dividend strips are strongly predictable using the price of the dividend strip normalized by the dividend as the predictor, which is analogous to the price-dividend ratio for the aggregate stock market.

[13]Time-varying risk premiums lead to an omitted variables bias in the EH tests, to the extent that the variable moving risk premia is correlated with interest rates. In contrast to the foreign exchange literature, the EH for bonds cannot be rejected for several countries (see Bekaert et al. 1997 and Bekaert & Hodrick 2001).

6. CONCLUSION

In this article, we review the literature on return and cash-flow growth predictability from the perspective of the present-value model. The present-value model allows for both time variation in expected returns and expected growth rates as drivers of stock price–dividend ratios and disentangles both sources of variation. The main conclusions of our review can be summarized as follows:

1. Stock returns are less and dividend growth is more predictable over the full 1927–2009 sample than commonly believed, when using standard predictability regressions with the dividend-price ratio (*dp*) as the predictor. This conclusion hinges on the dividend reinvestment assumption one makes to construct the dividend-price ratio and dividend growth. We have advocated reinvestment at the risk-free rate, not the stock market return.
2. In the post-1945 sample, these results reverse with no dividend growth and stronger return predictability, again using simple predictability regressions with the *dp* ratio as the predictor.
3. The *dp* ratio displays near-unit root behavior. Removing a low-frequency component from the *dp* ratio results in substantially stronger stock return and dividend growth predictability over the full 1927–2009 sample, using predictive regressions.
4. No predictability using the univariate regression approach does not imply no predictability. Although standard *dp* regressions uncover approximately the same amount of return predictability as the present-value model, there is a huge discrepancy for dividend growth predictability. Standard regressions strongly understate the amount of dividend growth predictability in both the full sample and the postwar sample. In the latter sample, they fail to detect predictability completely.
5. Although dividend growth predictability is strong, it is short-lived. In contrast, return predictability is modest, but expected returns are persistent. As a result, approximately 90% of the variation in price-dividend ratios is due to variation in expected returns. Removing a low-frequency component in expected returns lowers this estimate to 64%.

These results all point to the importance of going beyond simple predictive regressions and considering the present-value identity. The same present-value framework has been used to study predictability in other asset markets. These results have immediate implications for those modeling the risk-return trade-off in asset markets. Such models should feature both time-varying dividend growth (at business cycle frequency) and time-varying expected returns (at generational frequency). Although substantial progress has been made in developing structural asset pricing models with these properties, no model we are aware of is quantitatively consistent with all these conclusions. A further challenge is to understand better the economic reasons for dividend growth and return predictability. This ultimately requires studying firms' investment and financing policies more closely, as well as strengthening the link between asset prices and macroeconomic activity. Finally, future work should aim to integrate the results on predictability in equity, bond, currency, and real estate markets.

DISCLOSURE STATEMENT

The authors are not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review.

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Errata

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