Journal Of Investment Management, Vol. 21, No. 3, (2023), pp. 61–76

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ARE 60/40 PORTFOLIO RETURNS PREDICTABLE?

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Long-horizon asset class returns are reasonably predictable using simple models of expected return. However, equity returns over the last decade far exceeded model-based predictions. We posit a framework for the drivers of potential mean-reversion in equity returns. We believe increases in real bond yields and a decline in corporate profit growth are the most likely candidates to prompt an equity market correction.

"Returns are unforecastable," according to the conventional wisdom. In his book *A Random Walk Down Wall Street*, Burton G. Malkiel famously proclaimed that a monkey throwing darts at the *Wall Street Journal* could select a portfolio no better or worse than the so-called experts. However, such claims of unpredictability are usually centered around the notion of *relative returns*, comparing performance to some benchmark or model of expected returns. Indeed, a well-specified expected return model should be characterized by a set of residual returns, which are unforecastable.

However, these proclamations generally do not hold when one is describing the *absolute* level of expected returns. Expected returns associated with holding long positions in broad-based asset classes should be closely related to current and expected levels of certain state variables. Expected returns for bonds, for example, should be closely linked to the term structure of interest rates. Expected returns for equities should be driven by real bond yields, inflation, and expectations for profit growth.

In this paper, we put forth basic models for stock and bond total returns. We view these simple models as sensible starting points for an overall valuation framework and illustrate their application when constructing stock and bond portfolios. We also show that, despite these metrics' inherent limitations, the efficacy with which they forecast future returns is meaningful. We go on to demonstrate that differences between realized future returns and ex ante forecasts can be explained to some degree by innovations in certain macro-related variables, such as inflation and real interest

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rates. However, U.S. equity returns over the past decade have been significantly higher than those predicted by values from our model and cannot be fully explained by these same variables. Based on this observation, we posit a framework in which the fundamental drivers of equity returns may mean-revert to levels more aligned with their historical averages, and we analyze the consequences for future equity returns.

1 A Simple Model of Stock and Bond Returns

The basic model of Gordon (1962) for the price of an equity security can help to provide insight around the primary drivers of expected equity returns. Under the assumption of constant returns and growth rates, the expected nominal return on equities can be expressed as:

$$r^{eq} = \frac{D}{P} + G + \pi^e, \tag{1}$$

where D/P is the forward equity dividend yield, G is the expected (long-run) real dividend growth rate, and π^e is expected inflation. If corporations retain earnings at a rate b, the real earnings growth rate is proportional[1] to the company's real return on equity r^{eq}_{real}, so that $G = b \cdot r^{eq}_{real}$. Then the nominal growth rate of earnings can be expressed as $G_{nom} = r^{eq}_{real} \cdot b + \pi$, where π is realized inflation. Assuming that $\pi = \pi^e$, the nominal expected equity return can therefore be expressed as the sum of the earnings yield and expected inflation:

$$r^{eq} = \frac{E}{P} + \pi^e. \tag{2}$$

While the Gordon model posits constant returns and constant growth rates, the real world is not nearly as simple. Ample evidence shows that expected returns are time-varying (Campbell, 1991; Cochrane, 1992). In the Appendix, we derive a more generalized equation with time-varying expected returns, to allow for a more flexible structure than Equation (2). Adding time subscripts to account for time variation in Equation (2), the realized equity return at horizon k can therefore be expressed as:

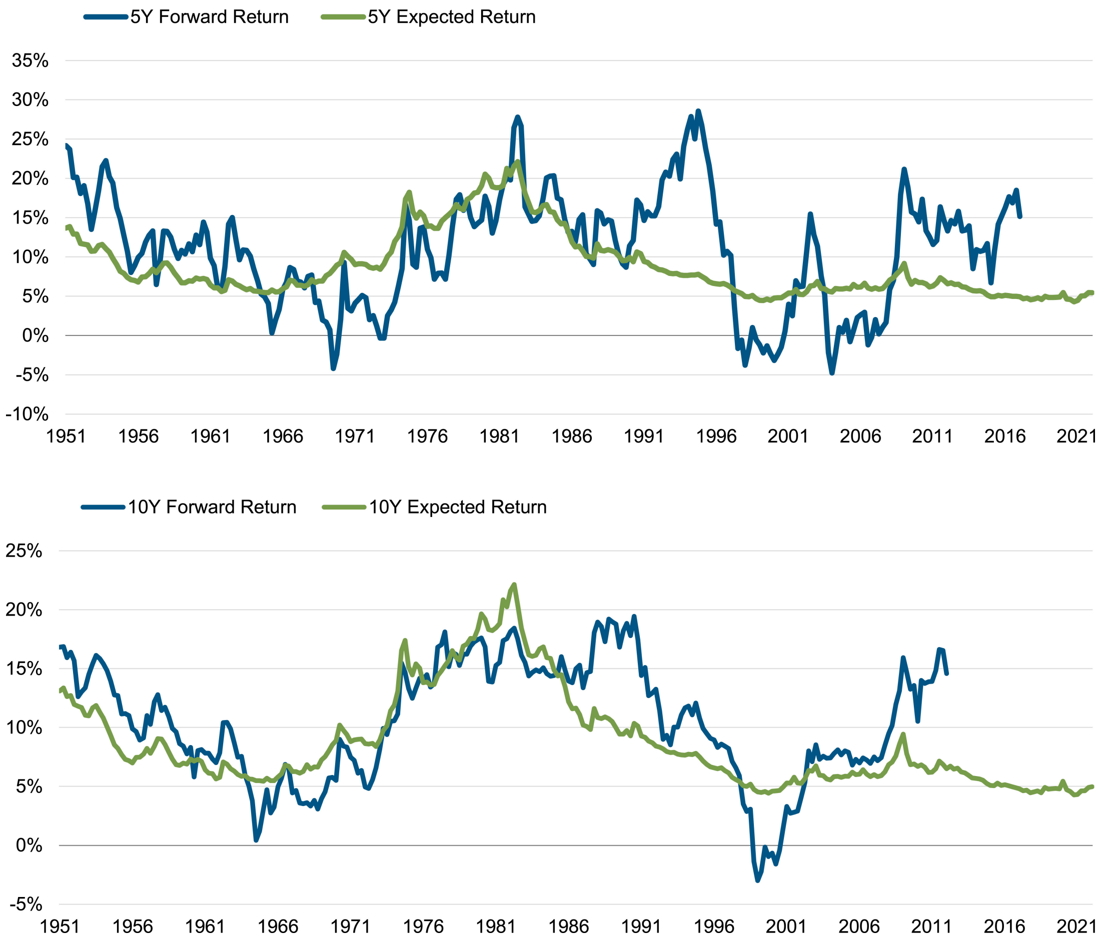
$$r^{eq}_{t+k} = \left(\frac{E}{P}\right)_t + \pi^e_{t+k} + \varepsilon_{t+k}. \tag{3}$$

Equation (3) shows that the nominal equity expected return is equal to the sum of the earnings yield and expected inflation but is conditional on the value of these variables at different points in time. Hence, the nominal equity expected return will vary through time depending on the level of the earnings yield and inflation expectations. ε_{t+k} is a residual term that accounts for returns not explained by the model.

The expected value of Equation (3) is simply the earnings yield plus expected inflation and therefore implicitly assumes no change in the future equity earnings yield—which, of course, is unlikely to be true in practice. However, Equation (3) should serve as a sensible starting point for evaluating equity expected returns. Additionally, the equation makes clear that equities are *real assets*, because nominal returns are linear in expected inflation. This requires the assumption that inflation is passed through one-to-one to earnings growth. In practice, the extent of inflation pass-through will vary with time, and the effect of changes in long-term inflation expectations may impact equity discount rates, resulting in overall valuation changes. Indeed, we show in subsequent analyses that the influence of inflation shocks on equity returns can be counter to the simple formulation in Equation (3).

We use the inverse of the Shiller price-to-earnings (P/E) ratio as a proxy for the earnings yield, and we follow Cieslak and Povala (2015) to estimate the expected inflation at different horizons. Exhibit 1 compares the time-series expected values for equity expected returns in Equation (3) with forward (future) returns at a 5Y and 10Y

Exhibit 1 Realized versus expected equity returns at the 5- and 10-year forecast horizons.



Source: PIMCO and Robert Shiller's Website as of 31 March 2022. The expected return for the S&P 500 over time from Equation (3) is shown (in green) alongside the realized forward return (in blue) at 5- and 10-year horizons. Expected return is earnings yield plus expected inflation. Earnings yield corresponds to the inverse of the Shiller's Cyclically-Adjusted *PE* Ratio and expected inflation is calculated following Cieslak and Povala (2005). Realized returns are computed as the annualized geometric future total return.

horizon. Visually, the series appear highly related. Although future realized returns vary considerably around the expected return, the general pattern of realized returns being below average when expected returns are low, and vice versa, seems apparent. Furthermore, realized deviations from the expected return are notably smaller at the 10-year horizon. In both graphs, we observe significant negative performance relative to the expected return in the late 1990s that followed the implosion of the tech bubble, and notable outperformance versus the expected return in the years following the 2008 global financial crisis (GFC).

For a default-free bond index, we can approximate the future return over horizon k as

$$r_{t+k}^{bd} = y_t - D_t \Delta y_{t,t+k}, \quad (4)$$

where y_t is the yield to maturity of the bond at time t, D_t is the bond's modified duration, and $\Delta y_{t,t+k}$ is the change in the bond yield over horizon k. For a bond held to maturity—absent defaults—the realized return will generally equal its yield. For a rebalanced bond portfolio, however, the realized return over any given interval of time will be a more complex function of the bond's duration and the evolution of interest rates. However, if one assumes no change in yields—consistent with the "random walk" view of bond yields—then the expected return on a bond is approximately equal to its yield:

$$r^{bd} = y. \tag{5}$$

Exhibit 2 shows the time-series of expected returns from Equation (5) for a monthly rebalanced 10-year Treasury index alongside forward (realized) 5- and 10-year total returns. Like the case for equities, Exhibit 2 also shows a clear pattern of realized returns moving in line with bond yields. Following the significant underperformance of Treasuries relative to starting yields in the 1970s, Treasury bonds materially outperformed their starting yield in the 1980s as runaway inflation become increasingly contained and bond yields fell. Similar to equities, deviations from the expected return model are notably tempered at a 10-year forward horizon in comparison to a 5-year horizon.

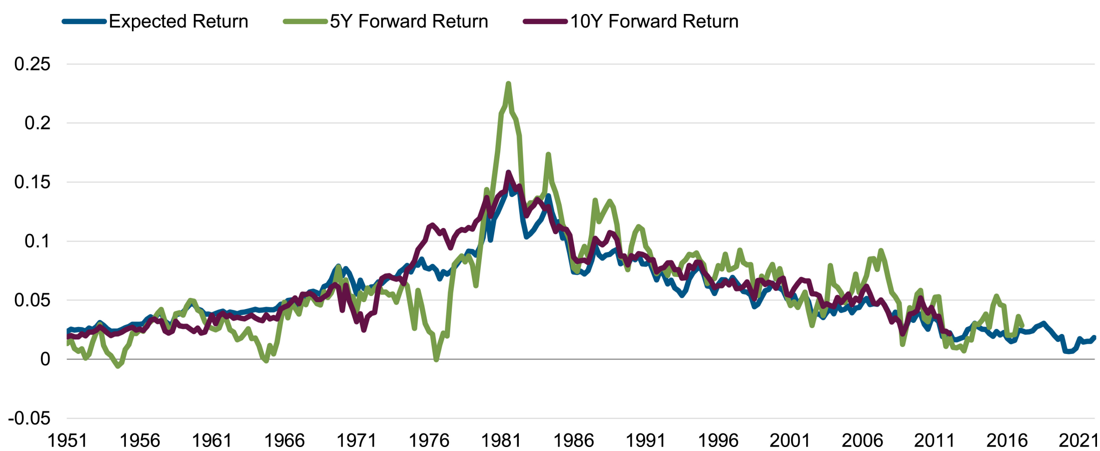
2 Portfolio Construction

Next, we illustrate the impact of our proposed metrics when constructing a stock and bond portfolio. Assuming investors maximize their utility with a CRRA function, we can show that the optimal equity allocation is:

$$w_{eq} = \frac{r_{eq} - r_{bd} + \gamma\sigma_{bd}^2 - \gamma\rho\sigma_{eq}\sigma_{bd}}{\gamma(\sigma_{eq}^2 + \sigma_{bd}^2 - 2\rho\sigma_{eq}\sigma_{bd})}, \tag{6}$$

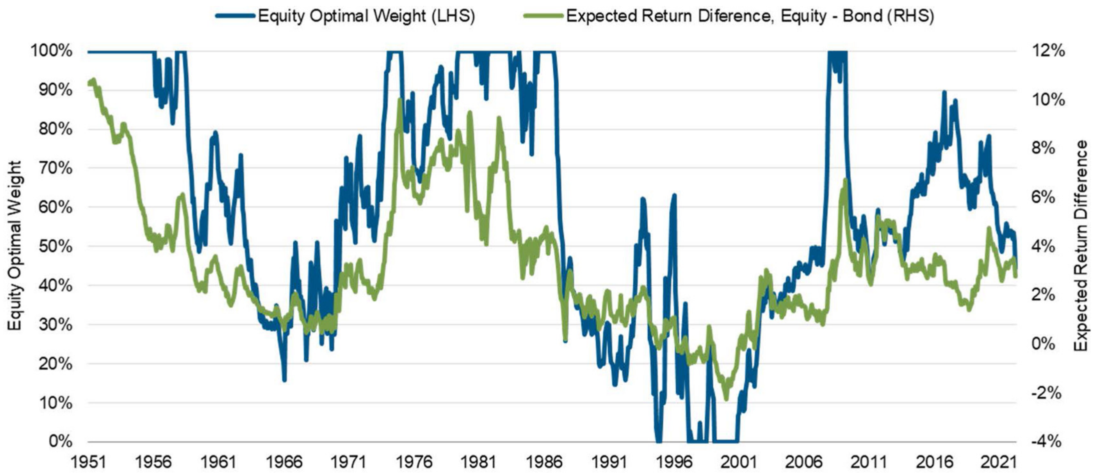
where r_{eq} is the expected equity return, r_{bd} is the expected bond return, σ_{eq} is the equity volatility, σ_{bd} is the bond volatility, ρ is the stock-bond correlation, and γ is the risk aversion parameter. Expected returns correspond to the proposed models in Section 1, while volatilities and correlations are simply based on 60-month trailing returns. Interestingly, by using a risk aversion parameter of 3, the average equity optimal allocation has been 60%.

Exhibit 2 Realized versus expected 10-year U.S. government bond returns at 5- and 10-year horizons.



Source: PIMCO and Global Financial Data as of 31 March 2022. The expected return for a 10-year U.S. government bond over time from Equation (5) is shown (in green) alongside the realized forward 5-year return (in blue) and at a 10-year horizon (in red) for a monthly rebalanced 10-year U.S. Treasury bond index. Expected returns correspond to the 10-year Treasury bond yield. Realized returns are computed as the annualized geometric future total return of the GFD 10-Year U.S. Treasury Bond Total Return Index.

Exhibit 3 Optimal equity allocation using proposed expected returns.



Source: PIMCO as of April 2022. The blue line (left-hand side) shows optimal allocation to equity in a portfolio investing in the S&P 500 and 10-year U.S. Treasury bonds. The green line (right-hand side) shows the difference between the equity and the bond expected return. The optimal allocation is determined by maximizing a CRRA utility function, as expressed in Equation (6). Weights are capped at 100% and floored at 0%. Expected returns are calculated following Section 1. Covariance matrices are calculated based on trailing 60-month returns. The risk aversion parameter is 3.

Exhibit 3 shows the historical optimal equity allocation and the difference between stock and bond expected returns. It is evident that the gap between stock and bond returns is the main driver in this asset allocation exercise. In the early 50s and throughout the 1970s, when expected equity returns were exceptionally high compared to bond yields, the optimal portfolio was mostly composed of equity. In contrast, by the end of the 1990s, when equity valuations were frothy and bond yields were high, the optimal portfolio was almost only bonds.

3 Long-Horizon Regressions

To more formally assess the efficacy of our simple models in explaining future returns, we run long-horizon regressions of future realized returns on the expected returns as described in Equations (3) and (5). We view our regressions as being in the spirit of the extensive literature on long-horizon regressions, which is usually centered around the dividend yield as a measure of current valuation (Cochrane, 2005). However, these studies generally use the dividend yield to explain both forward returns and future dividend growth, and generally find dividend yields to be more predictive of the returns than cash flow growth. Our simpler formulation effectively "endogenizes" dividend growth to be equal to a firm's return on equity (ROE) times the retention ratio. Therefore, we focus solely on the ability of our models to explain long-term future returns.

To better understand the empirical accuracy of Equations (3) and (5), we estimate the following regression for both equities and government bonds:

$$R_{t,t+k} = \hat{a} + \hat{b}E_t[r_{t,t+k}] + \varepsilon_{t,t+k}, \qquad (7)$$

where $R_{t,t+k}$ is the realized total return over horizon k and $E_t[r_{t,t+k}]$ is the expected return for each asset class as defined in Equation (3) or (5) at the start of each period.[2] If our basic models of expected return are indeed unbiased predictors of future returns, then the expected values for $\hat{a}$

Exhibit 4 Regression parameter estimates for equities, bonds and 60/40.

	60/40 Portfolio			Equity			Bonds		
	3	5	10	3	5	10	3	5	10
Intercept	3.7%	2.7%	1.7%	5.5%	3.8%	2.3%	−1.5%	−1.5%	−0.5%
	(1.93)	(1.69)	(1.53)	(1.71)	(1.40)	(1.13)	(−1.67)	(−1.88)	(−1.19)
Expected return	0.74	0.84	0.92	0.65	0.79	0.88	1.33	1.30	1.13
	(3.32)	(4.82)	(9.34)	(2.48)	(3.69)	(5.26)	(7.38)	(9.98)	(24.26)
R^2	18.3%	35.8%	68.4%	8.9%	20.9%	52.2%	59.5%	77.1%	88.5%

Source: PIMCO and Global Financial Data as of April 2022. The table shows the regression parameter estimates, with the Newey–West (1987) corrected t-statistics in parentheses. The regression is run for the period January 1951–April 2022. The equity index is the S&P 500, and the bond index is Global Financial Data's 10-Year US Treasury Total Return Index. All returns are total returns.

and $\hat{b}$ are 0 and 1, respectively. Exhibit 4 shows the regression results for bonds, equities and a standard 60/40 portfolio.[3]

Consistent with much of the literature on long-horizon regressions, we find that returns are reasonably forecastable at long horizons. The slope coefficient on equities ranges from 0.65 at a 3-year horizon to 0.88 at 10 years, with the slope increasing toward 1 with the investment horizon. While the slope coefficients for bonds are greater than 1 at all horizons, they converge toward 1 as the time horizon increases. All slope coefficients are highly statistically significant when estimated using Newey–West (1987) corrected standard errors with lags equal to the regression horizon. The intercept terms are all positive for equities and negative for bonds, but both sets of intercepts gravitate toward zero as the horizon increases, and none is statistically significant. Furthermore, while the t-statistics on the expected returns are all significantly higher than 2, most of the t-stats versus the coefficient equaling 1 are less than 2 in absolute value; the exception is bonds at the 5- and 10-year horizons.[4] R-squareds (R^2s) all increase with the horizon, but the interpretation is complicated by the use of overlapping data. Acknowledging the statistical complexities of overlapping data in long-horizon regressions (Ang and Bekaert, 2007; Hodrick, 1992), these results broadly indicate that our simple models of expected return are sensible as unbiased predictors of forward returns, with no convincing reason to believe that $\hat{a}$ and $\hat{b}$ are meaningfully different from 0 and 1, respectively.[5]

Academic studies using long-horizon regressions of the type employed here usually utilize *excess* realized returns, or the return over and above the risk-free rate. In some sense, this is a bit of a mystery, as dividend yields should forecast some combination of future cash flows and total rather than excess returns. In contrast, our regressions are based on *total* returns. We do this for two reasons. First, the simple models that we have posited are indeed intended to predict total return, not excess. Second, asset allocators care most about the predictability of total returns. Predicting excess returns is of little use to investors if the models have poor predictability for the risk-free component of return.

As it turns out, including the risk-free component of total return is significant. Exhibit 5 shows the same results as Exhibit 4, but the dependent variable is measured as excess returns. Although the broad conclusions one would reasonably derive from Exhibit 5 are similar to those of Exhibit 4, the models' explanatory power is

Exhibit 5 Regression parameter estimates for equities, bonds and 60/40 using excess returns.

	60/40 Portfolio			Equity			Bonds		
	3	5	10	3	5	10	3	5	10
Intercept	1.6%	1.1%	1.3%	1.5%	0.6%	1.1%	0.3%	0.6%	0.5%
	(0.74)	(0.72)	(0.81)	(0.44)	(0.24)	(0.58)	(0.26)	(0.69)	(0.50)
Expected return	1.01	1.06	0.94	1.15	1.24	1.01	0.97	0.65	0.80
	(1.84)	(2.36)	(3.73)	(1.97)	(2.84)	(3.84)	(1.97)	(1.66)	(2.95)
R^2	9.8%	18.2%	28.0%	12.2%	23.9%	35.9%	5.5%	4.0%	11.5%

Source: PIMCO and Global Financial Data. The table shows the regression parameter estimates, with Newey–West corrected t-statistics in parentheses, for regressions using excess returns. The regression is run for the period January 1951–April 2022. The equity index is the S&P 500, and the bond index is Global Financial Data's 10-Year US Treasury Total Return Index.

significantly diminished when excess returns are used. This is most evidenced by the notable reduction in R^2 at 10-year horizons, particularly for bonds for which the risk-free rate usually contributes materially to total return. Therefore, our results indicate that Equations (3) and (5) embed substantial information about the risk-free component of future returns. This is good news for investors who care about total returns and their inherent predictability.

Exhibit 6 Regression parameter estimates for equities, bonds and 60/40, pre- and post-1991 samples.

	60/40 Portfolio			Equity			Bonds		
	3	5	10	3	5	10	3	5	10
Pre-1991 sample									
Intercept	1.5%	0.5%	1.1%	3.9%	2.2%	2.6%	−4.1%	−3.6%	−1.1%
	(0.69)	(0.33)	(0.75)	(1.39)	(0.86)	(0.95)	(−4.06)	(−4.42)	(−3.32)
Expected return	0.90	0.98	0.96	0.73	0.85	0.84	1.57	1.49	1.19
	(3.89)	(6.07)	(8.96)	(3.45)	(5.09)	(4.71)	(8.54)	(12.40)	(33.06)
R^2	32.5%	56.6%	74.5%	16.9%	37.2%	55.2%	69.5%	84.9%	90.1%
Post-1991 sample									
Intercept	0.4%	−3.7%	−1.7%	−8.4%	−18.6%	−11.9%	0.2%	0.3%	0.6%
	(0.07)	(−0.57)	(−0.46)	(−0.68)	(−1.86)	(−3.14)	(0.18)	(0.77)	(1.37)
Expected return	1.54	2.21	1.60	3.06	4.58	3.13	1.26	1.17	0.99
	(1.34)	(2.11)	(3.07)	(1.60)	(3.19)	(5.51)	(7.26)	(13.34)	(12.44)
R^2	8.7%	27.6%	39.2%	11.4%	39.6%	65.5%	51.3%	75.8%	84.6%

Source: PIMCO and Global Financial Data as of April 2022. The table shows the regression parameter estimates, with Newey–West corrected t-statistics in parentheses. The pre-1991 regression is run for the period January 1951–December 1990, while the post-1991 regression is run from January 1991–April 2022. The equity index is the S&P 500, and the bond index is Global Financial Data's 10-Year US Treasury Total Return Index. All returns are total returns.

Finally, researchers have found that the efficacy of valuation measures such as dividend yield as a predictor of future returns has waned since the 1990s as growth-driven markets have largely outperformed and valuation has, presumably, become less relevant. For example, Lettau and Ludvigson (2001) generally find lower overall explanatory power for the dividend yield using data updated through the third quarter of 1998. However, using our methodology, along with a much more current data window, we find no such breakdown in predictability. Exhibit 6 shows regressions using the same methodology as in Exhibit 4 but splits the sample between pre-1991 and post-1991 periods. We generally find that the models of expected return put forth in Equations (3) and (5) have similar predictive power over both time periods. In both the pre-1991 and post-1991 samples, the coefficients on expected return are positive and statistically significant. In fact, equity R^2 are higher in the post-1991 sample at 5- and 10-year horizons. Interestingly, the coefficients on the expected return for equities are much larger than 1 in the post-1991 sample. This indicates not only that our models of expected return have been positively related to future total returns but also that the effect has been *amplified* relative to the pre-1991 period.

4 Return Differences versus Models

Although the models described in Equations (3) and (5) do a reasonable job of predicting long-horizon returns, as shown in Exhibits 1 and 4, the realized deviations from expected returns can at times be meaningful. This is particularly true in the case of equities, given their inherent long duration and resulting high sensitivity to innovations in market-wide discount rates. For example, as shown in Exhibit 1, equity markets have performed significantly better in recent years than their expected return. To better understand these linkages, in this section we investigate the portion of realized returns that are unexplained by Equations (3) and (5).

For bonds, slippage between forecasts and realized returns is driven almost entirely by innovations in market-wide bond yields. Equation (5) implicitly assumes that bond yields remain unchanged, so naturally future changes in yields will cause differences between realized and expected returns.

Equities should be similarly influenced by changes in bond yields, as they represent the risk-free component of discount rates. Additionally, equities should respond to shocks to the growth rate of earnings, increasing when earnings growth is high, and vice versa. To ascertain the degree to which these factors influence residual returns for equities and bonds, we run regressions of the differences between realized returns and forecasted returns on changes in real bond yields, earnings growth rate shocks and inflationary shocks. Specifically, we estimate regression models of the following form for equities, bonds and a 60/40 portfolio:

$$\begin{aligned} R_{t,t+k} - E_t[R_{t,t+k}] &= \hat{\alpha} + \hat{\beta}_1 \Delta y^r_{t,t+k} \\ &\quad + \hat{\beta}_2 e^{sur}_{t,t+k} + \hat{\beta}_3 \pi^{sur}_{t,t+k} + \epsilon_{t,t+k}, \quad (8) \end{aligned}$$

where $E_t[R_{t,t+k}]$ is the expected return from Equations (3) and (5) for the period between t and $t+k$, $\Delta y^r_{t,t+k}$ is the realized change in the 10-year real bond yield, $e^{sur}_{t,t+k}$ is the realized earnings surprise, and $\pi^{sur}_{t,t+k}$ is the realized inflation surprise. All of the right-hand variables are *contemporaneous* with the left-hand variables, as our purpose is to explain—rather than predict—a portion of the non-model future returns.[6]

The results from regression Equation (8) for equities, bonds and the 60/40 portfolio are shown in Exhibit 7. As expected, both the change in

Exhibit 7 Residual return regressions for equities, bonds and 60/40.

	60/40 Portfolio			Equity			Bonds		
	3	5	10	3	5	10	3	5	10
Intercept	2.0%	1.8%	1.2%	2.5%	2.1%	1.2%	0.7%	0.6%	0.4%
	(2.54)	(3.00)	(3.48)	(1.88)	(2.06)	(1.92)	(5.64)	(3.75)	(1.84)
Real yield change	−1.30	−0.21	0.67	1.98	3.09	2.78	−5.72	−4.51	−1.59
	(−0.97)	(−0.21)	(0.55)	(0.85)	(1.63)	(1.37)	(−13.60)	(−8.41)	(−1.47)
Real earnings surprise	0.11	0.13	0.14	0.18	0.24	0.26	−0.01	−0.02	−0.03
	(3.23)	(4.10)	(3.21)	(2.95)	(3.91)	(3.24)	(−0.55)	(−1.83)	(−1.06)
Inflation surprise	−1.20	−0.98	−0.33	−1.53	−1.29	−0.44	−0.79	−0.56	−0.20
	(−4.10)	(−4.28)	(−2.17)	(−3.11)	(−3.30)	(−1.81)	(−14.23)	(−9.24)	(−3.12)
R^2	31.9%	40.6%	32.3%	24.0%	35.0%	31.5%	90.6%	81.8%	24.2%

Source: PIMCO and Global Financial Data as of April 2022. The table shows the regression results from Equation (8) for equities, bonds and a 60/40 portfolio. The regressions are run from the period January 1951 to April 2022.

real yields and unexpected inflation have a negative and statistically significant impact on the unexplained component of bond returns. The coefficient on the real yield change can be interpreted as the (negative of the) effective bond duration, which will differ from a bond's analytical duration. The real yield coefficient becomes significantly smaller in magnitude with horizon. At longer time horizons, the total return of a rebalanced bond portfolio is less affected by changes in yields and will be driven more by the path of interest rates and the corresponding coupon income. The coefficients on the inflation surprise are all negative and statistically significant, particularly at shorter horizons, implying that bonds are most sensitive to inflation shocks at a 3- to 5-year horizon. At a 10-year horizon, market yields will generally respond to innovations in the persistent component inflation; therefore, shocks to inflation should have a diminishing impact on bond returns over time.

Like bonds, equities also show a negative relationship with inflation surprise, and the results are highly statistically significant—though not at a 10-year horizon. Interestingly, equities exhibit even greater near-term inflation sensitivity than bonds, with inflation loadings more than two times higher. However, while the signs on the inflation coefficient are what we might expect for bonds, the results for equities run counter to Equation (3), which models equity returns with full inflation pass-through to earnings. The negative coefficients on inflation surprise show that reality is more complex, as even at 5-year horizon equities have a negative and statistically significant loading on inflation surprise. This may challenge the notion of equities as "real assets," as their positive linkage to inflation is dubious at best. At long horizons, however, inflationary shocks appear to be less problematic for equity investors.

Equities show a positive and statistically significant loading on earnings surprise. This is perhaps as expected, given that earnings are the fundamental driver of equity valuations. Nonetheless, the results in Exhibit 7 show that equities are highly sensitive to the unexpected component of earnings growth. But in contrast to inflation surprise and real bond yield change, the coefficient on earnings surprise gets larger in magnitude with horizon, and the statistical significance is similar across horizons. Given the long-duration nature of equity cash flows, one may expect equities to be characterized by a negative and statistically significant loading on the real yield change. In fact, the coefficients on the real yield change are all positive but statistically insignificant. Empirically, it tends to be the case that equities do well when real yields are rising, and vice versa, as central bank policy is generally pro-cyclical in nature. However, the linkage is weak statistically, as the t-stats on real yield change are low at all forecast horizons. Although we focused in macro variables, other factors explaining the recent outperformance of the equity relative to our models can be the increase in technological innovations and the improved market liquidity due to broader access to financial markets.

5 Equities and Current Valuations

Given our historical results in the previous section, which show strong U.S. equity performance over the past several years, an obvious question is, "Where do we go from here?" As shown in Exhibit 1, equity markets have significantly outperformed the model of earnings yield plus expected inflation in recent years, while bonds have more or less generated returns in line with their yield. Is there any reason to believe that this discrepancy for equities is likely to mean-revert over some horizon? To better understand this question, we revisit the Gordon model for the value of an equity security:

$$P = \frac{D}{r^{EQ} - g}, \tag{9}$$

where P is the value of an equity security, D is the next period's dividend, r^{EQ} is the expected return, and g is the equity dividend growth rate. For our purposes here, we treat each variable in Equation (9) as *real*. Taking the log of the equation and differentiating produces:

$$\frac{dP}{P} = \frac{dD}{D} - \frac{1}{r^{EQ} - g}[dr^{EQ} - dg]. \tag{10}$$

Equation (10) shows that the equity return is affected positively by changes in the dividend growth rate and the next period's dividend, and negatively related to changes in the equity expected return. Both the dividend growth rate and the equity expected return amplify returns by $(r^{EQ} - g)^{-1}$, which, as shown in Equation (9), is equal to the forward price-to-dividend ratio. Hence, Equation (10) can be expressed as:

$$\frac{dP}{P} = \frac{dD}{D} - \frac{P}{D}[dr^{EQ} - dg]. \tag{11}$$

Thus, changes in the dividend growth rate and the required return will have a disproportionally large change on stock returns relative to the next period's dividend change. This can be easily seen by the fact that the required return and growth rate are scaled by the price–dividend ratio, which, given the current U.S. equity dividend yield of about 1.5%, implies that the impact of changes is amplified by approximately 70 times.[7]

Predicting changes in the drivers of equity returns necessitates the development of a framework for thinking about a "natural habitat" for the equity expected return and dividend growth rate. In this spirit, we further decompose the denominator of Equation (9) into three subcomponents, as

$$r^{EQ} - g = (r^{EQ} - r^f) + (r^f - g^{GDP}) + (g^{GDP} - g), \tag{12}$$

where r^f is the real risk-free bond yield and g^{GDP} is real GDP growth. Each of the components in Equation (12) has an economic interpretation, and we take some liberty in couching each of them as a *risk premium*. The *equity risk premium*, $r^{EQ} - r^f$, is the required return in excess of the risk-free rate necessary to compensate investors for incurring equity risk. The *bond risk premium*,

$r^f - g^{GDP}$, is the difference between the real government bond yield and real GDP. Although the conventional definition of the bond risk premium is different from what we have used here, there is a clear positive economic linkage between the rate of GDP growth and the risk-free rate of interest in the economy.[8] Finally, we term $g^{GDP} - g$ as the *equality risk premium* because it can be interpreted as the difference between labor income growth and corporate profit growth. Because labor income represents approximately 70% of U.S. GDP, when this gap is small it broadly implies that both labor income and investment capital are experiencing similar growth rates. Ignoring the dD/D term in Equation (11), given its relatively small importance, and defining each risk premium in Equation (12) more compactly as α, β and γ, respectively, we can express Equation (11) as:

$$\frac{dP}{P} = -\frac{P}{D}[d\alpha + d\beta + d\gamma]. \qquad (13)$$

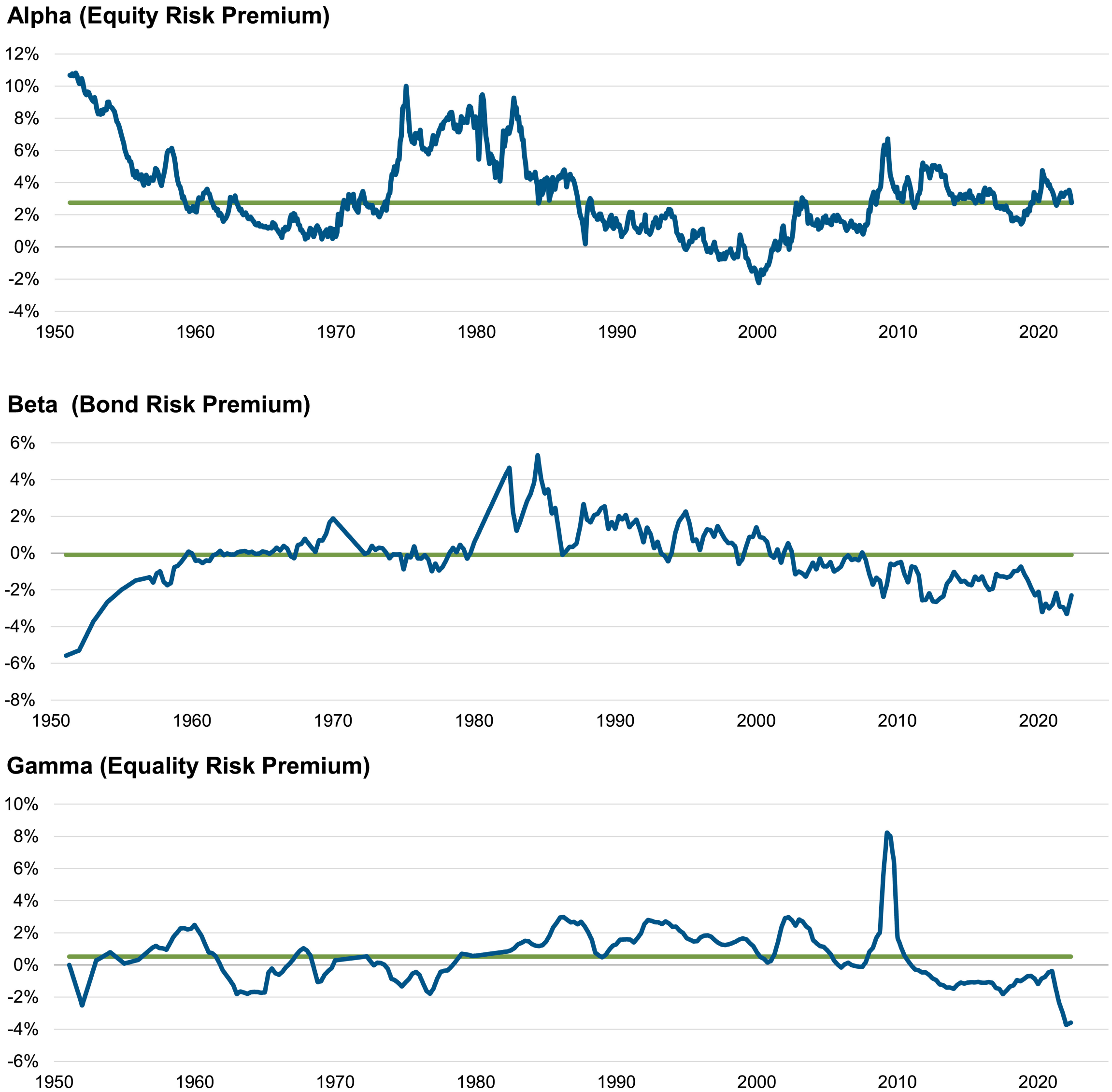
Exhibit 8 shows the time-series graphs for α, β and γ since 1951, along with their average values. Additionally, we present a table showing the distribution of values for each variable. Alpha is measured as the difference between the inverse of the Shiller P/E ratio and the estimated 10-year real bond yield.[9] Beta is the difference between the estimated real 10-year bond yield and forecasted 10-year GDP growth.[10] Finally, gamma is the 10-year expected real GDP growth minus expected real earnings growth.

The equity risk premium, or alpha, was generally at its median level based on history to 1951, although it was somewhat below its mean value by approximately 0.2 standard deviations. Because alpha measures the risk premium of equities relative to risk-free bonds, we conclude that equities were generally fairly valued relative to bonds as of 30 April 2022. However, if we extended the data to samples going back further than 1951, equities would appear somewhat rich, as the ex ante equity risk premium was much higher in periods before the U.S. Treasury-Federal Reserve Monetary Accord of 1951. Both the bond risk premium (beta) and the equality risk premium (gamma) are currently at levels far below their historical averages.

Low real interest rates instituted by the Federal Reserve in the post-GFC era, and the dramatic cut to short-term rates following the onset of the COVID-19 crisis in March 2020, have resulted in real interest rates today that are well below real GDP. As such, the bond risk premium currently resides in the 10th percentile of history, using data since 1951. Relatively stagnant wage growth over this same time period has resulted in a far higher rate of corporate earnings growth relative to GDP. Low real interest rates globally, as well as quantitative easing programs initiated after both the 2008 financial crisis and the 2020 COVID-19 outbreaks, have arguably favored corporate profit growth over labor income growth. As a result, gamma currently resides at the lowest level in our sample going back 70 years. Indeed, barring a significant but short-lived increase in gamma during the heart of the GFC, due to the precipitous fall in real GDP growth, the variable has been well below its historical average since around 2002.

Because the alpha term is in line with history, while both beta and gamma are well below their historical means, we view increases in the bond risk premium or the equality risk premium as the most likely candidates to precipitate an equity market sell-off. Although beta could increase due to either an increase in bond yields or a decrease in the long-run GDP growth rate, given historically low bond yields today, a rise in yields would seem to be the greatest risk. On the other hand, we view potential increases to the gamma term as likely to come from a decline in corporate profit growth

Exhibit 8 Historical time-series for alpha, beta, and gamma.



30 April 2022	Current	Percentile	Median	Mean	Standard deviation
Alpha	2.75%	50%	2.76%	3.27%	2.63%
Beta	−2.30%	10%	−0.08%	−0.10%	1.51%
Gamma	−3.59%	0%	0.57%	0.55%	1.63%

Source: PIMCO, Global Financial Data, and Robert Shiller's website. Data covers period from January 1951 through April 2022. The graph shows the time-series for the equity risk premium (alpha), the bond risk premium (beta), and the equality risk premium (gamma). The equity risk premium is currently near its long-run average level, but both the bond risk premium and the equality risk premium are well below their long-term means.

relative to GDP, given the stark contrast between profit growth and overall economic growth in recent years.

With the bond risk premium and the equality risk premium at historically low levels, it is useful for investors to understand the potential implications of increases in these variables. As shown in Equation (13), an increase in any of the three terms—alpha, beta or gamma—will, in theory, have the same impact on equity returns. To better understand the potential effect that an increase in any one of these variables may have on equity returns, Exhibit 9 shows the impacts of various increases in one of these terms at different investment horizons. The first column in Exhibit 9 indicates the shock to one of the three terms, and the cells represent the annualized-to-horizon returns associated with each shock. Shocks are assumed to occur at the end of the first year and be zero thereafter. As expected, increasingly large shocks lead to more negative returns initially. However, because discount rates are now higher, long-run returns are higher as well. However, the break-even period is in excess of 10 years, highlighting the long-duration nature of equities.

Exhibit 9 Impact of shocks to alpha, beta, and gamma for various investment horizons.

Shock size (bps)	Horizon (years)				
	1	3	5	10	20
0	5.64%	5.64%	5.64%	5.64%	5.64%
50	−2.00%	3.35%	4.46%	5.30%	5.72%
100	−8.42%	1.36%	3.44%	5.03%	5.83%
150	−13.87%	−0.38%	2.56%	4.83%	5.98%
200	−18.54%	−1.91%	1.80%	4.68%	6.15%
250	−22.58%	−3.26%	1.15%	4.59%	6.35%

Source: PIMCO. The table shows annualized returns associated with different investment horizons after a one-time shock to alpha, beta, or gamma. All shocks are assumed to occur at the end of the first year and remain at the new values thereafter. Positive shocks lead to lower current returns but ultimately result in higher long-run returns.

6 Conclusion

Long-horizon total returns are reasonably predictable using simple models of expected return. Under certain simplifying assumptions, the classic Gordon model for the value of an equity security produces expected returns equal to the earnings yield plus expected inflation. The random-walk model for bond yields implies that a bond's expected return is equal to its yield. Although these basic formulations of expected return by no means perfectly predict future returns, rigorous statistical analyses indicate that these models contain real information and therefore should prove useful to asset allocators as a starting point when constructing optimal portfolios.

In the post-GFC era, equities have significantly outperformed the basic expected return model posited here. Furthermore, this outperformance cannot be completely explained by contemporaneous changes in real bond yields, earnings growth or inflation. To assess the potential impact of reversion of equity prices to some "equilibrium" level, we posit a conceptual framework for the drivers of the discount rate for the Gordon model. Given today's valuation levels for the *bond risk premium* and the *equality risk premium*, we view a rise in real rates and/or a decline in the rate of corporate profit growth to be the most likely candidates for mean-reversion.

Appendix A Derivation Equity Expected Return

The Gordon growth model states that price of a stock is

$$P = \frac{D}{r_{real}^{eq} - G} \tag{A.1}$$

where D is the dividend, G is the expected (long-run) real dividend growth rate, and r^{eq}_{real} is the equity real return. Assuming the firm retains earnings at a constant rate b then $D = (1-b)E$. If dividend growth matches earnings growth, we can rewrite the dividend growth as

$$G = \frac{\Delta E}{E} = \frac{bE}{E} \cdot \frac{\Delta E}{bE} = b \cdot i, \quad \text{(A.2)}$$

where ΔE is the dollar change in earnings and i is the real internal rate of return on retained earnings. In equilibrium, firms invest until $r^{eq} = i$ hence

$$P = \frac{(1-b)E}{r^{eq}_{real} - b \cdot r^{eq}_{real}} = \frac{E}{r^{eq}_{real}} \quad \text{(A.3)}$$

$$r^{eq}_{real} = \frac{E}{P}. \quad \text{(A.4)}$$

Finally, the nominal expected return can be expressed as the sum of earnings yield and expected inflation π^e:

$$r^{eq} = \frac{E}{P} + \pi^e. \quad \text{(A.5)}$$

Note that by assuming real earnings growth is proportional to the real growth, we are defining the nominal earnings growth as:

$$g = R^{eq} \cdot b + \pi^e. \quad \text{(A.6)}$$

Appendix B Earnings Yield and Time-Varying Returns

The definition of the gross returns is

$$R_{t+1} = \frac{P_{t+1} + D_{t+1}}{P_t}, \quad \text{(B.1)}$$

where P is the price and D is the cash flow during the period. Multiplying by R^{-1}_{t+1} yields the identity

$$1 = R^{-1}_{t+1} R_{t+1} = R^{-1}_{t+1} \frac{P_{t+1} + D_{t+1}}{P_t}. \quad \text{(B.2)}$$

Multiplying by the dividend-to-price ratio and manipulating produces

$$\frac{D_t}{P_t} = (R_{t+1}) \left(\frac{D_t}{D_{t+1}} \right) \left(\frac{1}{1 + P_{t+1}/D_{t+1}} \right). \quad \text{(B.3)}$$

This formulation shows that the current dividend yield must explain future returns, future dividend growth or future prices. More specifically, when the dividend yield is "high," it must imply some combination of higher returns, lower cash flow growth or lower future price–dividend ratios.

Let b be the earnings retention ratio so that $D_t = E_t(1-b)$. If the retention ratio is constant, then $D_t/D_{t+1} = E_t/E_{t+1}$. Therefore, Equation (B.3) can be written in terms of the earnings yield as

$$\frac{E_t}{P_t} = (R_{t+1}) \left(\frac{E_t}{E_{t+1}} \right) \left(\frac{1}{1 - b + P_{t+1}/E_{t+1}} \right) \quad \text{(B.4)}$$

or

$$\frac{E_t}{P_t} = \frac{R_{t+1}}{G_{t+1}} \left(\frac{1}{1 - b + P_{t+1}/E_{t+1}} \right), \quad \text{(B.5)}$$

where G_{t+1} is the gross earnings growth rate. As with the dividend yield, the current earnings yield is a statement about future returns, future dividend growth or future prices. As is customary, we impose the "no-bubble condition," which says that the P/E ratio should not move continually higher. Therefore, we can express the log earnings yield as

$$\ln\left(\frac{E_t}{P_t} \right) = c + \ln(R_{t+1}) - \ln(G_{t+1}), \quad \text{(B.6)}$$

where $c = -\ln(1 - b + \bar{P}/\bar{E})$. Hence, $\bar{P}/\bar{E}$ can be interpreted as the long-run average price-to-earnings ratio. Given the well-documented research that there is little relationship between the valuation measures and future cash flow

Exhibit B.1 Robust standard errors of parameter estimates for equities, bonds and 60/40.

		60/40 Portfolio			Equity			Bonds		
		3	5	10	3	5	10	3	5	10
Intercept	Coefficient	3.7%	2.7%	1.7%	5.5%	3.8%	2.3%	−1.5%	−1.5%	−0.5%
	NW SE	1.9%*	1.6%*	1.1%	3.2%*	2.7%	2.0%	0.9%	0.8%	0.4%
	Hodrick SE	2.3%	3.8%	7.9%	3.2%*	5.5%	11.9%	1.7%	2.7%	4.9%
	Non-overlapping SE	3.6%	2.0%	1.3%	5.6%	3.0%	2.0%	1.6%	0.9%	0.5%
Expected Return	Coefficent	0.74	0.84	0.92	0.65	0.79	0.88	1.33	1.30	1.13
	NW SE	0.22**	0.17**	0.10**	0.26**	0.21**	0.17**	0.18**	0.13**	0.05**
	Hodrick SE	0.32**	0.53	1.03	0.33*	0.57	1.17	0.35**	0.55**	0.95
	Non-overlapping SE	0.28**	0.27**	0.31**	0.34*	0.36**	0.45*	0.25**	0.21**	0.12**

Source: PIMCO, Bloomberg and Global Financial Data as of April 2022. The table shows the regression parameter estimates and standard errors corrected using different methods. ** are statistically significant at a 5% level and * at 10% level. The regression is run for the period January 1951–April 2022. The equity index is the S&P 500, and the bond index is Global Financial Data's 10-Year US Treasury Total Return Index. All returns are total returns.

growth (), we focus on the ability of the earnings yield to explain future returns. As noted in the paper, we find little difference in the regression results between log and non-log, and therefore use non-log regressions largely for purposes of intuition.

Standard error correction for long-horizon regressions

As observations in long-horizon regressions overlap, the regression errors will be serially correlated and the standard errors will be biased downward. We use the method of Newey and West (1987) to correct the standard errors, utilizing a lag equal to the horizon in the regressions. Following Ang and Bekaert (2007), we also include the correction proposed by Hodrick (1992). Additionally, we produce standard errors for regressions with no overlapping data. In Exhibit B.1, we show the standard errors corrected by the different methodologies. While Hodrick standard errors are higher than Newey–West, Newey–West standard errors are more similar to non-overlapping standard errors.

Endnotes

1 See the Appendix for a more detailed derivation of the expected equity return.

2 Academic studies using long-horizon regressions usually use log excess returns on log dividend yields. This is done because log-linear approximations can be obtained under certain assumptions, which lend themselves nicely to linear regressions. We find that taking logs makes little difference in our regressions. As such, we present our results using raw returns.

3 The 60/40 returns were computed by rebalancing between the S&P 500 and Global Financial Data's 10-Year US Treasury Total Return Index at a monthly frequency.

4 t-Statistics versus 1 not shown.

5 In the Appendix, we estimate standard errors using Newey–West, Hodrick, and nonoverlapping data. Consistent with Ang and Belaert (2007), the Hodrick standard errors are higher than for Newey–West, however, standard errors using nonoverlapping data are more consistent with Newey–West. The debate over which

standard errors to use in long-horizon regressions is robust, and we do not attempt to resolve it here.

[6] The 10-year real bond yield is the nominal 10-year U.S. Treasury yield from the Global Financial Data minus the Cieslak–Povala expected inflation. Real earnings surprise is the realized real earnings growth minus the expected real earnings growth, with expected real earnings growth measured as the 30-year trailing realized real earnings growth. Earnings data is taken from Robert Shiller's website. The inflation surprise is the realized inflation minus the Cieslak–Povala expected inflation.

[7] The first-order approximation shown in Equation (10) overstates the negative returns associated with increases in the equity discount rate. This is because the long-duration nature of equities implies that they are highly convex in each of these variables. Thus, the actual return will be less negative than that suggested by Equation (10).

[8] From a theoretical perspective, real interest rates should be high when income growth is high, as investors require higher interest rates in order to defer consumption into the future.

[9] To estimate the real bond yield, we use the 10-year government bond yield from Global Financial Data and subtract the Cieslak–Povala expected 10-year inflation at each point in time.

[10] Expected 10-year real GDP growth is estimated as a function of the trailing 10-year real GDP growth. Using annual data from 1992 to 2021, we fit a linear model that uses the trailing 10-year real GDP growth to match the Survey of Professional Forecasters' 10-year expected real GDP growth. Once the model is fitted, we use the predicted values from the model to calculate the expected 10-year real GDP growth on a quarterly frequency from 1951 to 2022.

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Keywords: Expected returns; 60/40 portfolio; asset allocation.