What rate of return can we expect over the next decade?

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Abstract

I evaluate how a range of stock market predictors have captured fluctuations in long-term (10 years) US real stock returns during the 1891-2016 period. Two predictors stand out: (i) the cyclical-adjusted earnings yield (CAPE) and (ii) the 'sum of the parts', in this case the sum of the dividend yield, GDP growth, and mean reversion in the stock price-GDP multiple. I use CAPE and the 'sum of the parts' to calculate time-series estimates of expected returns on stocks throughout history. Currently, real returns from stocks are expected to be low over the coming decade. Together with expected low real returns from bonds, this implies expected low returns from a typical equally-weighted stock/bond portfolio. I briefly discuss implications of low expected returns.

Key words: Stock return predictors. Expected real returns. Low interest rates. Consequences of low returns.

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1. Introduction

What should we expect stocks and bonds to return over the next decade? The answer to this question has important implications for private investors who think about how much to put aside for long-term savings (e.g., retirement savings), for the asset-allocation decisions of long-term investors (both individual investors and professional asset managers, e.g., pension funds), and for societies at large that strive to achieve economic outcomes where individuals do not face significantly lower income streams during retirement.

In this paper, I analyze a range of forecasting variables and use those that have tracked time-series movements in expected real stock returns particularly well to estimate expected returns over the coming decade. I proceed as follows. I first provide an overview of methods analysts can use to back out estimates of expected real stocks returns from observable market data. Based on this overview, I analyze eighteen stock-market predictors for which I have time-series data covering the period from 1871 through 2016. I evaluate how each predictor, year-by-year, has tracked ten-year ahead real returns from US large-cap stocks. I find that valuations ratios (the Shiller CAPE, the dividend yield, the stock price/GDP ratio, etc.) at the beginning of the holding period and expected mean reversion in valuation ratios over the holding period, in general, have been useful for forecasting ten-year ahead real stock returns. Interest rate variables (the short interest rate, the Fed Model, etc.), on the other hand, have not. I also find that (i) the cyclical-adjusted earnings yield (CAPE) of Shiller (Campbell & Shiller, 1988a) and (ii) the sum of the dividend yield, GDP growth, and reversion in the stock price-GDP multiple towards its historical mean ('the sum of the parts') have tracked future returns particularly well. Combining CAPE and 'the sum of the parts', I calculate time-series estimates of expected returns throughout history. I also calculate a forecast of what we can reasonably expect U.S. large-cap stocks to return in real terms over the next decade.

I expect low returns going forward. I expect stocks to return around 3% per annum over the next decade in real terms. This is close to only half of the app. six percent that stocks historically have returned in real terms. In fact, there have been few years where expected returns have been as low as they are today. I also discuss how robust this forecast is with respect to meaningful variations in input parameters. I find it to be rather robust.

I combine expected returns from stocks with expected returns from bonds to find the expected return on an equally-weighted (50%/50%) stock-bond portfolio. I expect bonds to return close to 1% percent in real terms over the next decade. Hence, a 50%/50% portfolio of bonds and stocks is expected to yield around 2% per annum on average over the next decade. This is considerably lower than the average annual real return of 4.4% that investors have obtained from such a portfolio since 1871.

My analysis relates to a large literature dealing with forecasts of long-horizon stock returns, including, e.g., Fama & French (1988, 2002), Bogle (1991a, 1991b), Arnott & Bernstein (2002), Ibbotson & Chen (2003), Grinold & Kroner (2002), Asness & Ilmanen (2012), Bernstein (2015), Bogle & Nolan (2015), and Siegel (2016). These papers generally present long-term (usually ten years) equity forecasts based on one a priori selected predictor. I make at least five contributions to the literature: First, I provide a consistent overview of different methods analysts can use to back out expected returns from stocks. This overview should help analysts gauging different forecasts for stocks. Second, I compare how well different predictors have captured movements in ten-year ahead real equity returns throughout history. Third, I find that mean reversion in the stock price-GDP multiple has tracked ten-year ahead real returns with higher precision than mean reversion in the stock price-earnings (or stock price-dividends) multiple. Fourth, I show that the 'sum of the parts' (the sum of the dividend yield, GDP growth, and mean reversion in the stock price-GDP multiple) has forecasted future returns as well as the often-used CAPE-ratio of Shiller. Fifth, I present estimates of expected real returns over the coming decade and I discuss robustness and implications.

The paper proceeds as follows. I the next section, I present an overview of different methods analysts use to back out time-series estimates of expected returns from stocks. I describe the data I use in Section 3. Section 4 contains the main analysis. It shows how well different predictors have captured fluctuations in real stock returns throughout history. In Section 5, I briefly discuss expected real returns from bonds, such that I can present time-series estimates of expected returns on 50/50 portfolios in Section 6, including the current estimate of expected returns over the next decade. Section 7 discusses variations in input parameters, and how they affect the current estimate of expected returns. Section 8 concludes.

2. How can we back out expected returns on stocks?

A useful starting point is to recall that stock returns:

$$1 + R_{t+1} = (P_{t+1} + D_{t+1})/P_t,$$

can always be decomposed as:[1]

$$R_{t+1} = {}^{D_{t+1}}/_{P_t} + \Delta F_{t+1} + \Delta PF_{t+1}, \tag{1}$$

where D_{t+1}/P_t is the dividend yield, i.e. dividends paid out during the investment period in relation to the price paid for the stock at the beginning of the investment period, ΔF_{t+1} is the growth rate of a relevant fundamental over the investment period, and ΔPF_{t+1} is the growth rate of the stock-price multiple over the investment period. The "fundamental" can be any variable that stock prices are expected to mean-revert towards, such as earnings, dividends, GDP, or similar. The stock-price multiple is the ratio of stock prices to the fundamental, such as the stock price-earnings multiple, stock price-dividend multiple, etc. Recognizing that stock returns are given by the sum of three components:

- The dividend yield,
- growth in fundamentals over the holding period, and
- growth in the stock-price multiple over the holding period,

provides a consistent approach to forecasting returns: To *forecast* stock returns, one has to *forecast* the dividend yield, growth in fundamentals, and growth in the stock-price multiple. As an example, if the dividend yield is expected to be 2%, growth in dividends per share

[1] I derive Eq. (1) in the Appendix. A small correction term also appears in the decomposition of returns. This term disappears when analyzing log returns and using the dividend-price ratio instead of the dividend yield in Eq. (1); see the Appendix.

also estimated to be 2%, and stock market valuations are at neutral levels, so that no changes in stock-price multiples are expected, expected future returns are 2% + 2% + 0% = 4%. Varying expected growth rates or rates of expansion/contraction in price-multiples, one can evaluate how forecasts of returns vary. For instance, a pessimistic investor who believes that the stock price-dividend ratio is high and market valuations consequently have to come down by, say, 4% per year, will expect a return of 0% over the investment horizon, if the dividend yield and dividend growth rate are expected to be 2% each. In the same vein, stocks have historically returned around 6% per year on average in real terms, as I also show below. If the dividend yield is 2%, it requires, e.g., a real growth rate of 2% and a multiple expansion of 2% per year, to reach the historical average of real stock returns.

But how should we evaluate whether fundamentals are expected to growth by 0%, 1%, 2% per year, or something different? And how should we judge whether multiples are likely to expand or contract over the coming decade? The procedures used in the literature can be classified into the following forecasting approaches:

- Forecast stock returns based on the dividend yield, i.e. the first component of Eq. (1): D_{t+1}/P_t.
- Forecast stock returns based on the dividend yield and growth in fundamentals, i.e. forecasts based on the first two components of Eq. (1): $D_{t+1}/P_t + \Delta F_{t+1}$.
- Forecast stock returns based on the dividend-price ratio, growth in fundamentals, and growth in stock-price multiples, i.e. forecasts based on all three components of Eq. (1): $D_{t+1}/P_t + \Delta F_{t+1} + \Delta PF_{t+1}$.

Dividend-price ratio or other valuation ratios in isolation:

A large academic literature, starting with Fama & French (1988), who even refer back to Dow (1920), uses the current value of the dividend-price ratio on its own, i.e. disregard growth in fundamentals and price multiples, when forecasting long-run stock returns.[2]

[2] Fama & French (1988) gave the following explanation: "*The hypothesis that D/P forecasts returns has a long tradition among practitioners and academics [for example, Dow (1920) and Ball (1978)]. The intuition of the 'efficient markets' version of the hypothesis is that stock prices are low relative to dividends when discount rates and expected returns are high, and vice versa, so that D/P varies with expected returns.*" Campbell & Shiller (1988b) formally showed why the dividend yield contains information about expected returns and growth rates of dividends.

While the initial reaction to the study of Fama & French (1988) was that it provided strong evidence in favor of return predictability by the dividend-yield, later research has questioned this interpretation (see Cochrane, 2008 for a discussion). For instance, dividends might be smoothed, or firms might return profits to shareholders via buy-backs instead of outright dividends, causing the dividend yield to send imprecise signals about future returns (Boudoukh et al., 2007). Researchers have thus looked at other stock-price valuation ratios when forecasting the return on a broad portfolio, such as the share-price to GDP ratio (Rangvid, 2006), the share-price to consumption ratio (Menzly, Santos & Veronesi, 2004), the consumption-asset wealth ($\widehat{cay}$) ratio (Lettau & Ludvigson, 2001), etc. It is important to note that some of the more recently invented predictors, such as the $\widehat{cay}$-ratio, are not available for the long historical sample that I study.

One valuation ratio plays a particularly prominent role when predicting long-term real stock returns: the earnings yield, and, probably even more popular, the Cyclical-Adjusted Price-Earnings (CAPE) ratio of Shiller (Campbell & Shiller, 1988a) which is the current share price dividend by the average of earnings over the last ten years. There is a good reason why CAPE has played a prominent role when forecasting real returns; by themselves, earnings yields should proxy for expected real returns on stocks (Siegel, 2014 and Pedersen, 2015).

Dividend yields and growth in fundamentals:

Fama & French (2002), Arnott & Bernstein (2002), Ferreira & Santa-Clara (2011), and Asness & Ilmanen (2012) forecast returns by combining current dividend yields with expectations to growth in dividends or earnings. When forecasting returns over long periods of time – such as ten years – some researchers simply assume a growth rate, say 1.5% per year (Asness & Ilmanen, 2012). An often-used alternative is to forecast growth rates by a rolling window of historical growth rates of dividends per share or earnings per share, i.e. use the growth rate in dividends or earnings over the last decade or two as an estimate of future growth in fundamentals. Bogle (1991a, 1991b) uses a 30-year moving average, Ferreira & Santa-Clara (2011) use a 20-year moving average of growth in earnings per share, while Bogle & Nolan (2015) use a 10-year moving average. Given that Eq. (1)

does not pin down which fundamental should be used, other authors use GDP growth when predicting returns on the aggregate market portfolio. Grinold & Kroner (2002), for example, estimate growth in fundamentals based on an assumed long-run relation between GDP and dividends/earnings, such that growth in dividends/earnings per share will be related to growth in the economy, possibly adjusted by how much profits in the corporate sector will differ from GDP growth over the forecast horizon. Arnott & Bernstein (2002) thoroughly discuss and estimate the relation between GDP growth and growth in dividends.

Arnott & Bernstein (2002), Ferreira & Santa-Clara (2011), and Asness & Ilmanen (2012) recognize that one should in principle include the expected stock-price multiple expansion in a return decomposition/-prediction. Based on the argument that rational investors should not expect changes in valuations, as valuations cannot grow or fall indefinitely, i.e. stock-price multiples are bounded, they a priori assume zero expected change in future stock-price multiples.

Dividend-yields, growth in fundamentals, and changes in stock-price multiples:

The final component of return is the percentage change in the stock-price multiple over the holding period. For instance, if stocks currently trade at a high valuation, a forecaster might expect the stock-price multiple to contract, dragging down returns, and vice versa for a currently low stock price valuation. This is the idea underlying Shiller's famous CAPE. Shiller expects stocks to perform poorly when CAPE is high.

There is a tension here. On the one hand, some researchers (e.g., Arnott & Bernstein, 2002; Ferreira & Santa-Clara, 2011; and Asness & Ilmanen, 2012) a priori rule out expectations of changes in stock-price multiples, as just mentioned. On the other hand, others (e.g., Shiller) mainly base their stock market outlook on implied changes in stock-price multiples. I argue (and evaluate the argument empirically) that when analyzing return expectations over the next ten years, expected changes in stock-price multiples should be taken into account. Empirically, stock-price multiples tend to revert slowly towards their means. I thus allow stock-price multiples to revert towards their historical average over the next ten years. Others have done the same. Bogle (1991b, 1991b) and Bogle & Nolan (2015) assume that the value of the price-earnings ratio at the end of their ten year forecast horizon equals its historical average of the preceding three decades. Grinold & Kroner (2002) provide an interesting example of a discussion of expected multiple changes at the point in time where they made their forecast.

2.1. Interest rate related variables

Assuming that monetary policy affects stock markets, the short-term interest rate, or the slope of the yield curve (proxied by the difference between a short and a long interest rate), have been used to predict returns (Campbell, 1991). The so-called Fed-model subtracts the nominal long-term fixed income yield (the yield on a ten-year bond, e.g.) from the earnings yield, the idea being that investors consider allocations between stocks and bonds based on the difference in yields provided by stocks and bonds. The somewhat peculiar feature of the Fed-model is that it compares a yield expressed in real terms (the earnings yield) with the nominal yield on bonds. Despite this comparison of real and nominal yields, the Fed model has been seriously examined, see, e.g., Asness (2003) or Maio (2013). As we can get long historical data series on these variables, I will also investigate them, even when they fall somewhat outside the consistent framework provided by Eq. (1).[3]

2.2. Empirical specifications

Based on the discussions in Sections 2 and 2.1, I consider the following variables when analyzing the determination of long-run expected real returns on the US stock market:

Valuation ratios

1. dp: Dividend yield.
2. ep: Earnings yield.
3. $1/CAPE$: Shiller's CAPE-index inverted to become a yield.

[3] The list of predictors that has been proposed in the literature is very long. It includes variables such as stock market variance, unemployment, the output gap, inflation, money growth, and many others. See Rapach & Zhou (2013) for a comprehensive survey. It is not possible to get long-term data for most of these variables. I base my analysis on Eq. (1) and use variables that are available over a long time span. I compare with a few often-used other predictors where long-term data are also available, such as interest rate based variables.

Dividend yields enter Eq. (1) directly and have been used to predict returns on their own, as mentioned. I consider two versions of the earnings yield: the basic earnings yield that divides current earnings with current price and the inverse of Shiller's Cyclical Adjusted Price Earnings ratio that relates the current stock price to the average of the last ten years' earnings, to smooth out temporary fluctuations in earnings.

Growth in fundamentals

4. Δe^{20}: Average of past twenty years of growth in real earnings.
5. Δd^{20}: Average of past twenty years of growth in real dividends.
6. Δy^{20}: Average of past twenty years of growth in real GDP.

I investigate growth in earnings per share, dividends per share, and real GDP as empirical measures of growth in fundamentals.

Dividend yield and growth in fundamentals. Disregarding growth in stock-price multiples

7. $dp + \Delta e^{20}$: Dividend yield and growth in real earnings.
8. $dp + \Delta d^{20}$: Dividend yield and growth in real dividends.
9. $dp + \Delta y^{20}$: Dividend yield and growth in real GDP.

Specifications 7., 8., and 9. combine the dividend yield with growth in fundamentals and disregard expectations of changes in multiples. I use the current dividend yield and combine it with a moving average of growth in fundamentals over the last 20 years, i.e. the average annual growth in fundamentals over the preceding two decades is used as the forecast of the average annual growth in fundamentals over the coming decade. Specification 7. is similar to the specifications in Bogle (1991a), Bogle & Nolan (2015), Ferreira & Santa-Clara (2011). In specifications 8. and 9., I combine the dividend yield with growth in dividends or GDP.

Growth in multiples

10. Δpe: Growth in the price-earnings ratio.
11. Δpd: Growth in the price-dividend ratio.
12. Δpy: Growth in the price-GDP ratio.

I allow stock-price multiples to revert to their historical mean during the next 10 years. The historical mean is calculated as the mean during the past 20 years.[4] Intuitively, if the stock-price multiple today is 10% above its historical average, I expect a drop in the stock-price multiple by 1% per year over the next ten years. The decomposition in Eq. (1) shows that this reduces returns by 1% per year.

Dividend yield and growth in fundamentals. Including growth in stock-price multiples

13. $dp + \Delta e^{20} + \Delta pe$: Dividend yield, growth in real earnings, and mean reversion in the stock price-earnings ratio.
14. $dp + \Delta d^{20} + \Delta pd$: Dividend yield, growth in real dividends, and mean reversion in the stock price-dividends ratio.
15. $dp + \Delta y^{20} + \Delta py$: Dividend yield, growth in real dividends, and mean reversion in the stock price-GDP ratio.

13., 14., and 15. are the empirical specifications of Eq. (1) that I use. I combine the dividend yield with growth in fundamentals and mean-reversion in valuation ratios. I forecast growth in fundamentals by past 20-years growth rates in dividends, earnings, and GDP, as in 7., 8., and 9. As in 10., 11., and 12., I allow stock-price multiples to revert to their historical averages over the next decade.

Interest rates variables:

16. Short (nominal) interest rate.
17. Slope of the yield curve: The short rate minus the long rate.
18. The Fed model: ep minus the long-term interest rate.

I consider both the short interest rate and the difference between the short and the long interest rate (a proxy for the slope of the yield curve) when forecasting long-run stock returns. Finally, I consider the Fed model.

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[4] I evaluate returns from an index of large-cap stocks (S&P 500). Earnings and dividends are measured 'per share', and are thus directly related to the index of share prices. GDP measures aggregate activity in the economy. Hence, the basis of earnings/dividends and GDP is different. This is not an issue. I am interested in the time series fluctuations in stock prices, dividends, earnings, and GDP. In other words, if stock prices and GDP mean revert towards each other, the stock price/GDP ratio will be mean reverting even if they are measured on a different basis. For more on this, see Rangvid (2006).

3. Data

I primarily use data from Robert Shiller's home page. The data include for the SP500 (and its predecessors) the share price index, earnings per share, and dividends per share, as well as the Consumer Price Index (CPI) used to convert nominal figures to real figures, and a short and a long interest rate. I use real GNP to calculate growth rates of aggregate economic activity.[5] I calculate everything in real terms and in logs. The earnings yield, for instance, is calculated as $\ln(1 + E_{t+1}/P_t)$, where E_{t+1} are per share real earnings (earnings measured in 2016 prices) paid out by the firms included in the index during a holding period from period *t* to *t+1* and P_t is the real per share stock price (stock price measured in 2016 prices) at the beginning of the holding period *t*. The dividend yield and $1/CAPE$ are calculated in similar ways. Growth rates are calculated as, e.g., $\ln(E_{t+1}/E_t)$ and similarly for growth in real dividends, real GNP, etc. Interest rates are calculated as $ln(1 + I_t)$ with I_t as the yield itself. Real stock market returns are calculated as $r_{t,t+1} = \ln\left(\frac{P_{t+1}+D_{t+1}}{P_t}\right)$.[6] When using log-returns, average per annum real returns for a ten-year holding period are easily calculated as $r_{t,t+10} = [r_{t,t+1} + r_{t+1,t+2} \dots + r_{t+9,t+10}]/10$.

3.1. Summary statistics

Table 1 collect summary statistics. The full sample covers 1871-2016. I use 20-year rolling windows when calculating growth rates of fundamentals and the values towards which the pd-ratio, pe-ratio, and py-ratio mean revert. Summary statistics for the full sample in Table 1 thus start 20 years after 1871, i.e. cover 1891-2016. I also analyze the post-1945 subperiod, in order to see whether results are robust both over the full sample and over a more recent subsample.

[5] The data consist of the 'official' GNP data from 1929, available, for instance, on the homepage of the St. Louis Fed. The pre-1929 data are from Balke & Gordon (1989).

[6] Bogle (1991a, 1991b), Bogle & Nolan (2015), and Ferreira & Santa-Clara (2011) analyze nominal returns. Investors are, however, ultimately interested in the amount of consumption that they can buy with their funds, i.e. interested in the real returns from their investments.

The average annual real stock return has been around 6%, both over the full sample and since 1946, though marginally higher since 1946. These are average annualized returns over rolling ten-year holding periods. Their standard deviation is around 5% per year.

The unconditional average earnings yield is close to the unconditional average stock return. The question I analyze in this paper is whether fluctuations over time in the predictor variables, such as the earnings yield, line up with fluctuations in future returns. In this regard, it is relevant to note that the volatility of the earnings yield is only half of the volatility of returns. The inverted CAPE-ratio resembles more or less the earnings yield in terms of summary statistics. The time-series average and the standard deviation of the dividend yield are lower than those of earnings yields.

Real dividends and earnings grow by 1-2% per year (rows 4 and 5 in Table 1), with the growth rates of dividends being lower than that of earnings. In fact, the average payout-ratio (D_t/E_t) is around 60% (not shown). Real GNP growth is considerably higher than real earnings and dividend growth.

The average rates of annual mean reversion in stock-price multiples (rows 10-12) are generally close to zero, such that there is no clear long-run trend in stock-price multiples over the full sample period. The average mean reversion of the stock price-GDP ratio differs somewhat from this general finding pre-1946, as it generally increases by close to three percent per year before 1946. After 1946, the mean reversion of the py-ratio is lower than one percent, i.e. closer to zero. The fact that the average growth rates are generally close to zero does not imply that stock price multiples are constant over time. In contrast, there is considerable variation in stock-price multiples. When the average growth rates are close to zero, but their standard deviations are different from zero, stock-price multiples temporarily drift away from their long-run mean, but revert towards them over time. This implies that investors should benefit from taking mean reversion of stock-price multiples into account when formulating expectations about future returns.

Combining the dividend yield with growth in fundamentals and mean reversion in stock price multiples (rows 13, 14, and 15) results in predictors that are more or less as volatile as stock returns themselves.

The average *nominal* interest rate (row 16) is slightly above 4%, which is lower than the average *real* equity returns. The negative average value of the slope of the yield curve indicates that long interest rates are typically higher than short interest rates. The average value of the Fed Model indicates that the earnings yield on average is higher than the long nominal interest rate.

4. Results

My goal is to gauge the forecasting value of each of the predictor variables for real equity returns over ten-year holding periods. To do so, I regress annualized ten-year real returns on the value of the predictive variables when entering the holding period. The forecasting regression thus takes the form $r_{t,t+10} = \alpha + \beta x_t + \varepsilon_{t,t+10}$, where x_t is the forecasting variable observed at the beginning of the forecasting period. I am primarily interested in the R^2 from this regression, as the R^2 will reveal how well the predictive variable has captured future movements in ten-year ahead returns on average over the sample period. I am also interested in the *t*-statistic for the test of the hypothesis that the β of the regression is equal to zero.

When predicting ten-year returns using data at an annual frequency, there will be overlapping observations in the residuals; the forecast error at time *t+2* will be correlated with the forecast error at time *t+1*, the error at time *t+3* will be correlated with the errors at *t+2* and *t+1,* etc. I deal with this by using *t*-statistics calculated using Newey-West (1987) standard errors, truncated at lag ten.

In Table 2, I show the results from the regressions. In Figure 1, I show the R^2s (from Table 2) in descending order so as to provide easily accessible information on how well the different variables have captured movement in future returns during the sample period.

A number of conclusions can be drawn. First, $dp + \Delta y^{20} + \Delta py$ is a strong predictor. Over the full sample period, it is the variable that historically has captured the highest fraction of movements in future ten-year returns. One reason for this, as Table 2 shows, is that mean reversion in the stock price-GDP multiple has had strong predictive power for future stock returns (row 12). Its predictive power has been stronger than that of mean reversion in the stock price-earnings and stock price-dividends ratio (rows 10 and 11). This finding is consistent with results in Rangvid (2006).[7] Given that the related literature generally looks at growth in earnings or dividends, and mean reversion in stock price-earnings and stock price-dividends multiples, I find it interesting that using GDP instead of earnings or dividends has resulted in better predictions.[8]

Second, valuation ratios on their own have predicted returns well. The dividend yield, earnings yield, and CAPE are all strong predictors of returns (rows 1-3). Similarly, mean-reversions in price multiples predict returns strongly, too (rows 10-12). Mean reversion in the stock-price GDP multiple is a particularly strong predictor. These results indicate that important information about expected returns might be neglected if not taking mean-reversion in multiples into account when predicting returns.

[7] Rangvid (2006) also studies a stock price-consumption multiple, as an alternative to the stock price-GDP multiple. These multiples are highly correlated, though, and the predictive powers more or less equal. Mean reversion in the stock price-consumption multiple generates slightly lower R^2s though, supporting my focus on reversion in the stock price-GDP multiple.

[8] The dividend yield combined with earnings growth and mean reversion in the stock price-earnings ratio predicts poorly; $dp + \Delta e^{20} + \Delta pe$ is barely significant and the R^2 is only 7.4% for the full sample. This may seem surprising given that Bogle (1991a, 1991b) and Bogle & Nolan (2015) predict the SP 500 with $dp + \Delta e^{20} + \Delta pe$. It is not straightforward to compare with Bogle & Nolan (2015) as they mix annual and monthly observations, but I can compare with Bogle (1991b). Bogle predicts nominal ten-year returns over the 1937-1990 period. He writes "*Statistically speaking, the coefficient of correlation of +0.540 between the projected and the actual returns for the full sample is impressive.*" When I use my data and correlate nominal returns with $dp + \Delta e^{20} + \Delta pe$ calculated with nominal variables for the 1937-1990 period, I find a correlation of 0.547, i.e. the same as Bogle (1991b). When I calculate the correlation for the full 1891-2016 period, it drops to 0.22. Hence, $dp + \Delta e^{20} + \Delta pe$ in nominal terms predicted nominal returns well over the 1937-1990 period that Bogle (1991b) studied, but not over a longer period, updated with recent observations. Second, correlating $dp + \Delta e^{20} + \Delta pe$ in real terms with real returns over the 1937-1990 period lowers the correlation from 0.55 (for nominal returns) to 0.38. For the full sample, the correlation with real returns is 0.27. Finally, a correlation of 0.27 translates into a R^2 of 7.4% So, the difference to Bogle is that I use a long sample and real returns. I focus on real returns, as this is what matters for investors in the end.

Third, interest rate based variables contain very little information about future ten-year returns (rows 16-18). There might be information in interest rates about shorter-horizon returns, in fact the slope of the yield curve predicts returns one year ahead (not shown, but available upon request), but for longer-term returns, interest rate related variables do not predict returns.

Finally, growth in GDP and earnings do not in themselves predict returns (rows 4 and 6). Growth in dividends (row 5), on the other hand, has been highly correlated with future returns. However, dividend growth has been *negatively* correlated with future returns, as Table 2 reveals. I.e., when growth in real dividends during the past twenty years has been high, there has been a tendency that returns going forward have been low. The same goes for growth in earnings, but here the relation is statistically insignificant. This negative correlation between past dividend growth and future real returns means that when adding growth in dividends (or earnings) to the dividend yield, this predictor ($dp + \Delta d^{20}$) becomes insignificantly related to future returns (row 8), in spite of both dp and Δd^{20} being significant on their own (but with opposite signs). On the other hand, growth in GDP has been positively related to future returns, so when adding growth in GDP to dividend yields, strong return predictability results.

These overall conclusions appear when looking at the full sample from 1891-2016 and the post-WWII sample, i.e. they are reasonably robust. There is one important difference between results based on the full sample versus the recent subsample, though: Returns have been more predictable since 1946. This is seen via the generally higher R^2 and *t*-statistics during the 1946-2016 subsample. For example, there are eight predictive variables that capture more than 30% of the variation in ten-year ahead returns during the post-WWII period, whereas this is the case for only three variables across the total sample period. Most strikingly perhaps, this is the case for the dividend yield (row 1): During the full sample period, the R^2 is close to 18% and the *t*-statistic close to 3. For the post-WWII period, R^2 jumps to app. 46% and the *t*-statistic to more than 8. The higher degree of predictability of US returns after WWII by the dividend yield reconfirms related findings in Chen (2009) and Golez & Koudijs (2016).

4.1. Choosing a predictor

The results in Table 2 and Figure 1 imply that valuation ratios on their own and the 'sum of the parts' (the combination of the dividend yield with GDP growth and mean reversion in the stock price-GDP ratio, i.e. $dp + \Delta y^{20} + \Delta py$) have captured the higher fraction of variation in future real returns. Among valuation ratios, earnings yields (either ep or $1/CAPE$) generate the highest R^2 over the full sample period whereas dp generates a higher R^2 after 1945. Information in the dividend yield is included in $dp + \Delta y^{20} + \Delta py$.

Figure 2 shows the time series of $1/CAPE$ in Panel A, $dp + \Delta y^{20} + \Delta py$ in Panel B, and an average of the two, i.e. $0.5(p + \Delta y^{20} + \Delta py) + 0.5(1/CAPE)$, in Panel C. I include ten-year ahead real returns in all graphs so that one can judge how well the predictors capture future realized returns. Using the very first observation in Panel A to illustrate, the interpretation of the figures is as follows: At the entrance of 1891, $1/CAPE$ predicted an annualized return over the next decade of 6.16%. The realized annualized return over the ten-year period 1891-1901 turned out to be 8.06%. As another example, the last observed realized ten-year return was for the 2006-2016 period. During this period, stocks returned 5.59% on an annualized basis. At the entrance of 2006, $1/CAPE$ predicted an annualized return of 3.81%. Finally, the last observation for $1/CAPE$ is for 2016. This predicts an average annual rate of return of 3.60% over the coming decade.

The three predictors in Figures 2a, 2b, and 2c capture many of the overall movements in realized ten-years ahead returns: The increase in returns during the 1910s, the drops during the 1950s and 1960s, the increases during the 1970s, and the drops during the 1990s. There are, however, also some important differences between $1/CAPE$ and the sum of the parts ($dp + \Delta y^{20} + \Delta py$). First of all, $dp + \Delta y^{20} + \Delta py$ is more volatile than $1/CAPE$, which also appears from Table 1: the standard deviation of $1/CAPE$ is 2.79% vs. a standard deviation of $dp + \Delta y^{20} + \Delta pd$ of 5.65%. This means that there are some spikes and troughs that the sum of the parts capture but $1/CAPE$ does not. For instance, the drops in returns during the 1950s is better captured by $dp + \Delta y^{20} + \Delta py$. Similarly, $dp + \Delta y^{20} + \Delta py$ more or less captures spot-on the low returns going forward from 1999 which $1/CAPE$ basically does not catch. On the other hand, there are some volatile spikes in $dp + \Delta y^{20} + \Delta py$, such as the 15% annualized return predicted in 1932; stocks returned "only" 5% per annum during 1932-1942. Overall, this means that there will be gains from combining the smooth behavior of $1/CAPE$ with the more volatile behavior of $dp + \Delta y^{20} + \Delta py$. This is what I do in Panel C of Figure 3 that shows the average of $1/CAPE$ and $dp + \Delta y^{20} + \Delta py$. I call the predictor $Combi$ (the combination of $1/CAPE$ and $dp + \Delta y^{20} + \Delta py$). $Combi$ captures movements in future returns well. If using $Combi$ in a forecasting regression similar to the ones underlying the results in Table 2, it results in an estimated slope coefficient of 0.71 and associated *t*-statistic of 6.54, i.e. highly significant, and a R^2 of 34.4% for the full sample period. This is higher than for any of the variables shown in Table 2, i.e. a small forecasting gain is obtained by combining $1/CAPE$ and $dp + \Delta y^{20} + \Delta py$. For the 1946-2016 period, I obtain 0.84 (slope), 4.81 (*t*-statistic), and 40.8% (R^2).

What does this variable – $Combi$ – imply for returns going forward? As mentioned, $1/CAPE$ predicts an annualized real return of 3.60% over the next decade. $dp + \Delta y^{20} + \Delta py$ predicts a somewhat lower return: 2.6%. The estimate of annualized real returns for the next decade is thus (3.6% + 2.6%)/2 = 3.1%. Compared to the historical return of close to 6%, this is a very low expected returns.

3.1% is a point estimate. There is uncertainty surrounding this estimate. One way to illustrate this is provided in Figure 3. The figure is a scatter plot of $Combi$ and subsequent ten-years ahead realized returns. It illustrates how $Combi$ has been positively related to future returns, but it also illustrates that the relationship is not perfect. In the figure, I indicate the range of historical ten-year ahead returns observed when $Combi$ was in the neighborhood of 3% (as it is today) in order to illustrate the uncertainty associated with forecasts. For example, in 1994, $Combi$ was 3.73% and subsequent realized ten-year annualized returns were as high as 8.05%. On the other hand, in 1965, $Combi$ was 2.95% and subsequent ten-year realized returns were as low as a negative -3.56%. So, there is uncertainty surrounding forecasts, but given the historical relation between $Combi$ and subsequent returns, the more likely scenario is one where returns going forward will be considerably lower than what we have been used to in the past.

4.1.1. Discussion

I take the average of $1/CAPE$ and $dp + \Delta y^{20} + \Delta py$. I doing so, I am inspired by Asness & Ilmanen (2012).[9] By taking the average of $1/CAPE$ and $dp + \Delta y^{20} + \Delta py$, I obtain an intuitive predictor that is easy to replicate and understand. There is, however, nothing to prevent a researcher from choosing different weights. For instance, one might argue that given that $dp + \Delta y^{20} + \Delta pd$ has generated a marginally higher R^2 than $1/CAPE$, a weight of 45% to $1/CAPE$ and 55% to $dp + \Delta y^{20} + \Delta pd$ could be chosen. Or some other weights. I prefer 50/50. Another approach could be to combine even more predictors, and choose weights in a data-dependent way. There exist by now a sizeable literature that extracts and combines information from many predictors to generate dynamic combinations of predictors, see for instance Cremers (2002) and Kelly & Pruitt (2015). Such procedures have their merits. On the other hand, the procedures are certainly also less intuitive and replicable than the one I use in this paper. As will all things in life, it is a trade-off: In this case between intuition, simplicity, understandability, and easiness of replication versus dynamic optimization, Bayesian procedures, and technical complications. There are pro and cons with each. In this paper, my goal is to present an intuitive and easily replicable predictor. It is important to emphasize, though, that my approach of choosing two predictors that have tracked a high fraction of historical return variation is clearly superior to using all eighteen predictors, combined with equal weights. Using the average of the eighteen predictors as one predictor captures a considerably lower fraction of return variation than $Combi$, generating an R^2 for the full sample period of only 15%, and 23% for the post-1946 sample. This can be compared to, as mentioned, R^2s of 34.4% and 40.8% that $Combi$ generates for the two samples. I thereby reduce noise and obtain a more precise predictor by relying on two predictors that have worked well, compared to relying on all proposed predictors where some have tracked future returns well whereas others have not.

I am interested in ten-year, i.e. long-horizon, forecasts. If the point of the paper was to examine market-timing, one would in addition to results in Table 2 study out-of-sample

[9] "*Our estimate of the real equity yield is a simple average of (i) the smoothed earnings yield (the so-called Shiller price-earnings ratio, inverted to become a yield) and (ii) the sum of the current dividend yield and 1.5 percent, an assumed real growth for dividends per share*", Asness & Ilmanen (2012).

forecasts over shorter horizons, such as one quarter or one year. This is not done in the literature this paper is related to.[10] There are good reasons: When evaluating long-horizon return expectations, in-sample regressions are better suited. If readers are interested in the alternative question of how variables such as those studied here perform in market-timing exercises, one might consult Rangvid (2006) or Asness et al. (2016). Asness et al., for example, show how one might improve upon the market-timing signals that CAPE contains by combining CAPE with a momentum strategy.

Finally, a remark on my choice of using an implicit coefficient of one to the average of $1/CAPE$ and $dp + \Delta y^{20} + \Delta py$ when calculating estimates of expected returns. This choice is based on the theoretical restriction that the models I base my predictions on impose. Eq. (1) showed that returns are given as the sum of the dividend yield, growth rate in fundamentals, and growth rate of the stock-price fundamental. Table 2 shows that the estimated coefficient to $1/CAPE$ is 1.01 for the full sample and 1.41 for the post-WWII sample, and the coefficients to $dp + \Delta y^{20} + \Delta py$ are 0.51 and 0.58, respectively. Hence, the best fit for ten-year returns has historically been obtained when scaling down expected returns based on $dp + \Delta y^{20} + \Delta py$ by a coefficient of 0.5-0.58. This was back-ward looking. When looking forward, I choose to rely on the theoretically-implied values. I thus agree with Ferreira & Santa-Clara (2011) who also argue for using a priori theoretically implied coefficients when looking forward.

5. Real interest rate

The best forecast of the real returns obtained from buying a long-term bond is its nominal yield minus expected inflation (Bogle & Nolan, 2015 and Malkiel, 2015). As the forecast of average inflation over the next decade, I use the average during the last decade.

Figure 4 shows the resulting real yield. The average real yield is close to two percent, but it has been fluctuating through time: Falling during the first thirty years of the sample period,

[10] Fama & French (1988, 2002), Bogle (1991a, 1991b), Arnott & Bernstein (2002), Ibbotson & Chen (2003), Grinold & Kroner (2002), Asness & Ilmanen (2012), Bernstein (2015), Bogle & Nolan (2015), and Siegel (2016) do not present out-of-sample results, as they all deal with long-horizon forecasts

increasing during the 1930s, falling until the mid-1950s, and then rising until 1980. Since app. 1980, we have seen almost monotonically falling real yields. Today, the expected real yield is 0.7%.

6. 50/50 portfolios

I can now calculate what a portfolio with 50% in stocks and 50% in bonds is expected to return on average per year after inflation, i.e. in real terms, over the next ten years. This is the average of the expected real returns from stocks depicted in Figure 2c and the expected real return from bonds depicted in Figure 4. The resulting time series of expected returns from this 50/50 portfolio is provided in Figure 5. This figure is probably the main figure of this paper.

Over the full sample period from 1891-2016, the average expected ten-years ahead annualized return from this 50/50 portfolio has been close to 5% (4.8%). This is not what investors have expected every year, though. As the figure makes clear, expected returns are time-varying to an almost dramatic extent. There have been years where investors expected a return of up to 10% per year over the following decade, as in 1918, 1932, and 1982. And there have been years where the expected returns were as low as close to zero percent, as in 1999 at the height of the dot-com bubble.

For 25 years, since 1990, expected returns have been below the historical average. This is, as Figure 4 showed, on the one hand due to the fall in real interest rates that has taken place since the early 1980s, but it is also due to expected stock returns being rather low, as Panel C of Figure 2 shows. With the exception of 2009, where stock prices were at bottom levels, and expected returns consequently relatively high, expected stock returns have been below the historical average since the mid-1980s.

So, currently, both stocks and bonds are expected to provide low returns over the coming decade. The expected annual real return from a 50/50 portfolio going forward is thus also low: 1.9%. Historically, there have only been few years where expected returns have been lower. In fact, throughout the last 140+ years, there are only six years where expected returns have been lower: the years from 1997 through 2001.

7. Determinants of expected returns

How should we understand the drivers of these low returns? What needs to improve for expected returns to increase? To answer such questions, consider the different components of expected returns one by one.

7.1. Expected stock returns

Expected real stock returns are, as mentioned, calculated as the average of $1/CAPE$ and $dp + \Delta y^{20} + \Delta py$. At the time of writing, the SP500 stood at 2,195.[11] The average of the last ten years of real earnings per share (expressed in 2016 prices) was 79.69. Hence, the current cyclical-adjusted price-earnings yield is:[12]

$$^{1}/_{CAPE} = ln\left(1 + \frac{79.69}{2{,}195}\right) = 3.6\%.$$

Real dividends per share (expressed in 2016 prices) during 2015 were 43.39, so the dividend yield is:

$$dp = ln\left(1 + \frac{43.39}{2{,}195}\right) = 2.0\%.$$

Average real GDP (log) growth has averaged 2.4% per year over the last twenty years. Currently, the stock price-GDP multiple is 16% above its average over the last 20 years. I consider a scenario where stocks are expected to return to their average over the forecasting period, i.e. over the next ten years. This means that changes in the stock price-GDP multiple over the next ten years subtracts $\ln(1 - 0.16)/10 = -1.7\%$ from the average annual expected returns.

[11] I use January values of the SP500 in the regressions, so that dividend yields are measured at the beginning of the year. When I calculate expected returns at the time of writing (December 2016), I use the November 2016 value of the SP500.

[12] Some practitioners, such as AQR (2017), adjust the $1/CAPE$ forecast by an assumed growth rate of real earnings. AQR assumes 1.5% per year for five out of the ten subsequent years when forecasting over a decade, i.e. scaling the estimate by 1.075. In my case, this would push up the estimate from 3.6% to 3.87%. I prefer not adjusting $1/CAPE$ in order to stay close to Shiller's original idea, also because it is $1/CAPE$ that is used in the regressions in Table 2.

All in all, this means that my prediction of average annual real stock returns over the next ten years is:

$$\frac{[3.6\% + (2\% + 2.4\% - 1.7\%)]}{2} = \ 3.1\%.$$

We cannot discuss the stock price and dividends, as they are what they are, but we can discuss the projected growth in fundamentals and the predicted change in the stock price-GDP multiple over the next ten year, and we can discuss the use of a ten-year window for earnings when calculating $1/CAPE$.

7.1.1. Discussing growth in fundamentals

I forecast growth in fundamentals by the historical growth in GDP. To illustrate robustness, one could also use historical growth in real dividends or earnings, even when these have not predicted returns as well as GDP, as Table 2 showed. Over the last twenty years, earnings have been growing with more or less the same as GDP (2.5% vs. 2.4%). I.e., it would not change predictions of expected returns if using historical growth in earnings. On the other hand, over the last twenty years, dividends have been growing faster than earnings and GDP, by 3.6% per year. So, if basing predictions on growth in dividends, instead of growth in earnings or GDP, the estimate of expected annual real stock returns over the next decade will be app. 0.6 (= (3.6 - 2.4)/2) percent higher. It seems counter-intuitive, however, to expect faster dividend growth than GDP or earnings growth. First of all, Table 1 showed that, historically, dividends have been growing by less than earnings and GDP. Second, dividends simply cannot continue to grow faster than earnings over long periods of time; firms need to generate profits before paying out dividends on the long run. Finally, dividend growth has historically been a counter-intuitive predictor of future returns, as mentioned earlier: positive past dividend growth has predictive negative returns. All in all, it seems hard to justify a prediction of returns based upon unusually high dividend growth during the last couple of years.

One could look at other estimates for, e.g., potential GDP growth. For instance, one could look at long-run projections from the OECD. This does not provide reason for much optimism. OECD (2016) expects US real GDP to growth with 2.65% per year on average during the 2016-2025 period. The Congressional Budget Office (2016) is a little more pessimistic with real GDP expected to grow by 2% per annum from 2016-2026. Basically, one seems hard pressed to expect higher GDP growth, and if using GDP growth as a proxy for growth in fundamentals, then something like 2.5% per year seems reasonable over the next decade.

On the long run, GDP on average grows faster than earnings and dividends; see Table 1. One might speculate whether using GDP per capita instead of GDP itself would change results. The average growth rate of real GDP per capita over the full sample period more or less equals 2%, which is closer to the average growth rate of real earnings or dividends, as Table 1 shows. Population growth is very stable, however, i.e. fluctuations in GDP per capita mainly arise from fluctuations in GDP itself. This implies that the forecasting results are robust towards using GDP or GDP per capita.

My final remark on the use of GDP growth is that while some might find that I rely on a fundamental growth rate that is to tilted towards the high side (GDP growth higher than growth in earnings and dividends), others might find that I use dividend yields and earnings yields ($1/CAPE$) that are tilted towards the low side. For example, Siegel (2016) argues that $1/CAPE$ underestimates future returns (I discuss Siegel's point in more detail below). Regarding dividend yields, a shift in payout practices have occurred in the US since the 1980s, as firms have started paying out less in dividends and more via share-buys; Ibbotson & Straehl (2015) have an interesting discussion. In my $Combi$ predictor, I incorporate information in both GDP, earnings, and dividends in an intuitive way, thereby being less dependent on potential changes in earnings definitions, dividend payouts vs. share buybacks, etc.

7.1.2. Discussing mean reversion in stock-price multiples

Reversion of the py-ratio to its past 20-years average subtracts 1.7% from expected returns per year going forward. Two alternative price-multiples come to mind; the price-dividend multiple or CAPE (or the price-earnings multiple). These price-multiples indicate a more favorable outlook for stocks than the price-GDP multiple. Both CAPE and the price-earnings multiple are currently close to their 20-year average. This means that the expected contribution to returns from changes in any of these two price-multiples is close to zero. Remember here (from Eq. (1)) that if we use the stock price-earnings multiple, we should add earnings growth (2.5%) instead of GDP growth (2.4%) to the equation, i.e. use $dp + \Delta e^{20} + \Delta pe$. This means that if using mean reversion of CAPE or the price-earnings multiple, instead of the price-GDP multiple, expected average annual returns from stocks increase from 3.1% to:

$$(3.6\% + 2\% + 0\% + 2.5\%)/2 = 4.1\%.$$

Using the price-dividend ratio would be even more favorable for stock returns. The price-dividend ratio today is below its 20-year average. Mean reversion would add 1.5% to expected return per year. And the average growth rate in dividends over the last twenty years is 3.6%, i.e. one percentage point higher than earnings growth and GDP growth. Using $dp + \Delta d^{20} + \Delta pd$ thus implies an expected return of:

$$(3.6\% + 2\% + 3.6\% + 1.5\%)/2 = 5.4\%.$$

Historically, GDP growth has been higher than growth in dividends and earnings, as Table 1 reveals. In this sense, it seems paradoxical to expect higher growth in dividends than GDP going forward, as discussed earlier. The high growth in dividends during the last five years drive a lot of this: Average growth in real dividends from 2011-2015 has been more than 11% per year, compared to an average 2% growth in GDP and less than 1% growth in earnings over the same period. It seems unrealistic to expect this to continue. At the same time, it is this high dividend growth that makes the price-dividend ratio seem low. In the end, $dp + \Delta d^{20} + \Delta pd$ indicates higher expected returns than $1/CAPE$ and $dp + \Delta y^{20} + \Delta py$ but, unfortunately, this higher return does not seem particularly realistic.

One could ask whether the inverse of the pe-ratio provide a different estimate for expected real stock returns than the inverse of the CAPE ratio. $1/CAPE$ gives an expected return of 3.6% per year, and $1/pe$ gives an expected return of 3.9% per year. So, whether one normalizes the current level of share prices with its one-year or ten-year moving average, the implication for expected return is more or less similar.[13]

Finally, one might wonder whether the forecast is different if using all eighteen predictors. I mentioned in Section 4.1.1. that a simple combination of all eighteen predictors has not captured movements in returns well throughout history. But we could nevertheless ask ourselves if we would get a significantly different estimate of expected returns if we use all predictors instead of focusing on $1/CAPE$ and $dp + \Delta y^{20} + \Delta py$. Based upon the equal-weighted average of all eighteen predictors, we get a return forecast of 2.6%. This is even lower than my preferred forecast.

All in all, the conclusion is that it does not matter much whether one combines the current dividend yield with growth in GDP or earnings, and consequently look at mean reversion in the stock price-GDP, respectively stock price-earnings, multiple. Both $dp + \Delta y^{20} + \Delta py$ and $dp + \Delta e^{20} + \Delta pe$ provide estimates of expected real returns from stocks around 3%-4% per annum. Using dividends changes the prediction somewhat. $dp + \Delta d^{20} + \Delta pd$ yields expected returns above 5% per annum. Given that $dp + \Delta y^{20} + \Delta py$ historically has captured movements in future returns better than $dp + \Delta e^{20} + \Delta pe$ and $dp + \Delta d^{20} + \Delta pd$, and given that the very high dividend growth seen throughout the last five years seems unlikely to continue, I believe that that the more likely outlook for stocks is the one where stocks are expected to return three (if using growth in GDP and the price-GDP ratio) to four percent (if using growth earnings and the price-earnings ratio) annually.

7.2. Expected bond returns

What about the expected return from bonds? The nominal yield is what it is, so the only thing we can discuss is the expected rate of inflation. The average annual rate of inflation

[13] Siegel (2016) argues that reported S&P500 earnings are 'too low', pushing up the CAPE 'too much', and thereby causing expected returns based on CAPE to be 'too low'. The reason, Siegel argues, roots in changes to accounting practices since 1990 that cause earnings to be lower during downturns than what has been the historical norm. If so, the fall in earnings during the financial crisis of 2008-2009 has pushed up CAPE more than it should, compared to earlier otherwise similar experiences. Siegel finds that, as of January 2015, expected real returns from the S&P500 are 2.81% per year over the next decade based on CAPE but 5.25% when based on NIPA earnings. Siegel raises an interesting point. My estimate of expected returns is also based on stock price-GDP multiple, as mentioned. The stock price-GDP multiple should not be affected by the issues raised by Siegel.

over the last decade was 1.8%. This is also my forecast for inflation going one decade forward. The ten-year yield at the time of writing is 2.5%, so the expected real return from bonds is 0.7%.

An expected rate of inflation around 2% seems reasonable. It is close to the historical rate of inflation of 2.03% over the 1871-2016 period. It is also what the Fed expects 'on the longer run' (FED, 2016). Given that I expect slightly lower inflation than two percent, I also expect slightly higher real returns from bonds than if basing inflation expectations on the standard '2%'. In this sense, my projections for real returns on bonds do not seem exaggerated.

8. Conclusion

I have presented estimates of the expected annual real returns from stocks and bonds over the coming decade. Returns are expected to be low. I estimate an expected real return from stocks around three percent per year and an expected real return from bonds around one percent. A traditional 50%/50% portfolio in stocks and bonds is thus expected to yield close to 2% on average per year over the next decade. This is considerably below the historical average of realized real returns of 4.39% per year.

There is, of course, uncertainty surrounding estimates of expected returns. It follows that an investor would be ill-advised to start day-trading on the predictors I propose. The message is instead that investors should think about the implications of low returns going forward for their overall savings decisions. For instance, if the real return from a stock-bond portfolio is going to be close to only half of what we have been used to, this will present daunting challenges to investors. U.S. state-sponsored pension plans are allowed to discount their promised payments by the expected return from stocks and bonds. One thing is that it has been pointed out that liabilities should be discounted with a risk-free rate (Novy-Marx & Rauh, 2011). Another is that even if allowing plans to discount with expected returns from stocks and bonds, the expected returns I present differ from those typically used. Rauh (2016) reports that the median assumed return is 7.75%. The numbers

I present here are considerably lower. They imply an expected nominal return in the order of four percent for a 50/50 portfolio (around 2% real return and 2% inflation).

Low returns present not only a challenge to US state-sponsored plans, but are common challenges to long-term investors. In general, they imply that individuals will have to save more, retire later, or face lower income during retirement in order to keep up a certain retirement income. These challenges are only more relevant when also acknowledging that individuals face the otherwise happy outlook of growing life expectancies. This makes it important to discuss how to prepare for a world where returns from savings will be lower than what we have historically been used to.

Regarding investment advice, the case for stocks is still there. My estimates still imply considerably higher expected returns from stocks compared to bonds, even if returns from both stocks and bonds are expected to be lower than historically.

If investors aim for returns like those they have been used to historically, they have to take more risk. This can be achieved by buying more stocks, but also in the form of different 'alternative investments', where investors try to harvest other risk premia, such as liquidity risk premia. In the end, though, it is important – as always – to remember that in equilibrium, nobody can expect higher returns without taking some form of higher risk.

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Appendix. Drivers of stock returns

In this appendix, I show how stock returns can be decomposed into their underlying components. The derivation holds both for nominal and real returns. Starting from the definition of returns:

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

one can multiply the price increase by any variable that equals 1. I label the fundamental (earnings, dividends, GDP) that I look at F_t. I multiply $\left(\frac{P_{t+1}}{P_t}\right)$ by $\left(\frac{F_{t+1}/F_{t+1}}{F_t/F_t}\right) = 1$:

$$1 + R_{t+1} = \frac{D_{t+1}}{P_t} + \frac{P_{t+1}}{P_t}\left(\frac{F_{t+1}/F_{t+1}}{F_t/F_t}\right) = \frac{D_{t+1}}{P_t} + \frac{(P_{t+1}/F_{t+1})}{(P_t/F_t)}\left(\frac{F_{t+1}}{F_t}\right).$$

As, for any variable, $X_{t+1}/X_t = (1 + \Delta X_t)$, where ΔX_t is the percentage increase in the variable between time *t* and *t+1*, I can now write returns as:

$$1 + R_{t+1} = \frac{D_{t+1}}{P_t} + (1 + \Delta PF_{t+1})(1 + \Delta F_{t+1})$$

where I have used the notation ΔPF_{t+1} for the percentage growth in the price-fundamental multiple $[(P_{t+1}/F_{t+1}) - (P_t/F_t)]/(P_t/F_t)$. It follows that returns are given as:

$$1 + R_{t+1} = \frac{D_{t+1}}{P_t} + 1 + \Delta PF_{t+1} + \Delta F_{t+1} + \Delta PF_{t+1}\Delta F_{t+1}$$

or:

$$R_{t+1} = \underbrace{\frac{D_{t+1}}{P_t}}_{\substack{\text{Dividend} \\ \text{yield}}} + \underbrace{\Delta PF_{t+1}}_{\substack{\text{Growth in the} \\ \text{stock-price} \\ \text{multiple}}} + \underbrace{\Delta F_{t+1}}_{\substack{\text{Growth in} \\ \text{fundamentals}}} + \underbrace{\Delta PF_{t+1}\Delta F_{t+1}}_{\substack{\text{Small} \\ \text{multiplicative} \\ \text{term}}},$$

The multiplicative term is small. Hence, returns are mainly driven by:

- Dividends paid out during the investment period (in relation to what the investor paid for the stock).

- Growth in the stock price multiple (usually the price-dividend ratio, the price-earnings ratio, or the price-GDP ratio when dealing with the aggregate stock market).
- Growth in the fundamental (dividends, earnings, or GDP).

Log-returns

Recognizing, as above, that:

$$\frac{P_{t+1}}{P_t} = \frac{P_{t+1}}{P_t}\left(\frac{F_{t+1}/F_{t+1}}{F_t/F_t}\right) = (1 + \Delta PF_{t+1})(1 + \Delta F_{t+1}),$$

Santa-Clara & Ferreira (2012) note that the dividend yield can be rewritten as:

$$\frac{D_{t+1}}{P_t} = \frac{D_{t+1}}{P_{t+1}}\frac{P_{t+1}}{P_t} = \frac{D_{t+1}}{P_{t+1}}(1 + \Delta PF_{t+1})(1 + \Delta F_{t+1}),$$

such that returns can be written as:

$$1 + R_{t+1} = \frac{D_{t+1}}{P_t} + \frac{P_{t+1}}{P_t} = \frac{D_{t+1}}{P_{t+1}}(1 + \Delta PF_{t+1})(1 + \Delta F_{t+1}) + (1 + \Delta PF_{t+1})(1 + \Delta F_{t+1})$$

$$1 + R_{t+1} = \left(1 + \frac{D_{t+1}}{P_{t+1}}\right)(1 + \Delta PF_{t+1})(1 + \Delta F_{t+1}).$$

Log returns, with lowercase letters denoting logarithmic values, are then given as:

$$r_{t+1} = dp_{t+1} + pf_{t+1} + \Delta f_{t+1},$$

which is similar to Eq. (1) except for the timing of the share price in the dividend-price ratio, and that it is expressed in logs.

Table 1. Summary statistics

Means and standard deviations of stock returns and explanatory variables. Full sample (1891-2016) and post-WWII (1946-2016).

	1891-2016		1946-2016	
	Average	STD	Average	STD
Real stock return, p.a.	6.03%	5.03%	6.54%	5.55%
Valuation ratios:				
1. dp	4.06%	1.59%	3.30%	1.34%
2. ep	7.00%	2.65%	6.67%	2.75%
3. 1/cape	6.76%	2.79%	6.10%	2.39%
Growth in real fundamentals:				
4. Δe^{20}	1.58%	2.57%	2.17%	2.18%
5. Δd^{20}	1.14%	1.42%	1.38%	1.43%
6. Δy^{20}	3.41%	0.81%	3.53%	0.79%
Dividend yields and growth in real fundamentals:				
7. $dp + \Delta e^{20}$	5.65%	2.61%	5.47%	2.42%
8. $dp + \Delta d^{20}$	5.20%	1.78%	4.68%	1.47%
9. $dp + \Delta y^{20}$	7.47%	1.86%	6.84%	1.88%
Mean reversion in valuation ratios:				
10. Δpe	0.11%	3.88%	-0.19%	4.26%
11. Δpd	-0.52%	3.10%	-1.17%	3.29%
12. Δpy	1.84%	4.24%	0.94%	4.34%
Dividend yields, growth in real fundamentals, and growth in multiples:				
13. $dp + \Delta e^{20} + \Delta pe$	5.75%	5.97%	5.27%	6.04%
14. $dp + \Delta d^{20} + \Delta pd$	4.68%	4.37%	3.51%	4.01%
15. $dp + \Delta y^{20} + \Delta py$	9.32%	5.65%	7.78%	5.75%
Interest rates:				
16. Short (nominal) interest rate	4.28%	2.86%	4.73%	3.35%
17. Slope	-0.21%	1.58%	-0.60%	1.52%
18. Fed Model	2.51%	3.18%	1.35%	3.26%

Table 2. Results from predictive regressions

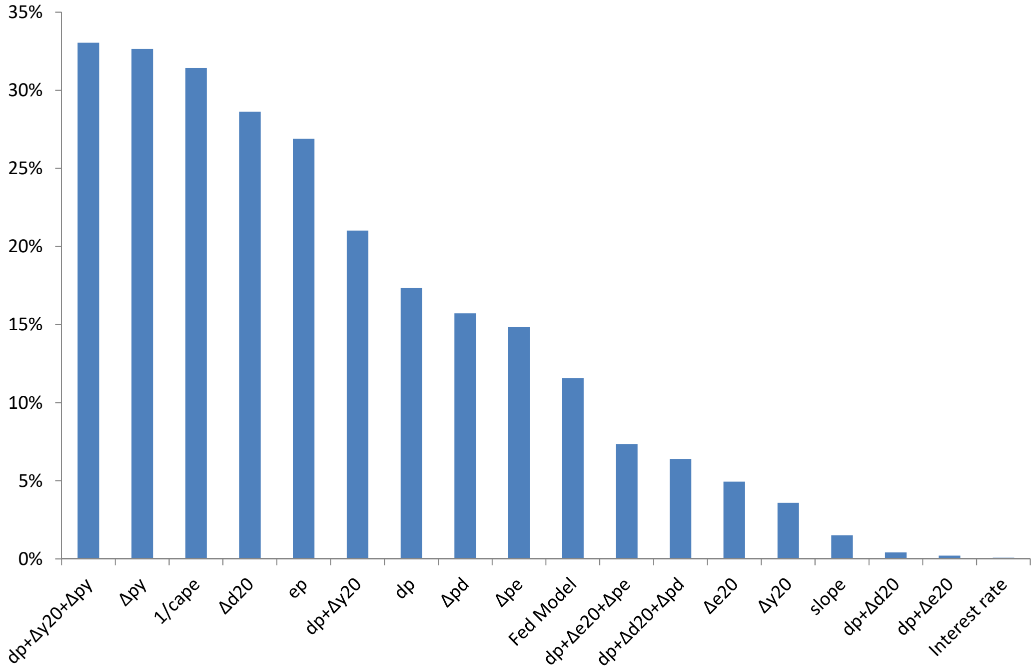
The table shows results from regressions of ten-year ahead real stock returns on the different predictors. The table shows the estimated coefficient ($\hat{\beta}$), the Newey-West (1987) *t*-statistic, and the R^2. I investigate predictive performance for the full 1891-2016 sample and the 1946-2016 subsample.

	1891-2016			1946-2016		
	$\hat{\beta}$	*t*-stat	R^2	$\hat{\beta}$	*t*-stat	R^2
Valuation ratios:						
1. dp	1.36	2.90*	17.3%	2.78	8.31*	45.1%
2. ep	0.98	5.76*	27.0%	1.21	5.29*	38.0%
3. $1/\text{cape}$	1.01	6.39*	31.4%	1.41	3.83*	39.0%
Growth in real fundamentals:						
4. Δe^{20}	-0.48	-1.38	5.0%	-0.92	-1.67	10.2%
5. Δd^{20}	-1.90	-4.13*	28.6%	-2.69	-8.21*	49.3%
6. Δy^{20}	1.18	1.91	3.6%	1.38	1.33	3.6%
Dividend yields and growth in real fundamentals:						
7. $dp + \Delta e^{20}$	0.09	0.29	0.2%	0.27	0.51	1.4%
8. $dp + \Delta d^{20}$	0.18	-0.38	0.4%	-0.29	-0.25	0.6%
9. $dp + \Delta y^{20}$	1.33	3.38*	21.0%	1.80	5.91*	33.9%
Mean reversion in valuation ratios:						
10. Δpe	0.50	3.27*	15.7%	0.66	3.53*	25.8%
11. Δpd	0.63	3.54*	15.9%	0.93	4.65*	31.6%
12. Δpy	0.66	6.69*	32.6%	0.68	4.36*	33.8%
Dividend yields, growth in real fundamentals, and growth in multiples:						
13. $dp + \Delta e^{20} + \Delta pe$	0.23	2.02*	7.4%	0.39	2.69*	17.0%
14. $dp + \Delta d^{20} + \Delta pd$	0.28	1.83	6.4%	0.57	3.05*	18.0%
15. $dp + \Delta y^{20} + \Delta py$	0.51	6.05*	33.0%	0.58	5.01*	39.3%
Interest rates:						
16. Short (nominal) interest rate	0.05	0.14	0.1%	-0.09	-0.19	0.3%
17. Slope	-0.41	-0.96	1.5%	-0.89	-1.47	5.7%
18. Fed Model	0.52	1.58	11.6%	0.73	2.22*	20.4%

Figure 1. *R*²s from predictive regressions

The figure shows R^2s in descending order from regressions of ten-year ahead real stock returns on predictive variables for two samples: The 1891-2016 sample (Panel A) and the post-WWII 1946-2016 sample (Panel B).

Panel A: 1891-2016



Panel B: 1946-2016

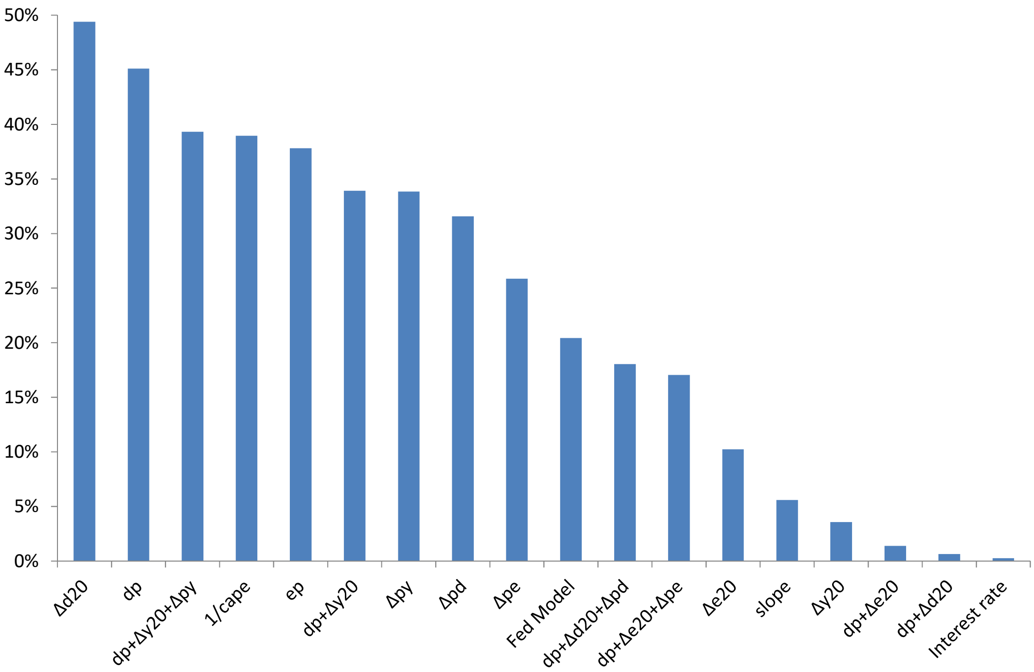
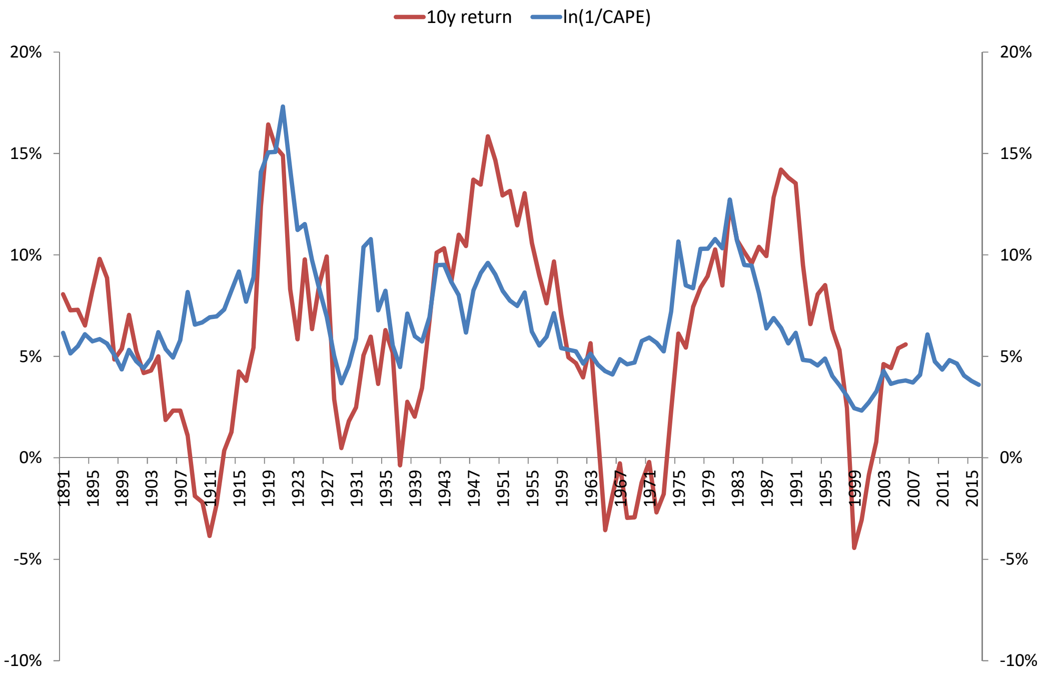


Figure 2. Expected and realized real stock returns

The figure shows ten-year ahead realized real stock returns together with 1/CAPE in Panel A, the 'sum of the parts' ($dp + \Delta y^{20} + \Delta py$) in Panel B, and the average of 1/CAPE and the 'sum of the parts' in Panel C.

Panel A: 1/CAPE and 10-year ahead returns



Panel B: $dp + \Delta y^{20} + \Delta py$ and 10 years ahead returns

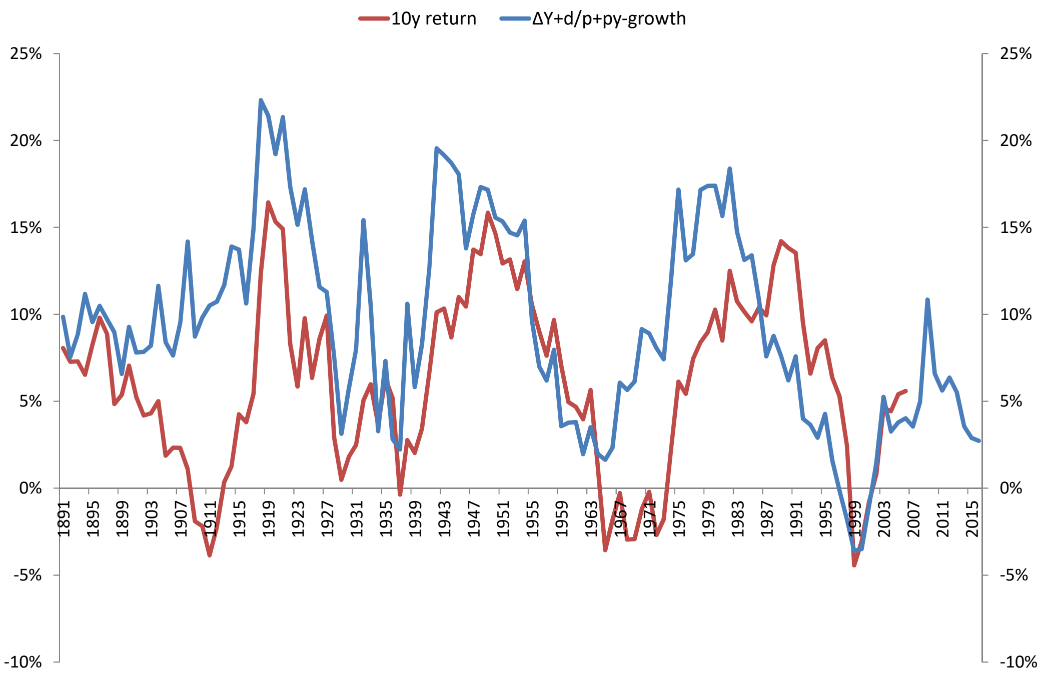


Figure 2 (cont.).

Panel C: [0.5(1/CAPE) + 0.5($dp + \Delta y^{20} + \Delta py$)] and 10 years ahead returns

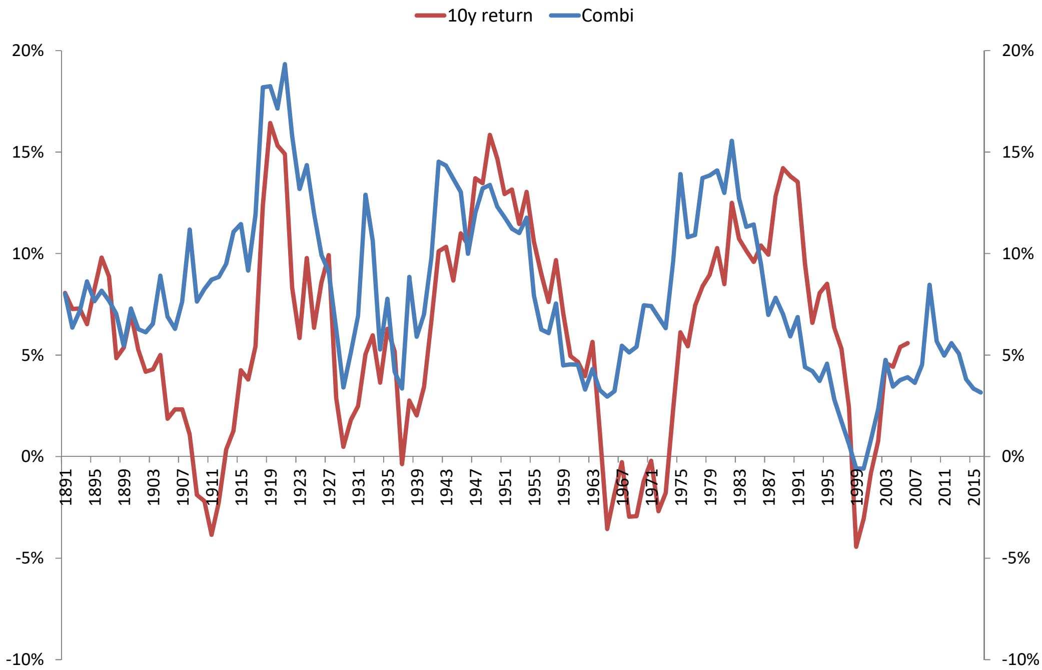


Figure 3. Uncertainty surrounding estimates of expected stock returns

The figure shows a scatter plot of observations of *Combi* and subsequent annualized ten-year ahead real stock returns. A trend line is added to the figure and the circle visualizes the range of historical observations of subsequent ten-year ahead returns when *Combi* was around 3%, as it is today.

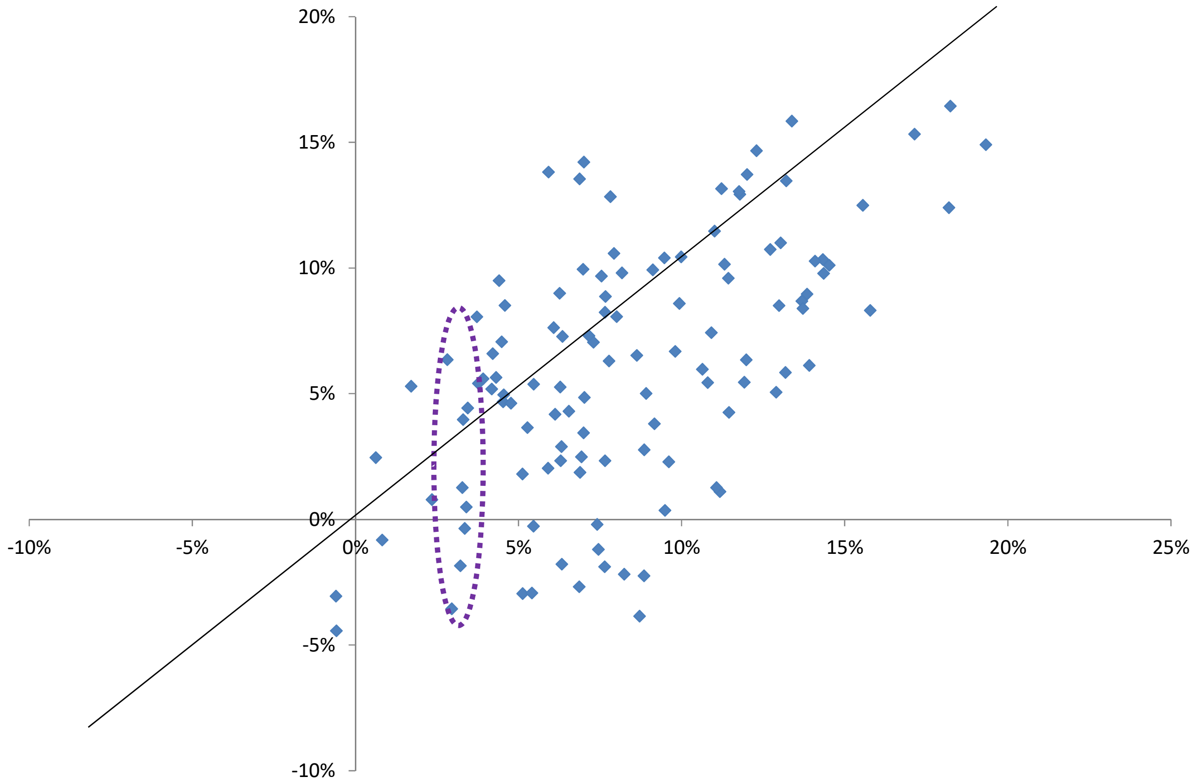


Figure 4. Expected real returns from bonds

The figure shows the expected real returns from a long-term bond. It is given as the entry nominal yield minus expected inflation. I proxy expected inflation as the average rate of annual inflation during the last decade.

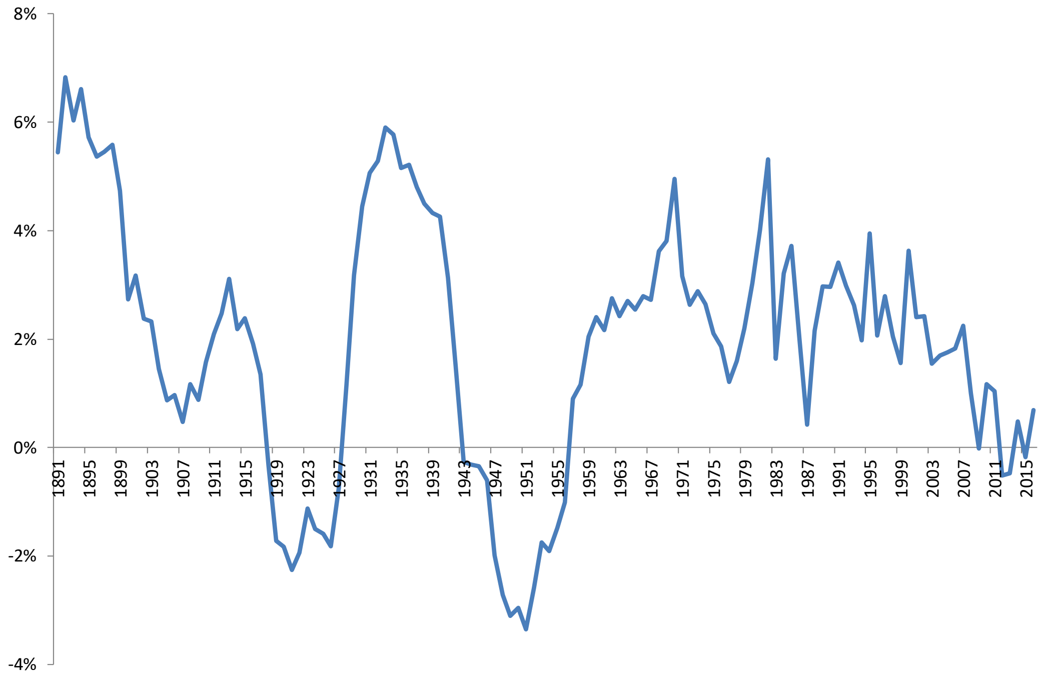


Figure 5. Expected real returns from a 50/50 stock-bond portfolio

The figure shows the time series of expected 10-year ahead real returns from a portfolio invested 50% in stocks and 50% in bonds. The dotted line is the average over the period.