

Long-Term Investing in a Nonstationary World

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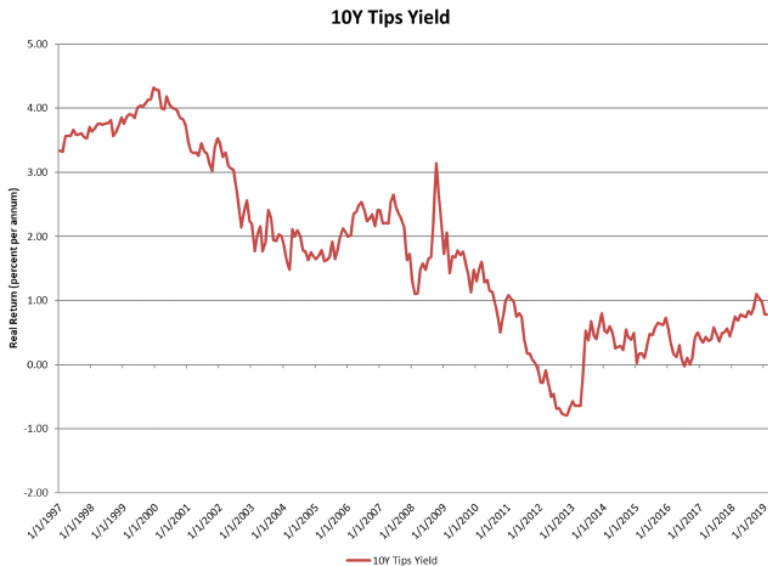
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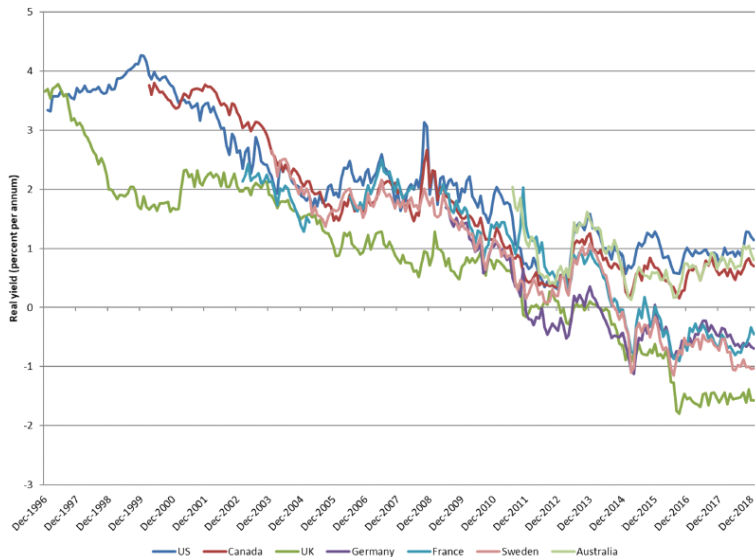
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 - ▶ Floating exchange rate (Friedman 1953)
 - ▶ Long-term real interest rate aka TIPS yield (Campbell and Shiller 1996)

The 10-Year TIPS Yield



Long-Term Real Interest Rates Around the World



Implications of Declining Real Rates: Wealth vs. Income

- Changes in long-term real interest rates change the relation between wealth and income
- Claims to safe real income (DB pensions) become more valuable relative to asset holdings (DC pensions)
 - ▶ Helps to explain political conflicts over public-sector pensions
- Human capital (owned by the young) becomes more valuable relative to financial assets owned by the old
 - ▶ This offsets the apparent shift in resources to the old caused by rising asset values

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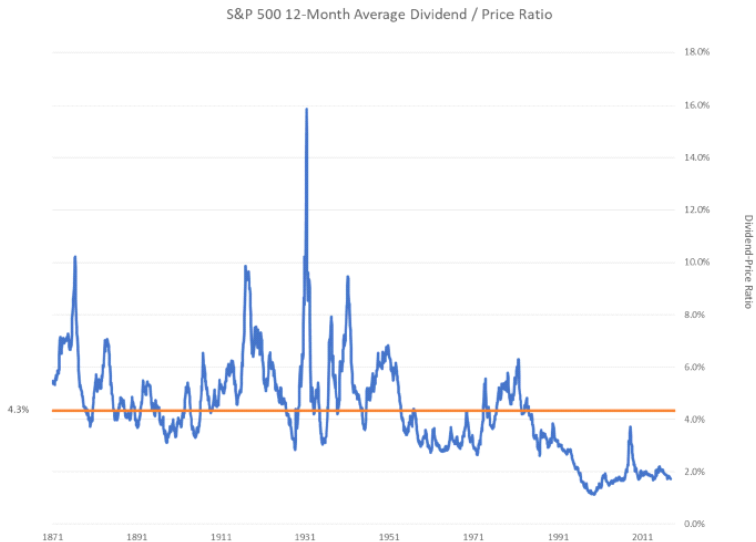
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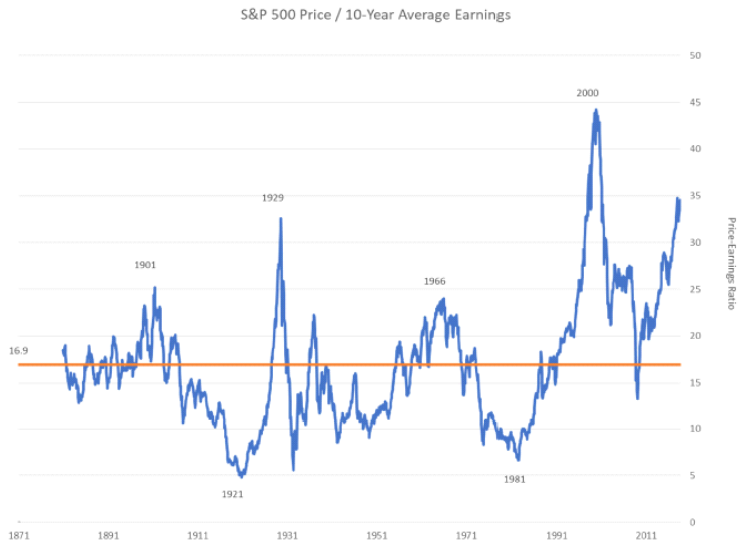
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 - ▶ Cyclically adjusted price-earnings (CAPE) ratio (Campbell and Shiller 1988b)

The Dividend-Price Ratio



The CAPE Ratio



Outline of the Talk

Nonstationarity of returns has profound implications for investors. I will discuss three of them.

- 1 Forecasting returns
- 2 Intertemporal hedging
- 3 Reaching for yield

Implications for Investors: Forecasting Returns

- Forecasting returns should take account of drifting valuations
 - ▶ Easy for TIPS, just use the yield
 - ▶ Harder for stocks, but one can derive a “drifting steady-state model” that generalizes the Gordon growth model
- Assumptions of the model:
 - ▶ Log dividend-price ratio follows a random walk
 - ▶ Dividend is determined one period in advance

- Then

$$\frac{D_{t+1}}{P_t} \approx E_t r_{t+1} - E_t g_{t+1},$$

where $r_{t+1} = \log(1 + R_{t+1})$ is the log gross return and g_{t+1} is the log dividend growth rate.

- ▶ See Campbell (2018, pp. 151–152).

Drifting Steady-State Model

- Rearranging,

$$E_t r_{t+1} \approx \frac{D_{t+1}}{P_t} + E_t g_{t+1},$$

where r_{t+1} is log return and g_{t+1} is log dividend growth rate.

- ▶ Important to use logs (geometric averages), because the volatility correction from geometric to arithmetic averages is not the same for returns and dividend growth when the dividend-price ratio varies over time.
- Siegel (2007) reports real geometric averages 1871–2006:

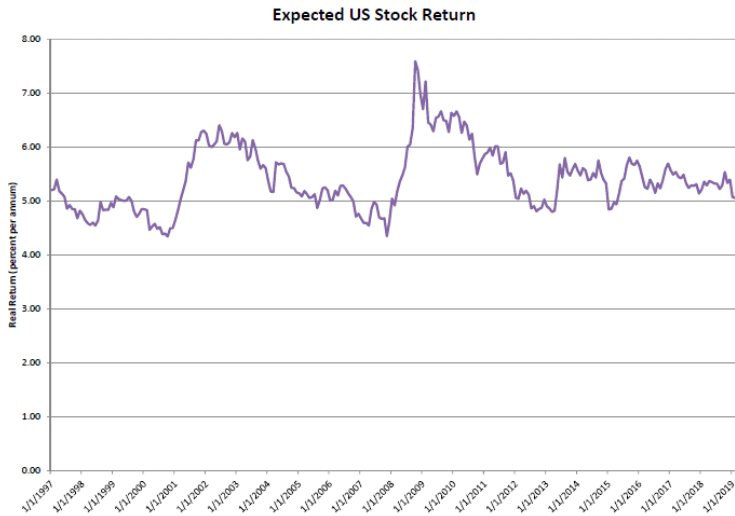
$$6.7\% = 4.5\% + 2.1\% + 0.1\%$$

- ▶ Geometric averages line up well with the model.
- ▶ Income accounted for 2/3 of total return over this period.

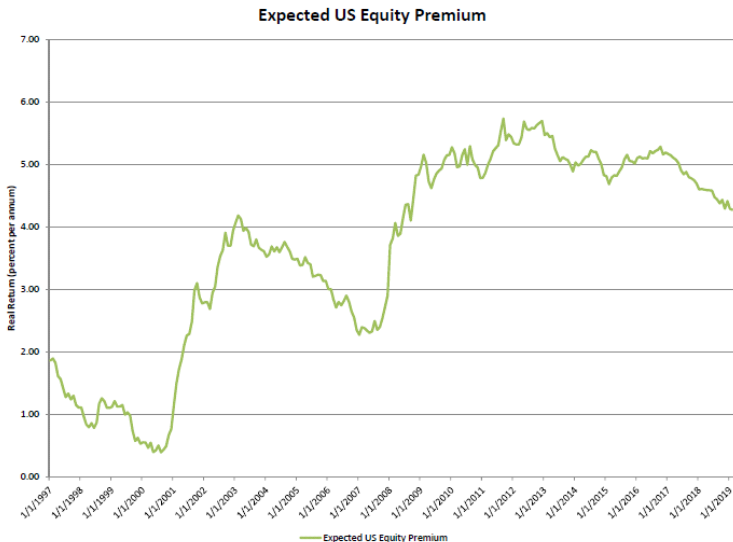
Drifting Steady-State Return Forecasts

- The drifting steady-state approach can also be applied to the earnings yield. Just as in a static model,
 - ▶ Dividends related to earnings by payout ratio.
 - ▶ Growth results from profitability (ROE) and reinvestment ratio.
 - ▶ Payout ratio and reinvestment ratio sum to one.
- High profitability in recent years implies higher growth and return, partially offsetting the decline in the earnings yield.

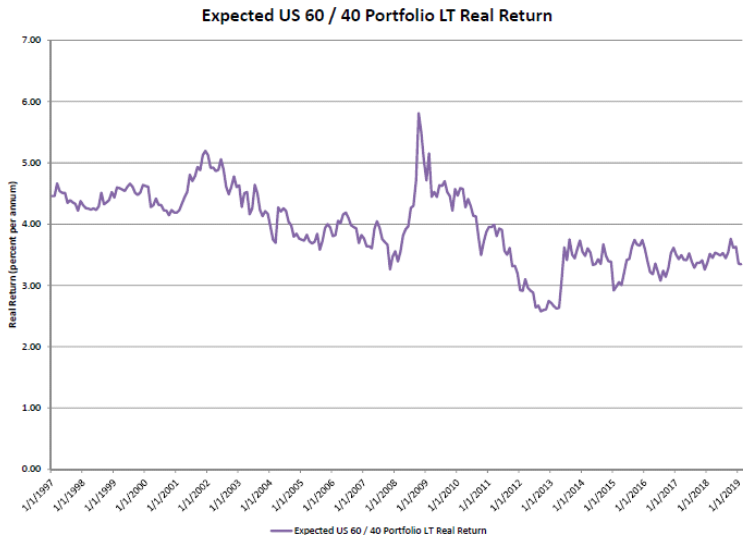
Drifting Steady-State Forecast: US Stock Return



Drifting Steady-State Forecast: US Equity Premium



Drifting Steady-State Forecast: 60/40 Portfolio Return



Sustainable Endowment Spending: First Cut

- In an environment where the expected return is a random walk, a constant spending ratio is not sustainable.
 - ▶ If the expected return drifts down, a constant spending ratio implies running down the endowment value.
- Assume spending is set one period in advance, then a sustainable spending rule is

$$C_{t+1} = (E_t R_{t+1}) W_t.$$

- ▶ This implies that wealth is a random walk because the expected return is consumed and only the unexpected return moves wealth.
- In logs,

$$c_{t+1} = \log(E_t R_{t+1}) + w_t,$$

where $c_{t+1} = \log(C_{t+1})$ and $w_t = \log(W_t)$.

- ▶ Note: $\log(E_t R_{t+1})$ is the log of the expected **net** simple return! Not the usual log of a gross return.

Intertemporal Hedging: First Cut

- What is the conditional variance of log spending? Lead one period and take conditional variances relative to time t expectations.

$$c_{t+2} = \log(\mathbb{E}_{t+1} R_{t+2}) + w_{t+1}.$$

$$\sigma_c^2 = \sigma_{er}^2 + \sigma_w^2 + 2\sigma_{er,w}.$$

- For any given conditional variance of log expected return σ_{er}^2 and conditional variance of log unexpected return σ_w^2 , the conditional variance of log consumption depends negatively on $\sigma_{er,w}$, the covariance between the log expected return and the log unexpected return.
- This is Merton's (1973) intertemporal hedging in the simplest possible form.

Simplicity is Valuable

John Cochrane (2014):

Dynamic incomplete-market portfolio theory is hard.... There is no simple closed-form solution, even for the simplest case.... Dynamic incomplete-market portfolio theory is widely ignored in practice, though it has been around for half a century. Even highly sophisticated hedge funds typically form portfolios with one-period mean-variance optimizers.... Institutions, endowments, wealthy individuals, and regulators struggle to use even the discipline of mean-variance analysis in place of name-based buckets, let alone to implement Mertonian state-variable hedging.

Well, calculating partial derivatives of unknown value functions is hard and, more importantly, nebulous. People sensibly distrust model-dependent black boxes.

Problems with the First Cut

$$C_{t+1} = (E_t R_{t+1}) W_t.$$

- A random walk expected return can go negative.
- The above spending rule then implies negative consumption.
- And even though wealth is a random walk with zero drift, consumption has a drift with the sign of $\sigma_{er,w}$.
- To fix this, we can work with the previous drifting steady-state model, reinterpreting “dividend” as consumption and “price” as wealth.

Sustainable Endowment Spending: Second Cut

- Assume that the log consumption-wealth ratio follows a random walk. Then the drifting steady-state model implies

$$\frac{C_{t+1}}{W_t} \approx E_t r_{t+1} - E_t g_{t+1},$$

where r_{t+1} is log return and g_{t+1} is log consumption growth rate.

- A sustainable spending rule sets $E_t g_{t+1} = 0$, implying

$$\frac{C_{t+1}}{W_t} = E_t r_{t+1}.$$

- If $\log(E_t r_{t+1})$ is a random walk, this is consistent with the requirement that the log consumption-wealth ratio is a random walk.
 - This model for $\log(E_t r_{t+1})$ keeps $E_t r_{t+1}$ and C_{t+1} positive.

Intertemporal Hedging: Second Cut

- We have

$$\Delta c_{t+2} = \log(\mathbb{E}_{t+1} r_{t+2}) - \log(\mathbb{E}_t r_{t+1}) + \Delta w_{t+1}.$$

- Hence, as before,

$$\sigma_c^2 = \sigma_{er}^2 + \sigma_w^2 + 2\sigma_{er,w}.$$

- Empirical illustration for the 60/40 portfolio: $\sigma_{er} = 15.7\%$, $\sigma_w = 9.6\%$, $\rho_{er,w} = -0.42$, so $\sigma_c = 14.5\%$.
 - ▶ Conditional standard deviation of consumption is higher than the single-period return standard deviation.
 - ▶ But in the absence of negative correlation, it would be even higher at $\sigma_c = 18.4\%$.
 - ▶ The risk-return tradeoff critically involves the correlation between realized and expected future returns, not just the variance of realized returns.

Riskless Long-Term Investing

- To get riskless consumption in this model, we need the elasticity of wealth with respect to the expected net return to be -1 .
- Equivalently, the negative elasticity of wealth with respect to the expected gross return (the “duration” of the portfolio) must be

$$\text{Dur}_t = \frac{1 + E_t r_{t+1}}{E_t r_{t+1}}.$$

- As the expected return falls, the duration must increase, from 30 years at an expected return of 3.5% to 101 years at an expected return of 1%.
- This may help to explain the demand for extremely long-term bonds in a stable-inflation environment with very low real interest rates.

Sustainable Spending Can Be Painful

- I have discussed the spending rule

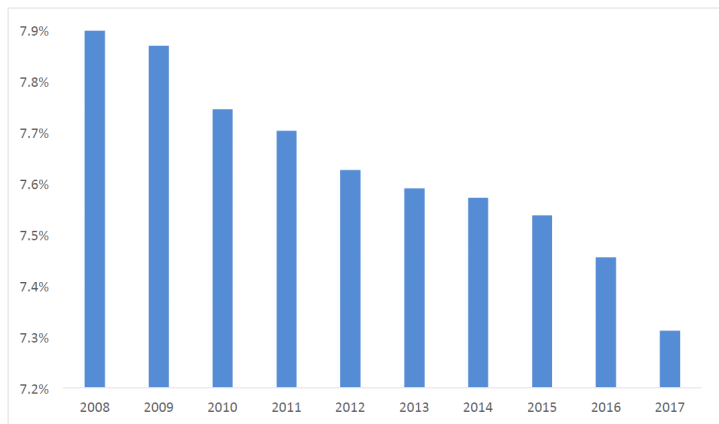
$$C_{t+1} = (E_t r_{t+1}) W_t.$$

- This is sustainable in the sense that the expected consumption growth rate $E_t g_{t+1} = 0$ when $\log(E_t r_{t+1})$ is a random walk.
- But when the expected return falls, it requires a painful cut in spending.
- In practice, endowments have been slow to reduce their target spending rates in the recent environment of declining returns.
 - ▶ Harvard's target spending rate remains fixed at 5%.
- A related phenomenon: public pension plans have been slow to reduce the rate at which they discount their liabilities (Lipshitz and Walter 2019).

Discount Rates of Public Pension Plans

Source: Lipshitz and Walter (2019)

Figure 10 - Average Discount Rate of 25 Largest Public Pension Systems (2008-2017)



Source: Comprehensive Annual Financial Reports. Data are reported as a simple average of the discount rates.

Utility Theory and Sustainable Spending

- Consider an investor with a standard power utility function, but who is constrained to follow the sustainable spending rule

$$C_{t+1} = (E_t r_{t+1}) W_t.$$

- This is a nonstandard formulation of the investment problem, but it may capture the situation of a university endowment:
 - ▶ The university has promised donors not to run down the expected value of future spending.
 - ▶ But the university also has spending needs, risk aversion, and discounts the future in the usual way.

Simplify to Comparative Statics

- To make the analysis tractable, consider a case where investment opportunities are constant, $E_t r_{t+1} = E r_{t+1}$, so

$$C_{t+1} = (E r_{t+1}) W_t.$$

- ▶ We have returned to the world of the standard Gordon growth model.
 - ▶ The consumption-wealth ratio is now constant.
 - ▶ There is no intertemporal hedging because asset returns are iid.
 - ▶ Log consumption is a random walk—with no drift because of the sustainable spending rule.
- The solution to this problem has some standard features:
 - ▶ With log utility, the investor chooses the usual growth-optimal portfolio that maximizes $E_t r_{t+1}$ and therefore also current spending.
 - ▶ With risk aversion $\gamma > 1$, the investor chooses a more conservative portfolio.

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- As the investor becomes more impatient, the investor takes more risk.
 - ▶ This is because the benefit of risk (higher spending) is obtained immediately, whereas the cost (more volatile future consumption) is delayed.
 - ▶ In the limit, an extremely impatient investor holds the growth-optimal portfolio regardless of risk aversion.

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 - ▶ Intuition (1): A given proportional increase in consumption requires a given proportional increase in the expected portfolio return. This requires a smaller increase in risk when the riskless interest rate is low than when it is high.
 - ▶ Intuition (2): At a lower riskless interest rate, an investor with a constant discount rate wants higher expected marginal utility in the future relative to today. If this cannot be achieved by increasing expected log consumption today relative to the future, it can be achieved by taking more risk.

Risk-Taking as Short-Termism

- These nonstandard features result from the conflict between a sustainable spending constraint and a utility function that discounts the future.
 - ▶ In the usual portfolio choice problem, when the interest rate moves while the time discount rate remains constant, the investor responds by tilting the planned consumption path.
 - ▶ If this is prevented, the investor may use portfolio risk as another indirect way to trade off the present vs. the future.
 - ▶ Chris Anderson (2019) makes the related point that arbitrary consumption rules alter the usual formulas of consumption-based asset pricing.
- Considerations like these may help to explain the evidence of reaching for yield among institutional investors.

Wealth vs Income

- In a world with persistent changes in rates of return, the level of wealth and the permanent income (sustainable spending) generated by that wealth can move in very different ways.
- The accounting profession has focused in recent years on measuring wealth (the mark-to-market value of assets).
- But there is a great need for measures of permanent income.
 - ▶ Quite different from current income, which is relevant for tax purposes but has little other economic meaning.
- Permanent income is hard to measure unambiguously, but the benefits are large enough to justify a substantial effort.