Financial Econometrics Econ 40357
Constant expected return model and efficient market hypothesis

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Textbook

- Brooks pp. 334-351.
- Brooks pp. 586-588.

Efficient Market Hypothesis and Testable Implications

Statement of the hypothesis

1. Current price of asset 'reflects' all currently available public information.
2. Implies you shouldn't be able to systematically predict future returns and earn abnormal profits based on publically available information.
3. When there is news, it gets incorporated into asset prices immediately.

Let I_t be information set at t. Then,

$$E(r_{t+1}|I_t) = 0$$

Testable implications. Let r_t be the return on an asset or portfolio of assets, and x_t be a vector of publically available information. Then β in the regression should be zero.

$$r_{t+1} = \alpha + \beta' x_t + \epsilon_{t+1}$$

ϵ_{t+1} is uncorrelated (orthogonal) to I_t

Test Efficient Market Hypothesis

1. What to use for x_t? How about past returns?
2. Fama, for many years (in the 70s and 80s, the biggest proponent of efficient markets hypothesis.
3. Then Fama himself uncovered violations of the hypothesis, with multiperiod returns.
4. What about multiperiod returns? If it's true for one-period ahead, it must be true for multiperiod returns.

Dividend yield as predictor

P is the stock price (not log price), d is the dividend (not log). $\beta = \frac{1}{1+\rho}$ is the subjective discount factor, ρ is the discount rate. Present value model,

$$P_t = E_t \sum_{j=0}^{\infty} \beta^j d_{t+j}$$

Let's say we expect dividends to grow at rate δ each period, so that

$$\begin{aligned} E_t d_{t+1} &= (1+\delta)\, d_t \\ E_t d_{t+j} &= (1+\delta)^j\, d_t \end{aligned}$$

and $\rho > \delta$. Then

Dividend yield as predictor (theory)

$$
\begin{aligned}
P_t &= E_t \sum_{j=0}^{\infty} \beta^j d_{t+j} = \sum_{j=0}^{\infty} \left(\frac{1+\delta}{1+\rho}\right)^j d_t = \left(\frac{1+\rho}{\rho-\delta}\right) d_t \\
E_t P_{t+1} &= \left(\frac{1+\rho}{\rho-\delta}\right)(1+\delta)\, d_t \\
E_t P_{t+2} &= \left(\frac{1+\rho}{\rho-\delta}\right)(1+\delta)^2\, d_t \\
E_t \frac{P_{t+1}}{P_t} &= \left(\frac{1+\rho}{\rho-\delta}\right)(1+\delta)\, \frac{d_t}{P_t} \\
E_t \frac{P_{t+2}}{P_t} &= \left(\frac{1+\rho}{\rho-\delta}\right)(1+\delta)^2\, \frac{d_t}{P_t}
\end{aligned}
$$

Must be the case that

$$
E_t \frac{P_{t+k}}{P_t} = \left(\frac{1+\rho}{\rho-\delta}\right)(1+\delta)^k\, \frac{d_t}{P_t}
$$

Dividend yield predicts future returns. Slope gets bigger as horizon increases.

Famous finance regression

$$r_{t,t+k} = \alpha + \beta_k \frac{d_t}{P_t} + \epsilon_{t,t+k} \tag{1}$$

where $r_{t,t+k}$ is the $k-$ period ahead future return on the stock market, d_t/P_t is the current period dividend yield on the market.

- Fama and French, Campbell and Shiller ran these regressions long ago. There are two points
- First, that returns are predictable
- Second, because the dividend yield moves around, the risk premium (on the market) varys over time.

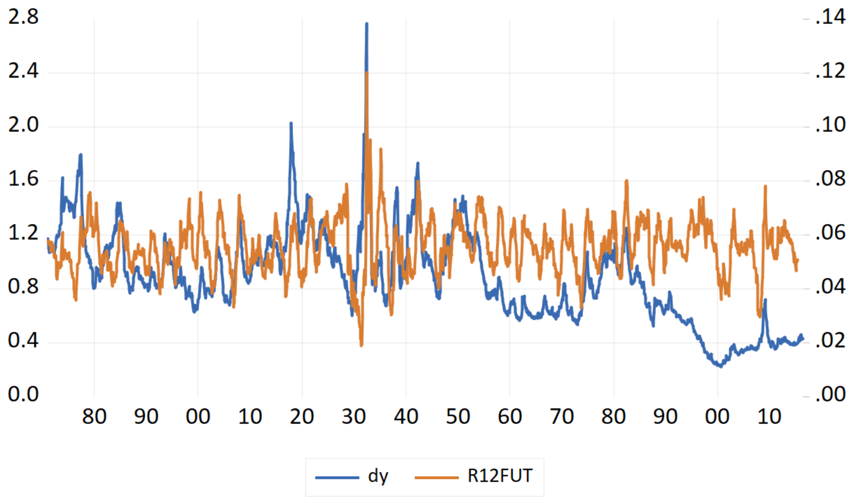
Before running this regression, we want to know if the dividend yield is stationary, or if it has a unit root. **Let's do it! with lh_dy.wf1.**

Note also that the predictive regression for $k > 1$ will induce serial correlation in regression error terms.

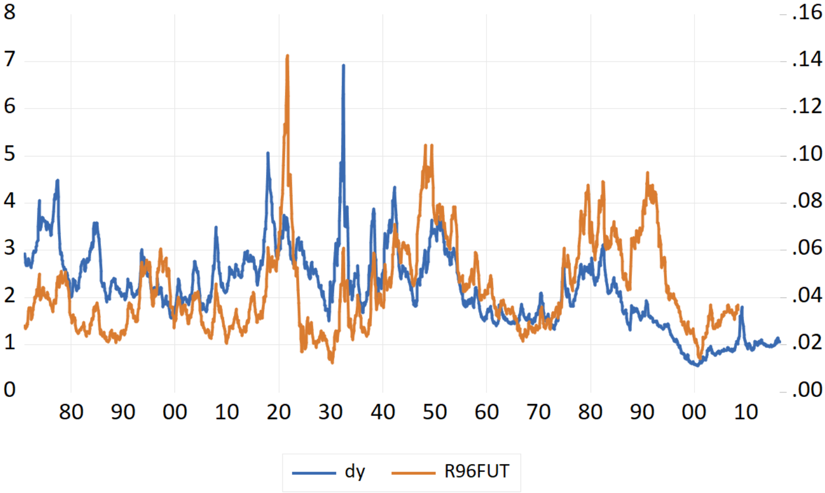
Standard errors need to be estimated by Newey-West.

The results reject the random walk hypothesis for stock prices.

Dividend yield and 12-month ahead 1-year return



Dividend yield and 96-month ahead 8-year return



'Overlapping' observations in regression

- Let $r_{1,t} = p_t - p_{t-1}$ and let $x_t = d_t / P_t$ be the dividend yield. The efficient markets idea is

$$E_t(r_{1,t+1}) = \beta_1 x_t$$
$$r_{1,t+1} = \beta_1 x_t + \epsilon_{t+1}$$

  ϵ_{t+1} not realized until $t+1$, and is uncorrelated (orthogonal) to all information available at t.

- Suppose process driving dividend yield is

$$x_t = \rho x_{t-1} + u_t$$

  where $0 < \rho < 1$, and $u_t \overset{iid}{\sim} (0, \sigma_u^2)$. Then

$$r_{1,t+2} = \beta_1 x_{t+1} + \epsilon_{t+2} = \beta_1 \rho x_t + \epsilon_{t+2} + \beta_1 u_{t+1}$$

$$
\begin{aligned}
r_{t+1} &= \beta_1 x_t + \epsilon_{t+1} \\
r_{t+2} &= \beta_1 x_{t+1} + \epsilon_{t+1} = \beta_1 \left(\rho x_t + u_{t+1}\right) + \epsilon_{r+1} \\
y_{t+2} &= r_{t+1} + r_{t+2} = \beta_1 \left(1 + \rho\right) x_t + \epsilon_{t+2} + \epsilon_{t+1} + \beta_1 u_{t+1} \\
y_{t+3} &= r_{t+2} + r_{t+3} = \beta_1 \left(1 + \rho\right) x_{t+1} + \epsilon_{t+3} + \epsilon_{t+2} + \beta_1 u_{t+2}
\end{aligned}
$$

Solution: Newey-West t-ratios

Two additional points

- There are variables that forecast stock returns.

$$R^e_{t+k,t} = \alpha + \beta \left(\frac{d_t}{P_t} \right) + \epsilon_{t+k}$$

  Plot dividend yield against the 7 year return. If you bought stocks in 1980, great! Bought stocks in 2000–not so good. **Code: LHret_DY_plot.m**.

- Lesson is, $E_t R^e_{t+k,t}$ varies a lot. Expected excess returns are large and **variable**. Why?

  The 1970s economy was terrible. Since 2008, the economy has been terrible. In the bad state, people have low tolerance for risk.

  But isn't P high because people forecast high dividend growth? Evidence says no! Prices are high relative to dividends because people expect low future returns. Prices move around dividends. Dividends don't move around prices.

  Prices are high (dividend yield low) when people are willing to hold risk (expansion/boom). Prices are low (dividend yield high) when people unwilling to bear risk (recession).