No office hours today.
Midterm is take home.

We were talking about Newey-West, serially correlated errors, multiperiod returns in predictive regression.

Looking at dividend yield, moves around mainly because of P_t.$d_t$is fairly stable.

Let $R^e_{t,t+h}$ be the $h-$period ahead excess return.

$$R^e_{t,t+h} = \underbrace{\alpha_h + \beta_h \left(\frac{d_t}{P_t}\right)}_{\text{risk premium}} + \epsilon_{t,t+h}$$

What is interpretation of $E\left(R^e_{t,t+h}|I_t\right)$?It's a risk premium!

Why does the dividend yield predict future returns? (A toy model)

P is the stock price. d is the dividend (not logs). $\beta = \frac{1}{1+\rho}$ is the subjective discount factor where ρ is the rate of time preference. The present value model says

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

Suppose we expect dividends to grow at rate δ. Then

$$\begin{aligned}
E_t d_{t+1} &= (1+\delta)\, d_t \\
E_t d_{t+2} &= (1+\delta)\, E_t d_{t+1} = (1+\delta)^2\, d_t \\
&\vdots \\
E_t d_{t+j} &= (1+\delta)^j\, d_t
\end{aligned}$$

Substitute these forecasting rules into the PV model

$$\begin{aligned}
P_t &= d_t \sum_{j=0}^{\infty} \beta^j (1+\delta)^j \\
&= d_t \sum_{j=0}^{\infty} \left(\frac{1+\delta}{1+\rho}\right)^j
\end{aligned}$$

we need $\rho > \delta$,then $(1+\delta)(1+\rho) < 1$,and

$$\begin{aligned}
P_t &= \left(\frac{1+\rho}{\rho-\delta}\right) d_t \\
E_t\left(P_{t+1}\right) &= \left(\frac{1+\rho}{\rho-\delta}\right) E_t\left(d_{t+1}\right) = \left(\frac{1+\rho}{\rho-\delta}\right)(1+\delta)\, d_t \\
E_t\left(\frac{P_{t+1}}{P_t}\right) &= \left(\frac{1+\rho}{\rho-\delta}\right)(1+\delta)\, \frac{d_t}{P_t}
\end{aligned}$$

So it must be the case that

$$E_t\left(\frac{P_{t+2}}{P_t}\right)=\left(\frac{1+\rho}{\rho-\delta}\right)(1+\delta)^2\,\frac{d_t}{P_t}$$

The implied slope in the regression is increasing with the return horizon.

Newey-West gives the 'correct' standard error (t-ratio) when the regression errors are serially correlated. They also give the correct values when the error terms are conditionally heteroskedastic. Lesson: When doing time-series regression with financial data, ALWAYS USE NEWEY-WEST.

Some necessary Matrix Algebra (sorry).

Text pp. 28-35.

Definitions.

Scalar is a single number.

Matrix is a two-dimensional array. a_{ij} is the entry in row i and column j. In this example, A is a 3×2 matrix.

$$A=\begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \\ a_{31} & a_{32} \end{pmatrix}$$

Vector: is a one-dimensional array.

$$v_1=\begin{pmatrix} a_1 \\ a_2 \\ a_3 \end{pmatrix}$$

This is a column vector of dimension 3. And

$$v_2=\begin{pmatrix} a_1 & a_2 & a_2 \end{pmatrix}$$

is a 3-dimensional row vector.

A square matrix has as many columns as rows.

$$A=\begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix}$$

A symmetric matrix is a square matrix where elements above the diagonal are the same as those below. i.e., $a_{ij}=a_{ji}$

$$A=\begin{pmatrix} 2 & 3 & 4 \\ 3 & 10 & 6 \\ 4 & 6 & 11 \end{pmatrix}$$

Transpose of matrix. The $i-th$ row of old matrix becomes the $i-$the column of the new matrix. If

$$A = \left(\begin{array}{cc} a_{11} & a_{12} \\ a_{21} & a_{22} \\ a_{31} & a_{32} \end{array} \right)$$

$$A' = A^T = \left(\begin{array}{ccc} a_{11} & a_{21} & a_{31} \\ a_{12} & a_{22} & a_{32} \end{array} \right)$$

if

$$v_1 = \left(\begin{array}{c} a_1 \\ a_2 \end{array} \right)$$

then

$$v_1' = \left(\begin{array}{cc} a_1 & a_2 \end{array} \right)$$

The zero matrix is where all the entries are 0.

$$A = \left(\begin{array}{cc} 0 & 0 \\ 0 & 0 \end{array} \right)$$

The identity matrix is square with 1's on diagonal and zeros every where else.

$$I = \left(\begin{array}{cc} 1 & 0 \\ 0 & 1 \end{array} \right)$$