7th set assignments Introductory Econometrics

Task 1

Practical example: Testing the Efficient Market Hypothesis

Literature: Hayashi(2000), pp.150-159, Mishkin(1992), Fama(1975)

A complete discussion of the example can be found in Hayashi(2000), pp.150. To summarize the problem: We want to test the efficient market hypothesis of Fama(1976). Following the arguments on p.152 in Hayashi there are two testable implications of the efficient market hypothesis when applied to Treasury bills in a rational expectation framework:

1. The ex-post real interest rate r has a constant mean and is serially uncorrelated

2. The nominal interest rate R_t is the best inflation forecast on the basis of all available information. Since the nominal interest rate is determined by the price of a Treasury bill this implication is equivalent to the notion that asset prices contain all available information. Formally, we can write $E(\pi_{t+1}|I_t) = -r + R_t$ where I_t is the full information set available at time t.

Data set description:

- `Year`

- `Month`

- `PAI1` $\hat{=}$ one-month inflation rate (in percent, annual rate)

- `PAI3` $\hat{=}$ three-month inflation rate (in percent, annual rate)

- `TB1` $\hat{=}$ one-month T-Bill rate (in percent, annual rate)

- `TB3` $\hat{=}$ three-month T-Bill rate (in percent, annual rate)

- `CPI` $\hat{=}$ consumer price index

- Download the Excel spreadsheet `mishkin.xls` and import the data in EViews.

- Create another inflation rate series calculated from the given CPI data as:

$$\pi_{t+1} = \left[\left(\frac{P_{t+1}}{P_t} \right)^{12} \right] \times 100$$

- Explore your data graphically and provide descriptive statistics.

- To test for stationarity, conduct Dickey/Fuller tests for all series in your data set and interpret the results. Therefore, open the respective data series and use `VIEW` → `UNIT ROOT TEST`

- **Test implication 1:** Compute the ex-post real rate r by subtracting the newly constructed inflation rate from the one-month T-Bill rate and test the real rate series for serial correlation. Use VIEW $\rightarrow$ CORRELOGRAM. First, look at the serial correlation for the period 1953:1 to 1971:7 (period used by Fama(1975)). Then, look at the post-Fama period. How do you conclude?

- **Test implication 2:** Let $y_t \equiv \pi_{t+1}$, $\mathbf{x}_t \equiv (1, R_t)'$, $\varepsilon_t \equiv \eta_{t+1}$ (the inflation forecast error) which is a martingale difference sequence with $E(\eta_{t+1}|I_t) = 0$.
  Estimate the following regression for the two time periods (Fama sample and post Fama sample):
  $$\pi_{t+1} = \beta_1 + \beta_2 R_t + \eta_{t+1} \ \text{ or } \ y_t = \mathbf{x}_t\boldsymbol{\beta} + \varepsilon_t$$

  In the estimation window you can choose under Options the standard errors being reported. Use classic standard errors as well as heteroskedasticity-robust standard errors and compare the results.

- Test the hypothesis coming from theory that the parameter β_2 is equal to one. Conclusion? How can you interpret the intercept? For which values $\bar{r}$ can you not reject $H_0 : r = \bar{r}$? Hint for computing confidence bounds :

  ```
  scalar up=eq01.@coefs(i)+2*eq01.@stderrs(i)
  scalar low=eq01.@coefs(i)-2*eq01.@stderrs(i)
  ```

  where eq01 is the name of the equation object and i denotes the ith element in the estimated coefficient vector.

- It is argued that the CPI series exhibits a strong seasonal pattern. In order to account for seasonality you are asked to replace the constant in the estimation with twelve dummy variables for each month. This can be easily done by just adding @expand(month) in the estimation window where you specify your regression configuration. Why do you have to remove the constant first if twelve dummies for each month are added? What happens if you do not remove the constant from the model?

Task 2

Read pp. 150 and reconsider why the efficient market hypothesis implies the important parts of the assumptions justifying the t-test in the regression above, i.e. the OLS estimator is asymptotically normal.