FE312: Homework 7

1 Predicting bond returns

Let's try to replicate (and extend) some of the bond predictability results we saw in class. Open the file "FamaDiscount.dta". It contains a time series of zero coupon bond prices of maturity 1 through 5 years. For convenience, we will work with logs throughout.

1. Create yields from bond prices. The yield to maturity of a zero coupon bond with price P^n maturing in n years is

$$y_t^n = -\frac{1}{n}\log\left(\frac{P_t^n}{100}\right)$$

2. Create a set of forward rates. The forward rate between years $n-1$ and n can be computed as

$$f_t^n = \log\left(\frac{P_t^{n-1}}{100}\right) - \log\left(\frac{P_t^n}{100}\right)$$

3. Create a set of 1-yr (=12 months) bond returns. The 1-yr holding period return for a zero with maturity of 1 year is obviously y_1. For bonds with maturity $n = 2..5$, it equals

$$R_{t\to t+12}^n = \log\left(\frac{P_{t+12}^{n-1}}{100}\right) - \log\left(\frac{P_t^n}{100}\right)$$

4. Does the forward spread predict future yields (the EH)? Estimate the following regression:

$$y_{t+12\times(n-1)}^1 - y_t^1 = a_n + b_n\left(f_t^n - y_t^1\right) + \varepsilon_{n,t}$$

Report your results: coefficients, R^2 and standard errors. Compare your results to what we did in class. One big difference that you will see is the standard errors. Your standard errors will be much lower; the reason is that the errors in the regression above are serially correlated (why?) One way to adjust the standard errors is using the Newey-west adjustment. This adjustment can be done in Stata by using the *newey* command (in place of *regress*). Specify the number of lags to equal the number of overlapping observations (here this is equal to $(n-1) \times 12$).

5. Now, run the bond return predictability regression:

$$R^n_{t\to t+12} - y^1_t = a_n + b_n \left(f^n_t - y^1_t\right) + \varepsilon_{n,t}$$

   Report your results: coefficients, R^2 and standard errors. Compare to the results in the lecture notes. As before, you need to compute standard errors using the NW adjustment. Choose a lag length of 12 months.

6. Now, let's extend this a bit. There is no reason why we cannot use *all* the forward rates in the above regression, is there? Repeat the above, but now estimate

$$R^n_{t\to t+12} - y^1_t = a_n + b_1 y^1_t + b_2 f^2_t + b_3 f^3_t + b_4 f^4_t + b_5 f^5_t + \varepsilon_{n,t}.$$

   Again, don't forget to adjust your standard errors using NW. Notice the increase in R^2 from the previous regression.

   Notice the pattern of the slope coefficients, and how the pattern changes across maturities. What is more interesting is that all of this predictability can be summarized by one variable. This is the Cochrane-Piazessi (2005, AER) bond predictability factor. To construct it, create a new variable named CP that contains the fitted values of the previous regression for $n = 2$ (use the Stata *predict, xb* command). See how much information you lose by using only the CP factor (which is a linear combination of y^1 and f^n). Estimate

$$R^n_{t\to t+12} - y^1_t = a_n + b_1 CP_t + \varepsilon_{n,t}.$$

   Compare the R^2 to the unrestricted specification. Convince yourself that adding individual forward rates does not help you much more.

7. What is CP? No one really knows, but it seems to be somewhat related to the business cycle. The dataset you have also contains NBER recession dates. Plot the CP factor versus the NBER recession dates.