Mgmt 237e: Homework 5

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Please use Matlab/R to solve these problems. You can work in groups of up to 4 students, and you can just hand in one set of solutions that has all the names of the contributing students on it. The problem set is due on March 1 by 9.00 AM. Use the electronic drop box to submit your answers. Submit the Matlab/R file and the file with a short write-up of your answers. If you have used Matlab for the previous problem set, please use R for this one, and vice-versa.

In class, we investigated the connection between the slope (term spread) of the yield curve and future interest rates. This problem set takes another look at this evidence by using forward rates. Do forward rates predict future interest rates or do they predict returns?

This problem set is based on a famous paper by Fama and Bliss (1987). Please download the Fama-Bliss zero-coupon bond yields. You may want to practice downloading the data from the CRSP database. If you choose to do this, you want to download the Fama-Bliss zero-coupon prices, which you can find under the heading 'Monthly Treasuries'. These are the prices of bonds that pay 100 dollars in 1,2,3,4 and 5 years. The data starts in 1952.6 and it ends in 2014.12. We will run the regressions with maturity n defined in terms of years.

An n-year zero coupon bond pays one dollar n years from now. $P_t^{(n)}$ denotes the price of an n-period zero-coupon bond. $p_t^{(n)}$ denotes the log price of an n-period zero-coupon bond. The log yield of an n-period zero-coupon bond is denoted $y_t^{(n)} = -(1/n)p_t^{(n)}$. The log holding period return is given by $hpr_{t+1}^{(n)} = p_{t+1}^{(n-1)} - p_t^{(n)}$, where the investor buys an n period bond and sells an $n-1$ period bond one year later. The forward rate $f_t^{(n,n+1)}$ is a rate you can lock in today for borrowing in the future from period n to period $n+1$. The forward rate can be synthesized by shorting an $n+1$ period bond and buying an n period bond:

$$\begin{aligned} f_t^{(n,n+1)} &= p_t^{(n)} - p_t^{(n+1)} \\ &= -ny_t^{(n)} + (n+1)y_t^{(n+1)} \end{aligned}$$

1. Predictability in Yields (50 pts): If the expectations hypothesis holds for interest rates, then the forward rate equals the expected future spot rate:

$$f_t^{(n,n+1)} = \mathbb{E}_t[y_{t+n}^{(1)}]$$

In post-war data, interest rates all share a very persistent component due to inflation. As a result, we subtract the short rate from both sides. We posit the following linear regression model for short-term interest rates:

$$y_{t+n}^{(1)} - y_t^{(1)} = \beta_0^{(n+1)} + \beta_1^{(n+1)} \left(f_t^{(n,n+1)} - y_t^{(1)} \right) + u_{t+n}^{(n+1)}, \qquad n = 1, 2, 3, 4$$

   (a) Suppose we want to test the expectations hypothesis using this linear regression model. State the null hypothesis to be tested. (25 pts)

   (b) Test the null hypothesis using monthly data on the entire sample. Calculate both OLS standard errors and HAC standard errors. Explain and interpret your findings. (25 pts)

2. Predictability in Returns (50 pts): Let us consider forecasting future excess holding period returns using the forward spread. We posit the following linear regression model:

$$hpr_{t+1}^{(n+1)} - y_t^{(1)} = \gamma_0^{(n+1)} + \gamma_1^{(n+1)} \left(f_t^{(n,n+1)} - y_t^{(1)} \right) + u_{t+1}^{(n+1)}, \qquad n = 1, 2, 3, 4$$

   (a) Suppose we want to test the expectations hypothesis using this linear regression model. State the null hypothesis to be tested. (25 pts)

   (b) Test the null hypothesis using monthly data on the entire sample. Calculate both OLS standard errors and HAC standard errors. Explain and interpret your findings. (25 pts)

References

Fama, E. F. and R. R. Bliss (1987). The information in long maturity forward rates. *American Economic Review 77*, 680–692.