ECON 485, Empirical Project (30% of the final grade) **Due: Monday, April 25**

Important: Each student is required to work completely independently on this project. Similarity in answers will be penalized (even if they are correct) by deducting points. No late submissions will be accepted.

Question 1 (20 points). The spreadsheet "bond data" in the file "data_PS3" contains monthly data for annualized yields to maturity of U.S. Treasury bonds with maturities of 1 to 5 years. The time series period is June 1952 – February 2015. Let $y_t^{(\tau)}$ denote the yield to maturity in month t of a bond with τ years to maturity. For example, $y_t^{(1)}$ denotes the yield to maturity for a one-year bond.

(a) Compute the bond prices for these bonds and plot them on one graph.

(b) Compute excess bond returns with a holding period of one year. Since the data is monthly, these returns $rx_{t+12}^{(\tau)}$ are computed between month t and $t+12$ (12 months in the future)Again, plot them in a graph.

(c) Compute the forward rates, denoted by $f_t^{(\tau)}$ implied in these bond yields. Run a regression for each $\tau = 2, 3, 4$, and 5

$$rx_{t+12}^{(\tau)} = \beta_0 + \beta_1^{(\tau)} y_t^{(1)} + \beta_2^{(\tau)} f_t^{(2)} + ... + \beta_5^{(\tau)} f_t^{(5)} + e_{t+12}^{(\tau)},$$

and report the estimates, standard errors, t-statistics and R^2 (you can use the command `newey y x` in STATA to obtain standard errors that take into account the serial correlation in the errors). Test for statistical significance of the coefficients and discuss the results. What are the implications of these results for the expectations hypothesis?

(d) Another way to test the expectations hypothesis is to run the regression

$$y_{t+12}^{(\tau-1)} - y_t^{(\tau)} = \delta + \gamma \frac{y_t^{(\tau)} - y_t^{(1)}}{\tau - 1} + u_{t+12}^{(\tau)}$$

and test the hypothesis $H_0 : \gamma = 1$ which is implied by the expectations hypothesis. Run the above regression for $\tau = 2, 3, 4$, and 5 and report estimates, standard errors, t-statistics and R^2 (again, you may want to use the command `newey y x` in STATA to obtain standard errors that take into account the serial correlation in the errors). Test the hypothesis $H_0 : \gamma = 1$ and discuss the results. What are the implications of these results for the expectations hypothesis? Compare your conclusions to those in part (c).

(e) Go to the website `http://www.federalreserve.gov/Pubs/feds/2006/200628/200628abs.html`. Click on the link "Data - Excel file (30 MB XLS)". This provides data for the daily smoothed yield curve for the U.S. Use the columns SVENY01 to SVENY30 which are the continuously compounded smoothed yields on zero-coupon bonds with 1 to 30 years to maturity. Take the data for 2016-04-07 and 2014-04-07 and plot it on a graph with years to maturity on the horizontal axis and the yields to maturity (in %) on the vertical axis. Discuss the differences in the level and the shape of these two yield curves.

Question 2 (10 points). The spreadsheet "oil data" in the file "data_PS3" contains weekly (every Wednesday) data for the nearest futures (spot) S_t and one-year (12-month) futures $F_t^{(1)}$ prices (measured in \$) for crude oil. The sample period is January 3, 1990 – March 16, 2016. The spreadsheet also contains the one-year zero-coupon yield $y_t^{(1)}$.

(a) Plot the logarithm of oil spot and one-year futures over time. Discuss their dynamics by linking some of their movements to particular events.

(b) Compute the one-year oil convenience yield $CY_t^{(\tau)}$ and plot it over time. Was the oil market mostly in backwardation or contango over this period?

(c) Construct the variables $\frac{S_{t+52}-S_t}{S_t}$ (the scaled change in the spot price over the next year (52 being the number of weeks in the year)) and $\frac{CY_t^{(1)}}{S_t}$. Run the regression

$$\frac{S_{t+52}-S_t}{S_t} = \alpha_0 + \alpha_1 \frac{CY_t^{(1)}}{S_t} + \alpha_2 y_t^{(1)} + e_{t+52}$$

and report the estimates, standard errors, t-statistics and R^2 (again, use the command `newey y x` in STATA to obtain standard errors that take into account the serial correlation in the errors). Test for statistical significance of the coefficients and discuss the results. Is convenience yields a good predictor of future changes in the spot oil price?