

**Problem Set 2**

Due online by 11:55pm, Friday, October 29, 2021

*Unless otherwise noted, the following problems appear in the Self-study questions section at the end of each respective chapter in Brooks. Please provide necessary explanations and **show your work**. For problems **marked \***: **for full credit, you must copy/paste and/or include screenshots of your EViews commands and/or output into your writeup.***

**Chapter 5:** 2, 3, 4, 6, 8, 9

**Applied Problem 1\***

Open the macroeconomics workfile ('[macro.wf1](#)') and estimate a regression of stock market returns on macroeconomic factors. Specifically, regress monthly excess returns on the S&P 500 (ersandp) on a constant and the following variables defined below:

dprod = change in industrial production

dcredit = change in consumer credit

dinflation = change in CPI inflation

dmoney = change in M1 money supply

dspread = change in credit spread of BBB- over AAA-rated bonds

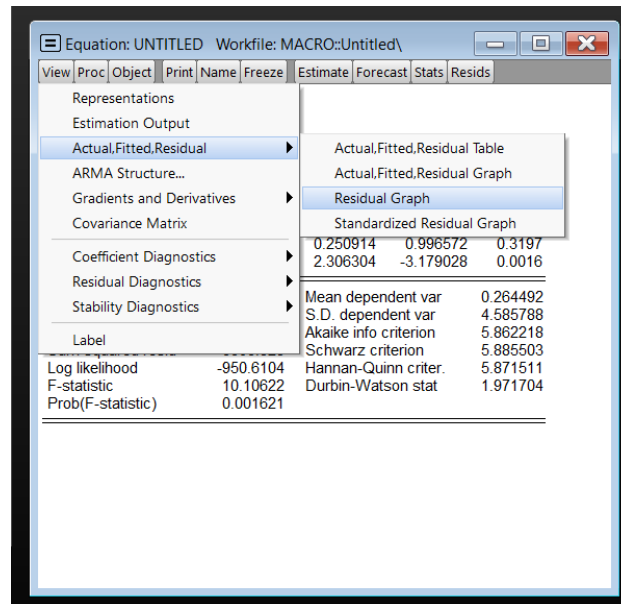
rterm = change in term structure (yield curve) of 10yr US T-bond over 3yr US T-bill

- a) Examine the model results both financially and statistically by investigating the signs and significance of the parameter estimates. Comment on what you find about the signs and significance; do the results fit with your prior expectations on how the macroeconomy should affect stocks? What about stock market efficiency? Explain.
- b) Conduct all the diagnostic tests for model adequacy we have covered in class for joint significance, goodness of fit, serial correlation, heteroskedasticity. Report, summarize, and comment on your results.
- c) Do you think it is necessary to apply the HAC adjustment to this model? Explain why or why not.
- d) Based on your results in part (a) regarding the significance of individual estimates, which variable(s) should you keep in the regression? Which variable(s) should you drop? Assume you only want to keep variables that are significant in the example. [See Section 5.11 for further discussion].

## Applied Problem 2\*

Using the same workfile ('[macro.wfl](#)') as above, now conduct the following:

- Estimate a regression of monthly S&P 500 returns (`ersandp`) on a constant and the change in credit spreads (`dsprsd`) only. Report and comment on your results.
- Examine graphically the residual plots. Copy/paste the residual plot into your problem set write up. Is there visual evidence of serial correlation and/or heteroskedasticity? Hint: to plot the residuals, in your Equation output window click **View>Actual,Fitted,Residual>Residual Graph** as follows



- Conduct all the various diagnostic tests for autocorrelation and heteroskedasticity we have encountered in class and report/comment on your results.
- Explain why serial correlation might be more of a problem in higher frequency vs. lower frequency data. For example, in Empirical Handout 2 we saw strong autocorrelation in daily returns, but what about monthly returns as we have here? [This is more of a finance-intuition type question].
- Based on your results in (c), is it necessary to use the HAC adjustment? Perform the regression with HAC standard errors and comment on any difference you find. Is the estimated relationship now stronger or weaker?
- As a final test of the predictability of stock market returns, include in the regression above one lag of S&P 500 returns, `ersandp(-1)`, and perform a robust regression (i.e., using HAC). Report and comment on the significance of the individual estimates. Discuss your results in light of weak-form and strong-form stock market efficiency.

### Applied Problem 3\*

Select `dspread` (change in credit spread) variable from the macroeconomics workfile ([‘macro.wfl’](#)). Conduct the following analyses:

- (a) Plot the `dspread` series. Using the “eyeball test”, comment on covariance stationarity, persistence vs. mean reversion, autocorrelation, and heteroskedasticity (no need for formal tests, just visual inspection and your intuition).
- (b) Plot the autocorrelation (ACF) and partial autocorrelation (PACF) functions, i.e., correlograms. Comment on what you see in terms of the spikes and/or decay pattern in both. Compare the patterns you see in the ACF and PACF to those in Section 6.6 of the book for ARMA processes of various orders. Which process does the `dspread` series most resemble based on an examination of the correlogram? [Hint: does it look like exponential decay in the ACF, and a damped sine wave in the PACF?]
- (c) Conduct a “grid search” by estimating ARMA( $p,q$ ) models for  $p = 0,1,2$  and  $q = 0,1,2$ . There will be 9 models in total. Note: ARMA(0,0) means intercept only, ARMA(1,0) is just AR(1); ARMA(0,1) is just MA(1); the rest are as usual (e.g., ARMA(2,1)). For each of these, note (1) which coefficients are significant or not, and (2) the Akaike (AIC) and Schwarz (SIC) information criterion. Of the models that have all significant coefficients, which also minimize AIC and/or SIC?
- (d) Based upon a consideration of your results in parts b and c, taken together as a whole, on balance which process do you think best describes the `dspread` series overall?
- (e) Estimate an ARMA(1,1) model for `dpsread`. Report the estimation results and check that the invertibility conditions are satisfied. Finally, check the correlogram for of the residuals from this model and comment on whether ARMA(1,1) is an adequate model (i.e., are there any unmodeled dynamics remaining in the residuals?).

### Applied Problem 4\*

[Consult Handout 5 for this problem]. Select again the `dspread` variable in the same workfile as in Applied Problem 3. Construct a forecasting framework using the following **Forecast Sample**: 2011m03–2013m04. Conduct both **recursive** and **one-step ahead** forecasts based on the following models:

- (i) An ARMA(1,1) model
  - (ii) An ARMA(0,0) model - i.e., simply estimating a model including only a constant (note: only static forecast is available here).
- a) Report (copy/paste) the EViews forecast results for each of these (there should be 3 forecast results).
  - b) Looking at **one-step ahead** (static) forecasts only, which model yields more accurate forecasts on the basis of RMSE, ARMA(1,1) or ARMA(0,0)? Report the RMSE’s and calculate their ratio.
  - c) Note, an ARMA(0,0) for *changes* in spread implies a random walk for the spread (in levels). Would you conclude that credit spreads follow a random walk (i.e., changes in the spread are completely unpredictable), or do our univariate time series models give better forecasts? Explain.