NYU STERN

Fall 2011

Problem Set #3 [Key]
Due: beginning of class November 19

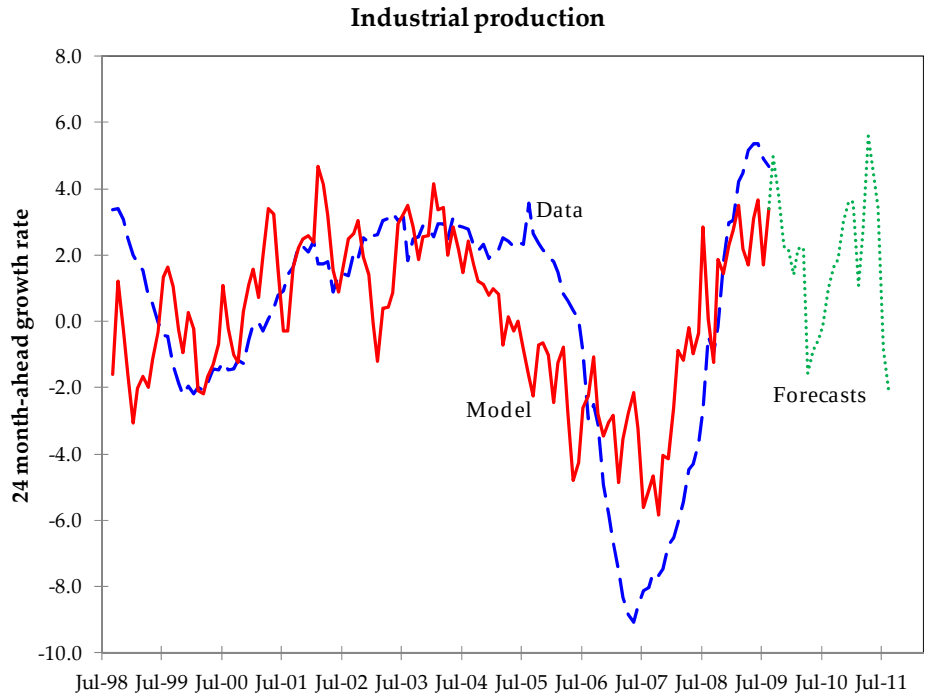
1. (**30 points**) You have been asked to summarize the prospects for the U.S. economy over the next several months. To do so, construct a regression-based forecast of the growth rate of industrial production between now and 24 months from now.

   Step 1. Compute the 24-month forward-looking growth rate of the index of industrial production. (use the data in column C in the sheet labeled "Data Q1.")

   Step 2. Estimate a regression of the 24-month forward-looking growth rate of industrial production on the following indicators: the **yield spread, the year-on-year growth rate of the DJIA Volatility Index,** and **the year-on-year growth rate of the BofA High Yield Bond Index**.[1] You can learn more about these indicators at the St. Louis Fed's FRED website.[2]

   Step 3. Use the estimated regression coefficients and the current values of your indicators to construct a forecast of industrial production growth over the next 24 months.

   a. (**5 points**) Plot the 24-month forward-looking growth rate from the data. On the same graph, plot the 24-month growth rate generated by your regression from October 1998 through September 2011. Note that this includes both the fitted values and the forecasts. Show the fitted values as a dashed line, and the forecasts as a dotted line.



[1] The year-on-year growth rate is the 12-month lagged growth rate. For example, y-o-y growth rate of industrial production for October 2011 is $\ln(IP_{\text{Oct11}}/IP_{\text{Oct10}})/12\times12\times100$.

[2] See: http://research.stlouisfed.org/fred2/categories

b. (**10 points**) Turn in a **neat** table of the regression coefficients from your forecast, including the R-squared, the standard error of the regression, and the standard errors of the coefficients. In one paragraph (max) discuss the fit of your regression. You should discuss both the individual indicators and the overall fit of the regression.

	Coefficients	*Standard Error*	*t-Stat*
Intercept	-1.46	0.334	-4.39
DJIA Vol	-0.069	0.0089	-7.71
Bond Index	-0.101	0.0167	-6.03
Yield Spread	1.852	0.236	7.86

Regression Statistics	
R Square	0.463569
Adjusted R Square	0.450997
Standard Error	2.592429
Observations	132

The indicators are all useful in predicting industrial production growth, as is evident in their large (in absolute value) t-statistics. The values of the t-statistics imply that there is well less than a 1 percent chance that we are finding a relationship that is not actually present in the data (a type I error). The R-square implies that about 45 percent of the variance in the IP growth rate can be explained by the indicators. For a simple linear regression model, this is decent, although we would certainly like a model with better fit. The substantial unexplained variance shows up in the standard error of the regression. As we show below, the standard error leads to large confidence intervals. Note that the yield spread is procyclical, but the other indicators are countercyclical.

c. (**5 points**) Construct and report a 2-standard-deviation confidence interval around your forecast for the 24 months beginning September 2011. What indicator(s) are driving your results for this period?

For September 2011, the forecast is -2.12 percent, with a confidence interval of [-7.30, 3.07]. Quantitatively, the large increases in the volatility index are driving the forecast.

d. (**10 points**) The data on DJIA volatility is only available from 1997 onward, which restricted the time period over which we could estimate the regression; Data for other indicators goes back several more years. The volatility measure seems to be a useful predictor, but we have given up the data prior to 1997 to use it. How might this shortened sample affect your results?

As long as the relationships between the variables stays fixed, more data generates more precise estimates and better forecasts. By using less data to estimate the relationship between IP growth and the indicators, we are losing observations, particularly observations from other recessions. Out forecasts are based on the behavior of the economy from 1998 onward; which may make our forecasts less robust.

2. (**25 points**) Using a linear probability model, we can compute the probability of a coming recession using indicators. This type of analysis is similar to forecasting growth rates, but the variable we are trying to predict is binary: it is equal to 1 if the country is in a recession and 0 if not. In sheet "Data Q2", you will find 3 variables: the binary recession variable, the yield on 10-year government bonds, and the yield on 3-year government bonds.

   Step 1. Use the data on yields to compute the yield spread. The yield spread is the yield on 10-year bonds minus the yield on 3-year bonds.

   Step 2. Create a 12-month-ahead, **forward-looking** recession variable. For example, in April 1953, this variable is equal to 1, since the economy is in a recession in April 1954.

   a. (**10 points**) Estimate a regression of the form

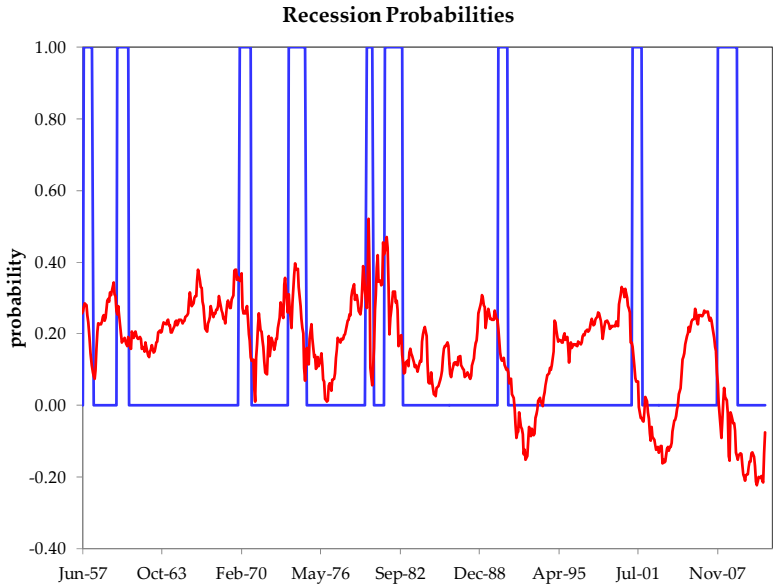
   $$R_{t,t+12} = \beta_0 + \beta_1 r_t + \varepsilon_t$$

   where $R_{t,t+12}$ is the 12-month-ahead recession indicator at time t and r_t is the yield spread. Turn in a neat table of the regression coefficients, the standard errors of the coefficients, the standard error of the regression, and the R-squared.

	Coefficients	*Standard Error*	*t Stat*
Intercept	0.256	0.016	15.72
Yield Spread	-0.203	0.021	-9.78

Regression Statistics	
R Square	0.122
Adjusted R Square	0.121
Standard Error	0.346
Observations	690

b. (**5 points**) Using the coefficients from your regression and the data on spreads, plot the fitted values from the regression in part a.; in the same figure, plot the recession indicator (**not** the 12-month-ahead indicator).

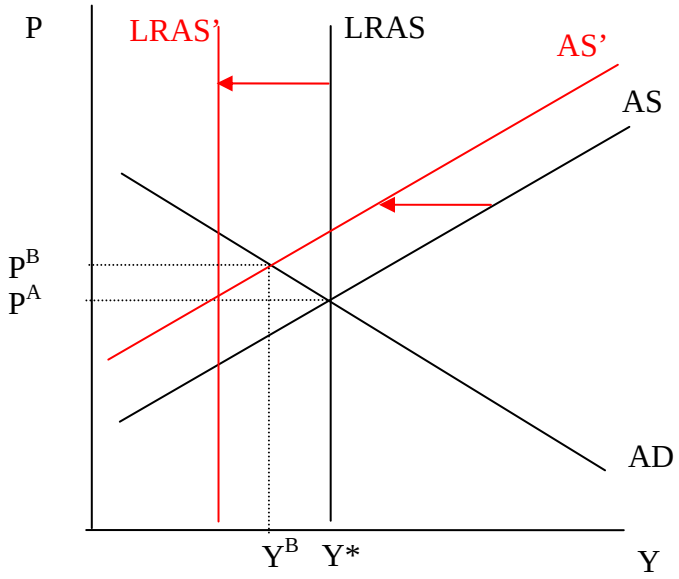


c. (**10 points**) The fitted values from the regression reflect the probability that the economy will be in a recession in one year.[3] In a few sentences, describe the patterns you find in the plot from part b.

The probability of entering a recession, as predicted by the term spread, increases and generally peaks immediately before a recession begins. The prediction is not always timely, though, the probability increased in the mid-90s, almost 5 years before the 2001 recession took place. To paraphrase Paul Samuelson, the yield spread forecasts 11 of the past 8 recessions.

[3] Some of the fitted values are negative, and probabilities cannot be negative. This is a drawback of the linear probability model, which we have chosen because it is easy to estimate in Excel. The probit model, which is more difficult to estimate, solves the negative-probability problem. You can learn more about the probit model online; if you are familiar with Minitab, you can estimate a probit model using Minitab.

3. (**15 points**) The economy is initially at its long run equilibrium, as represented in the figure below.



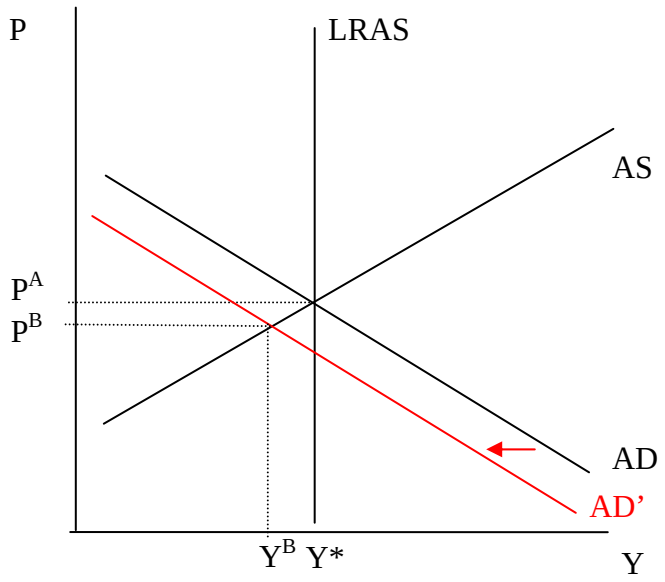
a. (**8 points**) As part of its clean air initiative, the Congress has enacted legislation that requires firms to submit lengthy reports about the company's impact on the environment. This sweeping regulation has made it more difficult for firms to produce: some of a firm's capital and labor that was producing output is now producing reports. Show the effect of this regulation of the figure above. (Assume that LRAS and AS shift by the same amount.) Label the short-run equilibrium (Y^B,P^B). Is this proposed legislation inflationary? Deflationary?

See figure above. This legislation is inflationary.

b. (**7 points**) What happens to output in response to this legislation? What is the implied relationship between output and prices?

Output falls to Y^B. Output and prices move in opposite directions.

4. (**20 points**) The economy is initially at its long run equilibrium, as represented in the figure below.



a. (**8 points**) The 2008 recession in Australia was mild compared to the recession in the United States. After 3 quarters of falling GDP, the Australian economy recovered, and began growing rapidly. Beginning in late 2009, the Reserve Bank of Australia began increasing its target interest rate. The higher interest rate affects the purchase of interest-sensitive goods: cars, homes, production machinery, and aircraft, to name a few. Show the impact of higher interest rates in the figure above. Label the short run equilibrium (Y^B,P^B). Is this inflationary? Disinflationary?
See figure above. This is disinflationary.

b. (**7 points**) What happens to output? What is the implied relationship between output and prices?

Output falls to Y^B. Output and prices move in the same direction.

c. (**5 points**) Why would the Reserve Bank of Australia want to raise interest rates?

The RBA is concerned that the rapid growth may lead to higher than normal inflation. To keep inflation on target (The RBA targets consumer price inflation of 2-3 percent per year.), the bank is raising the interest rate to dampen price pressure.

5. (**10 points**) Generalize your results from questions 3 and 4. When is the relationship between the price level and output positive? When is it negative?

Output and the price level have a positive correlation when driven by changes in demand, and a negative correlation when driven by changes in supply.