PROBLEM SET #8

This homework assignment is due at the beginning of lecture on Thursday, November 30. Although you may discuss the problems with others, you are expected to write your answers in your own words.

1. The expectations-augmented Phillips curve states that:

\[ \pi_t - \pi_t^e = -a(u_t - u_n), \]

where \( \pi_t \) is the actual inflation rate in year \( t \), \( \pi_t^e \) is the expected inflation rate in year \( t \), \( u_t \) is the unemployment rate in year \( t \), \( u_n \) is the natural rate of unemployment, and the constant \( a > 0 \). One version of the Phillips curve replaces \( \pi_t^e \) with last year’s inflation rate, \( \pi_{t-1} \). The purpose of this problem is to assess whether this version of the Phillips curve is consistent with U.S. macroeconomic data.

On the course web site (http://www.econ.yale.edu/smith/econ116a), you will find an Excel spreadsheet (called macrodata.xls) containing annual macroeconomic data for the U.S. from 1959 to 2002.

(a) Calculate the average unemployment rate over the entire period (use the Excel command average to compute the average of a column of numbers). Use your answer as an estimate of \( u_n \), the natural rate of unemployment.

(b) For every year, beginning with 1960, calculate the change in the inflation rate from the previous year. (For example, in 1961 the change in the inflation rate is \( 1.1 - 1.4 = -0.3 \).) In addition, for every year calculate the difference between the unemployment rate and the natural rate of unemployment that you calculated in part (a).

(c) If the Phillips curve with \( \pi_t^e = \pi_{t-1} \) provides a reasonable description of the U.S. macroeconomy, then \( \pi_t - \pi_{t-1} \) and \( u_t - u_n \) should be inversely related: that is, the product \( (\pi_t - \pi_{t-1})(u_t - u_n) \) should tend to be negative rather positive. Use your calculations from part (b) to determine the proportion of the 43 years between 1960 and 2002 in which this product is indeed negative. Do your findings provide empirical support for this version of the expectations-augmented Phillips curve?

(d) Use Excel to create a scatterplot with \( u_t - u_n \) on the x-axis and \( \pi_t - \pi_{t-1} \) on the y-axis. (For an example of a scatterplot, see Figure 12.7 on p. 9 of Lecture Slides.
Imagine trying to fit a “line of best fit” through the cloud of data points in the graph, i.e., a line that gets as close as possible to the data points in the graph. Does this line appear to have a negative slope, as predicted by the Phillips curve? Make an informed guess about the value of the slope (your guess serves as an estimate of the parameter $a$).

2. (a) On the course web site, you will find an article from *The Economist* magazine about the “revival” of the Phillips curve. The article tries to argue that the Phillips curve has become flatter in recent years (i.e., the parameter $a$ in the equation in part (a) of the first problem has become smaller). Based on your reading of this article, what factors might explain why the Phillips curve has become flatter?

(b) If the parameter $a$ becomes smaller, then the short-run aggregate supply (SRAS) curve also becomes flatter (be sure that you understand why). In the short run, does a decrease in aggregate demand (caused, for example, by a decrease in the money supply) have a larger or smaller impact on output when the SRAS curve becomes flatter? (Recall from p. 11 of Lecture Slides #6 that the natural rate of unemployment $u_n$ depends on the parameter $a$: an increase in $a$ decreases $u_n$. To simplify the analysis of the effects of a change in $a$, assume that the “other factors” $z$ adjust in response to any change in $a$ so as to keep $u_n$ unchanged. Under this assumption, changes in $a$ will affect the slope of the short-run aggregate supply curve but will not change the natural rate of output $Y_n$.)

(c) Answer the question in part (b) for the price level, the unemployment rate, the nominal wage, and the real wage.

(d) What effect, if any, does a change in the slope of the short-run aggregate supply curve have on the long-run aggregate supply curve? Does the value of $a$ influence the long-run effects of a decrease in aggregate demand on output and the price level? Explain. (Assume again that $z$ adjusts in response to changes in $a$ so as to keep $u_n$ constant.)

3. Milton Friedman, one of the greatest economists of the 20th century, died on November 16, 2006 at the age of 94. Friedman’s ideas, together with those of Edmund Phelps, provided the foundation for the modern theory of the Phillips curve.

(a) On the course web site, you will find three short articles about Milton Friedman: an obituary in *The New York Times*, a *New York Times* Op-Ed piece by the President of Harvard University (the economist Lawrence Summers), and a front-page overview in *The Wall Street Journal* of Friedman’s intellectual influence. Read these articles and list three of Milton Friedman’s influential ideas about economics (in addition to his work on the Phillips curve).
(b) Milton Friedman advocated monetarism, the idea that changes in the money supply largely account for short-run movements in output (GDP) but, in the long run, affect only the price level. As discussed in Chapter 17 of the textbook, the roots of monetarism lie in the the quantity theory of money, which states that $PY = Mv$, where $v$ is the *velocity of money* (see p. 13 of Lecture Slides #9). Because $Y$ is the *real* value of GDP (i.e., GDP measured in *constant* dollars), $PY$ is the *nominal* value of GDP (i.e., GDP measured in *current* dollars). Monetarists believe that $v$ is relatively constant over time, so that the growth rate of nominal GDP (i.e., the growth rate of the product $PY$) is equal to the growth rate of the money supply. Show that if $v$ is constant, then the inflation rate (i.e., the growth rate of the price level) is equal to the growth rate of the money supply minus the growth rate of real GDP, assuming that these growth rates are all close to zero. (Hint: In logs, the quantity theory of money is: $\ln(P) + \ln(Y) = \ln(M) + \ln(v)$.)

(e) The spreadsheet **macrodata.xls** (located on the course website) contains data for real GDP, the price level, and two measures of the money supply: narrow money, M1, and broad money, M2 (see p. 173 in the textbook for the exact definitions of narrow and broad money). Using each measure of money, calculate the velocity of money in each year. Does the velocity of money (associated with either measure of money) appear to be constant over time? Do your findings lend empirical support to the monetarist view that the growth rates of nominal GDP and of the money supply are closely related?