Homework Exercise Week 3

Due Tuesday 27 April 2004

1. Before doing this exercise: Read Chapter 4 and Chapter 4: Working with Economic Data.

2. There are two sets of exercises. Do only those exercises that are highlighted in boldface type.

3. The article by Robert Hall referred to in Problem 4.1 is posted on the class website at http://www.econ.ucdavis.edu/faculty/kdhoover/econ101/Files/HallBCArticle.pdf or on the class website under the link “Supplemental Readings”.

4. Excel hint for problem 4.10: To plot a graph with shaded NBER recession dates. Highlight the date (or observation), the data you wish to plot and the column of the NBER Dates. Insert Chart and select under Custom Types “Lines on 2 Axes”. The NBER Dates show up as a graph with a series of plateaus at 1 (measured on the right-hand axis). Format the NBER Date line (double-click on line to get Format Data Series). On the Options tab click Drop Lines and on the Patterns tab click None for both lines and markers. Now format the right hand axis (double-click on the axis to get Format Axis). On the Patterns tab set the Axis, the Major and Minor Tick Mark Types and the Tick Mark Labels to None. On the Scale tab set the Maximum to 1. Once you click OK, you should now have a shaded column for each recession. (It is also makes an easier to read graph if you set the gray background to white and remove the markers from your other data lines.)
Chapter 4: Statistical Exercises

4.S.1. Convert the Chinese exchange rate data and the duration of unemployment data in Example 4.1 into an index number series that equals 100 in 1995.

4.S.2. Prove that the correlation of $X$ with $Y$ is the same as the correlation of $Y$ with $X$. Make up two series of numbers ($X$ and $Y$) of equal length and enter onto a spreadsheet. Calculate the correlation coefficient with $X$ as the first series and again with $Y$ as the series.

4.S.3. Recall from the text (Chapter 4: Working with Economic Data) that the two series $X = \{7, 17, 27, 37, 47\}$ and $Y = \{28, 40, 24, 32, 32\}$ were said to be almost perfectly uncorrelated. Using a spreadsheet, calculate their correlation coefficient. Let $Z = X + Y$. Calculate the correlation coefficient of each of $X$ and $Y$ with $Z$. What does this illustrate about correlation?

4.S.4. The graphs immediately following illustrate different degrees of correlation. Without calculation try to guess the degree of correlation on the range $-1$ to $+1$. 

4.S.5. Give two examples of genuine correlations and two examples of nonsense correlation. Draw your examples from common experience. No data or calculations are necessary. Nevertheless, try to say whether you think the correlations are positive or negative, high or low. Why do you think the genuine ones are genuine and the nonsense ones nonsense?

4.S.6. Using annual consumption data, calculate the detrended series using linear and exponential regressions, and using a 7-period centered moving average.

Chapter 4: Empirical Macroeconomic Exercises

Problem 4.1. In Chapter 3, question 3.11 you were supposed to have identified the peaks and troughs of the business cycle using the two-quarter rule. If you have not done this exercise already, do it now. Table 4.3 gives the official NBER monthly dates in which peaks and troughs occurred. Convert these to the equivalent quarters and then construct a table that compares your results from Problem 3.11 to the NBER dates. Read the short article by Robert Hall that follows this exercise. In light of that article and your own understanding of the business cycle, explain how and why your dates differ from the official NBER dates.

Problem 4.2. Using Table 4.3, identify the shortest and longest booms, slumps, and complete cycles (peak to peak and trough to trough) for the period from 1945 to the present. What is the median boom, slump, and complete cycle?

Problem 4.3. Repeat the exercise in Problem 4.2 for the period before 1942. Does the business cycle have noticeably different characteristics before and after the Second World War?

Problem 4.4. Using the quarterly real GDP data for the period since 1947, calculate the percentage change in GDP for each recession (peak to trough), expansion (trough to peak), and complete cycles (peak to peak and trough to trough) and enter them as separate time series on a spreadsheet. For each series calculate the mean and median values.

Problem 4.5. Using monthly data for the period since 1947, calculate the change in the rate of unemployment for each recession (peak to trough), expansion (trough to peak), and complete cycles (peak to peak and trough to trough) and enter them as separate time series on a spreadsheet. (Data should not be percentage changes but differences of levels. For example, for a recession, the calculation is $\text{difference} = \text{unemployment}_{\text{peak}} - \text{unemployment}_{\text{trough}}$). For each series calculate the mean and median values.

Problem 4.6. Using the calculated in Problems 4.2, 4.4, and 4.5, describe the quantitative and temporal characteristics of the “typical” business cycle.

Problem 4.7. Some theories of the business cycle hypothesize that the higher the peak, the lower subsequent recession. Others reject that relationship and argue that the more severe the recession, the stronger the subsequent expansion. Others hold that the recessions and expansions are essentially independent of each other. How could you state these three views in terms of correlations of the changes in real GDP? Using the data you generated in Problem 4.4, test your hypotheses by calculating the correlations between the expansions and the subsequent recessions and between the recessions and the subsequent expansions. Which hypothesis do your calculations favor?

Problem 4.7. How good are the leading indicators as predictors of recessions? As we mentioned in the text, one rule states that if index of leading economic indicators turns
down two months in succession, then a recession should be expected. Statisticians recognize two types of error. *Type I error* (false negative) occurs when a recession is not signaled, but one in fact follows. *Type II error* (false positive) occurs when a recession is signaled and none in fact follows. Using Table 4.3 and the time series for the index of leading economic indicators, identify all the times in which the 2-quarter rule signals a recession, then check to see whether the business cycle reaches a peak (i., a recession begins) within the subsequent year. Similarly, identify all the times in which a recession occurs, then check to see whether the leading indicators signaled a recession within the preceding year. Fill in the number of each case in the following table:

<table>
<thead>
<tr>
<th>Recession</th>
<th>Does Not Occur</th>
<th>Occurs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do Not Signal Recession</td>
<td>No need to count this cell if all the others are counted. It is just the residual</td>
<td>Type I Error: enter the number of times a recession occurred without having been signaled</td>
</tr>
<tr>
<td>Signal Recession</td>
<td>Type II Error: enter the number of times a recession was signaled but failed to occur</td>
<td>Success: enter the number of times a recession was signaled and occurred</td>
</tr>
</tbody>
</table>

Repeat this exercise using a 3-quarter rule. How do the errors change? Which rule is best? Why? Is the best rule useful as a predictor of recessions?

Problem 4.8. Choose two series from those used in Figure 4.1 (no more than one should be a series from the national income and product accounts). Note that the data in Figure 4.1 have been converted to index numbers, you should use the data in their original units. Plot each series against the NBER cycle dates. Detrend each series and the index of coincident economic indicators using a 73-month centered moving average. Using detrended data, construct a table like Table 4.2 in which you compute the correlation between your series and the index at each lead or lag twelve months before and after the current date. Based on the graphs and the table, do your chosen series lead, lag, or coincide with the cycle at the peak? At the trough? Overall do your series lead, lag, or coincide with the cycle or are they not regularly related to it? If they have a definite relationship, what is the average lead or lag time? Note: the data in Figure 4.1 have been converted to index numbers. You will work with these data in their original units.

Problem 4.10. Calculate the time series for the annualized quarterly rate of real GDP growth. Plot this series against the NBER business cycle dates. Compare your graph to Figure 4.12. Do these two graphs conform roughly to the stylized relationship between fluctuations in a level series and the rate of change series as shown in Figure 4.10?