Economics 430
Chris Georges **Business Cycle Data Exercise**

The Stata file us-macro-quarterly.dta (which you can download from the courses page under my web page http://academics.hamilton.edu/economics/cgeorges/cgeorges.html) contains quarterly macroeconomic data for the US from 1947:1-2008:4.

Specifically, the file includes data on Real GDP (Y) and its components on the spending side (C, I, G, NX, and various subcomponents), the aggregate price level (gdp deflator), an exchange rate (trade weighted value of the dollar), interest rates (federal funds rate and prime rate), oil prices, stock prices (S&P 500 index), and the national unemployment rate.[1] [2] There is also a measure of purified TFP growth labeled dptfp.[3] Dates are listed in a variable called "date."

Exercise:

1. **Proximate causes of the recession of 2001:** The NBER dates the last recession in the U.S. as starting in 2001:2 and ending 2001:4.[4] Graph the major spending components of GDP (C, I, G, NX) to see which declined during the recession. You should create "line" plots using the variable *date* as your X variable (I suggest you plot the data on separate graphs covering a modest window around the recession: e.g., 1995:1-2003:4 - the farther back you go, the more you see the data relative to trend, the less far back you go the easier it is to eyeball the timing of a downturn or slowdown). For those that declined, which subcomponents declined? Also graph oil prices, stock prices, exchange rates, interest rates, and purified TFP. Do these graphs give any preliminary indication of what may or may not have caused the recession?

2. **A simple VAR exercise:** Let's consider the relationship between Real GDP, the aggregate price level, and oil prices for the post-war period in the U.S. We can run a VAR in Stata by selecting Statistics>Multivariate Time Series>Basic VAR. This will run the VAR and give impulse response (IR) plots for each pair of variables. For the purposes of generating the IR plots, Stata here uses the Sims method of asking for a recursive ordering of the variables (in terms of contemporaneous effects on one another).

So let's try the following ordering. Assume that oil prices respond (if at all) to changes in P and Y only with a lag (i.e., not contemporaneously). Assume further that the aggregate price level P responds (if at all) to changes in Y only with a lag (i.e., not contemporaneously). Note that we are not ruling out that changes in oil prices affect P immediately. Finally, assume that Y can respond to changes in both oil prices and P immediately. All variables can respond to changes in any other with a lag (we are putting no restrictions on the coefficients on lagged variables in the VAR).

---

[1] These data were downloaded from Economagic. The original sources include the Commerce Department (for the national income accounts), the BLS (for unemployment), and the Federal Reserve Board (interest rates).

[2] Spending Subcomponents: C is divided into durables, nondurables, and services. I is divided into residential, business fixed, and inventory. Business fixed is then divided into structures and equipment/software. Government spending is divided into federal and state/local. Federal is then divided into military and nonmilitary. Net exports is divided into exports and imports, which are each further divided into goods and services.

[3] This is TFP growth adjusted for factor utilization, courtesy of John Fernald. I have also provided the corresponding level of purified tfp (ptfp).

[4] Specifically, the NBER dates the previous expansion as starting in March 1991 and ending in March 2001. The subsequent recession was relatively short lived, with the recovery starting in November 2001. The NBER uses a variety of types of data to date the recession (GDP growth, unemployment, etc.).

The assumptions above make sense in terms of a standard new-Keynesian synthesis model (synthesis of RBC and Keynesian theory) that takes the prices of goods and services as being sticky with respect to spending shocks, but not necessarily cost shocks (like oil price shocks). Continuing with this interpretation, we can think of the P equation as an aggregate supply equation, and the Y equation as an aggregate demand equation, and the oil price equation as indicating that global oil prices could be at least partly endogenous to the state of the U.S. macroeconomy. This is clearly an overly simplified model (i.e., the VAR is likely to be misspecified),[5] but it may still give us some stylized evidence for the causal interactions between these variables.

One last thing before we start. Let's run the VAR on logged levels of the three variables. So please first create three new variables: lny = ln(y), lnp = ln(gdpdeflator), and lnoil = ln(oilprice).

To implement this VAR in Stata, select Statistics>Multivariate Time Series>Basic VAR, and then for the "dependent variables" select – lnoil lnp and lny – *in that order* (i.e., this both selects the variables to include and specifies the recursive order of the variables). Then increase the number of lags to include in the regression from 2 to 4 (this will include lags of 1,2,3 and 4 quarters for each explanatory variable in each equation), keep the selection of OIRF ("orthoganalized impulse response function" - this says use the recursive ordering to estimate the true shocks to each variable) and increase the number of periods in the horizon for the impulse response plots from 8 periods to 20 (this will create impulse response plots for 20 quarters (5 years) following hypothetical shocks rather than 8 quarters (2 years)).

Fire away, and Stata will run the regression and then (with a bit of a lag) generate a panel of OIRF plots. Unfortunately, it scales each plot the same, and so you will need to re-plot some of them separately (e.g., if lnoil rises by 1 in one graph, and lngdp rises by .01 in another graph, the gdp change will look miniscule on the second plot. So, e.g., to re-plot the response of gdp to an aggregate price shock, select Graphics>Time Series Graphs>Multivariate Time Series Graphs>IRF And FEVD After IRF Create, and then under "statistics to graph" select oirf, under "impulse variable" select lnp, and under "response variable" select lny.

Questions:

a. How consistent are the various impulse response plots with the predictions of the new-Keynesian synthesis model?

b. Is there evidence in these results to support Barsky and Killian's (2004) conjecture that global oil prices may be endogenous to the state of the U.S. economy?

Some Stata Help:

To create a line plot in Stata, you can use the menu sequence: Graphics > Twoway Graph. To restrict the time period, you can specify "if tin(date range)", where date range is for example (1995q1,2003q4).

You can look at the raw data by selecting Data¿Data Browser.

Note that an alternative to using the level or log level of a variable in the VAR would be to use the variable's growth rate. There are two ways of lagging a variable in Stata: $L.y$ is y lagged by one period, as is $y[\_n-1]$. So the (log) growth rate of y is, for example, $ln(y) - ln(y[\_n-1])$.

[5] Further, the variables we are looking at are nonstationary (there are not fixed long run averages for these variables - e.g., Y grows on average over time), and if we were being more careful, we would try to correct for this.