Economics 302: Macroeconomic Analysis
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Problem Set #1
Due: Wednesday, September 22, 2004

1. The following question requires the use of EViews. To start, create a new quarterly workfile (dated from 1947:1 to 2004:4) and import data for quarterly real U.S. GDP.[1] For each part below, please provide a printout of the results in EViews used to support your answer. Also, please e-mail me a copy of your EViews workfile prior to the problem set deadline (Wednesday, September 22$^{\text{nd}}$, at 4 PM).

   (a) Replicating the analysis in lecture, estimate the average growth rate of real GDP between 1947:1 and 2004:2 by regressing real GDP on a constant and a time trend (`@trend` in EViews' syntax). What is the estimated annualized average growth rate for real U.S. GDP over this time period? (*Hint: the regression does not immediately report the annualized growth rate — you need to do one additional computation.*)

   (b) Plot the actual, fitted, and residual values of this regression. If a model of a constant growth rate of GDP is accurate, then the residuals (blue line) should represent business cycle fluctuations of real GDP. Do you think these residuals are a good estimate of expansions and recessions? Why or why not?

   (c) Many economists believe the growth rate of productivity declined significantly in the U.S. (and around the world) following the 1973–1974 recession. Repeat the estimation in part (a) for the 1947:1 to 1973:4 and 1974:1 to 2004:2 sub-samples (i.e. two separate regressions). What are the estimated annual average growth rates of real GDP in each of these periods?

   (d) Are the differences in these estimated growth rates statistically significant? Provide a formal statistical test. (*Hint: To answer this question, you will need to include a dummy variable in a regression over the full sample period. A dummy variable that is equal to one in quarter 1974:1 and beyond can be generated in EViews with the following definition:* `dum1974 = @year > 1973`*. Think carefully about how to use the dummy variable in your regression.*)

   (e) Plot the actual, fitted, and residual values of the "trend break" regression model in part (d). Do you think the residuals of this regression better measure cyclical fluctuations in the economy? Explain.

   (f) Based on your estimated growth rate for real U.S. GDP between 1947 and 1973, forecast what the level of GDP would have been in 2004:2 had the economy grown at that constant rate since 1973:4. Are you surprised by your answer?

   (g) Based on your above analysis, comment on the following quotation:

   > *"Recessions are simply temporary fluctuations around a trend rate of growth for the economy."*

[1] You can get real GDP from a variety of sources, including *DataInsight*, the St. Louis Fed *FRED* database, and its primary source: the Bureau of Economic Analysis. In your problem set answers, list the source of your data.

2. Show mathematically that a Cobb-Douglas specification of an aggregate production function, $Y_t = K_t^{\alpha} N_t^{1-\alpha}$, satisfies the following properties:

   (a) Diminishing marginal product of capital

   (b) Constant returns to scale

   (c) Constant income share for labor

3. Consider two economies that are otherwise exactly the same — same saving rate, same depreciation rate, same growth rates of the labor force and of technology — but one has more educated workers than the other. Suppose the only effect of more education is a higher efficiency of workers. Using the Solow Model, what would you predict for the difference between these two countries for the following variables? Justify your answers.

   (a) The rate of growth of GDP

   (b) The level of income per worker

   (c) The real rental price of capital (ρ)

   (d) The real wage (ω)

4. The 2001 *Economic Report of the President*[2] (the last of the Clinton administration) claimed that an important contribution to the rapid economic growth of the second-half of the 1990's was the federal government budget surplus, which resulted in an increase in total saving as a share of GDP. The *Report* also suggested that a reversal back to deficit spending (as has since occurred during the Bush administration) would undermine long-run economic growth. Do the models of economic growth that we have studied support this claim? Explain.

5. In chapter 12, Blanchard discusses at length the appropriability and the fertility of research and development (R&D), and how they relate to economic growth. What would be the long-term effects on R&D and on output of each of the following events? Explain briefly.

   (a) Member countries of the World Trade Organization agree to international recognition and enforcement of intellectual property rights.

   (b) Congress eliminates funding for selected government-sponsored research consortia between U.S. universities and businesses.

   (c) The United Nations decrees that developing countries are free to produce low-cost generic equivalents of certain drugs that currently receive patent protection in developed nations.

Last revised: 11-Sep-2004

[2]See `http://www.gpoaccess.gov/usbudget/fy02/pdf/2001_erp.pdf` for the text of the 2001 *Economic Report of the President.*