Programming Assignment 1

(Due September 24)

1. Estimate the LQ/PI model using quarterly US data. Test the model by: (1) comparing the innovation variance of ΔC_t with the innovation variance of an AR(1) fit to Y_t, and (2) By checking the implied orthogonality conditions associated with the martingale prediction. Is there 'excess smoothness' and 'excess sensitivity'? (Before doing anything, plot your data on consumption and labor income).

   The data is posted at the bottom of the class webpage, in the excel file 'LQPIData.xls'. It contains 5 series, running from 1947:1 to 2019:2 - (1) Disposable Personal Income (DPI), (2) Personal Income on Assets (DPIA), (3) Personal Consumption Expenditures (PCEC), (4) Personal Consumption Expenditures on Durables (PCDG), and (5) the GDP deflator (GDPDEF). Form a proxy for labor income by subtracting asset income from disposable income ($DPI - DPIA$). Form a proxy for consumption of nondurables and services by subtracting durables from total expenditures ($PCEC - PCDG$). Convert to real terms by dividing by the GDP deflator. Although the data should be per capita, the quarterly working age population series doesn't begin until 1960. So just detrend real consumption and labor income by dividing by $(1+g)^t$, where g is the average quarterly growth rate of each series.

   To import an excel spreadsheet into Python just type

   import pandas as pd
   from pandas import ExcelFile
   df = pd.read_excel('File name, including path', sheet_name='Quarterly')

   df is called a 'dataframe'. Columns correspond to different time series.

   To run regressions in Python you can use the statsmodels package. Just type

   import statsmodels.api as sm
   model = sm.OLS(df['Y'], df['X'] (where Y and X are column names in the spreadsheet)
   results = model.fit()
   print(results.summary())

   Warning: Python does not include an intercept by default. To include one, just type

   df['const'] = 1

   which adds a column vector of ones to your dataframe. You can then define a list of exogenous variables, including 'const', to pass to the OLS method. For more info, see the python lecture *Linear Regression in Python* on QuantEcon. Since this example involves running autoregressions, you could also use the tsa subpackage of statsmodels. For example, **from statsmodels.tsa.ar_model import AR**.

2. Implement the "poor man's Bewley model" of Python lecture *Optimal Savings II: LQ Techniques*. Calibrate the initial top 1% wealth share to the 1980 US value. (If you don't know it, check out the World Inequality Database at wid.world). Simulate the model for 40 years with 500 agents. Assume that the idiosyncratic labor income process is the same for everyone, with parameters given by AR(1) you estimated in Question 1. (Of course, the innovations are agent-specific). How does the top 1% share change? Can you make the model fit the data by adjusting σ_y?