EXERCISE ON SIMPLE DYNAMIC PANEL

The course web site has data files in .RData and .csv format for indexes of real gdp for 22 countries in Europe, annually for 2007-2016. The data are from the eurostat web site. The 22 countries are all those with data covering the full 10 years. (The origina data cover 41 countries.)

In the exercise you use these data in several ways to estimate the model

$$y_{it} = c_i + \rho y_{i,t-1} + \varepsilon_{it}\,, \tag{$*$}$$

where y_{it} is the log of country i gdp in year t, under the assumption that $\varepsilon_{it} \sim N(0, \sigma^2)$ conditional on all values of $y_{i,t-s}$ for $s \geq 1$ and that the data are independent across i. Note that the data on the course web site are not yet logged.

Estimate the model and provide plots of level curves for the joint pdf of σ^2 and ρ, as well as marginal pdf plots for them. in the following ways:

(1) Use data only for 2016 and 2015. Assume log gdp is stationary, so the marginal distribution of y_{it} conditional on c_i, ρ and σ^2 is known. This makes the 2016 and 2015 values of gdp a jointly normal pair of random variables with a known normal distribution. Use as prior on $\{c_i\}$, $\sim (N(0, \nu^2 I))$, where ν^2 is large. Also consider as prior $\mu \sim N(100, \nu^2 I)$, again with ν^2 large, where $\mu = c_i/(1-\rho)$. You can use a flat prior on ρ over (-1,1) and an exponential prior on $1/\sigma^2$. (The prior mean of $\log(100)$ for μ comes from the fact that the data are indexes centered at 100 in 2010.)

(2) Same as previous case, But now without the stationarity assumption, instead postulating a joint normal distribution for y_{i0}, c_i, with unknown mean and variance matrix, independent of the prior on ρ and σ^2 (which can be the same as in the previous case).

(3) Use data for 2014-2016, differencing it, and using $y_{i,2014}$ as an instrument for $\Delta y_{i,2015}$. Find both a point estimate and a confidence band, based on usual IV asymptotics, for the ρ estimate.

(4) Repeat (1-2) with these three years of data, comparing to IV results.

(5) Repeat the three approaches — Bayesian stationary, Bayesian non-stationary, and IV — on the full data set.

It is likely that the data here are well modeled as random walks with differing drifts, meaning that their first differences satisfy ($*$). Repeat all the above exercises, except the Bayesian non-stationary cases, using first differenced data. Of course the "one-period" cases now use three years of data instead of two, etc.

Food for thought: Does the fact that the data are normalized so that all countries have $y_{it} = \log(100)$ in 2010 mean that using $y_{i,t-2}$ as an instrument for Δy_{t-1} would not work for $t = 2012$? Does the normalization mean we are ignoring something important above when treating data as independent across countries?

Date: March 9, 2017.