ECON 714: Problem Set 3

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Due: February 15, 2021

Problem 1

This problem asks you to update the CKM (2007) wedge accounting using more recent data. You are encouraged to use Matlab for the computations. Consider a standard RBC model with the CRRA preferences

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t U(C_t, L_t), \qquad U(C, L) = \frac{C^{1-\sigma} - 1}{1-\sigma} - \frac{L^{1+\phi}}{1+\phi},$$

a Cobb-Douglas production function $Y_t = A_t K_t^{\alpha} L_t^{1-\alpha}$, a standard capital law of motion $K_{t+1} = (1-\delta)K_t + I_t$, and four wedges $\tau_t = \{a_t, g_t, \tau_{Lt}, \tau_{It}\}$. Each wedge τ_{it} follows an AR(1) process $\tau_{it} = \rho_i \tau_{it-1} + \varepsilon_{it}$ with innovations ε_{it} potentially correlated across i. One period corresponds to a quarter.

1. Download quarterly data for real seasonally adjusted consumption, employment, and output in the U.S. from 1980–2020 from FRED database. The series for capital are not readily available, but can be constructed using the "perpetual inventory method". To this end, download the series for (real seasonally adjusted) investment from 1950–2020.

2. Convert all variables into logs and de-trend using the Hodrick-Prescott filter.

3. Assume that capital was at the steady-state level in 1950 and the rate of depreciation is $\delta = 0.025$ and use the linearized capital law of motion and the series for investment to estimate the capital stock (in log deviations) in 1980–2020. Justify this approach.

4. Linearize the equilibrium conditions. Assuming $\beta = 0.99$, $\alpha = 1/3$, $\sigma = 1$, $\phi = 1$ and the steady-state share of government spendings in GDP equal 1/3, estimate a_t, g_t and τ_{Lt} for 1980–2020. Run the OLS regression for each of these wedges to compute their persistence parameters ρ_i.

5. Write down a code that implements the Blanchard-Kahn method to solve the model. Use the values of parameters, including ρ_a, ρ_g and ρ_{τ_L}, obtained above, and assume $\rho_{\tau_I} = 0$ for now.

6. Solve the fixed-point problem to estimate τ_{It}: conjecture a value of ρ_{τ_I}, solve numerically the model for consumption as a function of capital and wedges, use the estimated values of consumption and other wedges to infer the series of τ_{It}, run AR(1) regression and estimate ρ_{τ_I}, iterate until convergence.

7. Draw one large figure that shows dynamics of all wedges during the period.

8. Solve the model separately for each wedge. Show a figure with the actual GDP and the four counterfactual series of output. Which wedge explains most of the contraction during the Great Recession of 2009? during the Great Lockdown of 2020? Explain.