Review: First Quiz
Eco 603
Quiz date: October 5, 2017

The quiz will cover the RBC model. All questions come from class notes. The supplementary material is (using the notation of the syllabus) C:1.3, C:2.2, C:1.4, C:1.6, C:1.7, and articles by Kydland and Prescott and Hansen. Study materials:

- Homeworks 1 and 2.
- This review sheet.

Question 1.

Suppose Dave rides a train to work in period 1. The train fare is $3 and he must take a taxi from the train station to his final destination at a cost $1.50 per mile. Work is 4 miles away and the taxi driver is self employed. Two cars are produced in period two. Dave buys one for $2000, the other is not sold. In period three, Dave drives the car to work, and does not take the taxi or ride the train. The economy wide private capital share is 1/3. The train is automated and has no workers.

a. Complete the table below, assuming the above goods and services constitute the entire economy. In the NIPA columns, compute the statistic as it is computed by the NIPA. In the RBC column, compute the statistic as it is computed in the RBC calibration.

	Period 1		Period 2		Period 3	
Statistic	NIPA	RBC	NIPA	RBC	NIPA	RBC
GNP						
Investment						
Consumption						
capital income	NA		NA	NA		
labor income	NA		NA	NA		

Table 1: Macro Data.

b. Suppose periods 1 and 3 represent a developing country acquiring more cars as income rises. Will the NIPA overestimate, underestimate, or correctly estimate economic growth? Explain.

Question 2.

Suppose the RBC model with return function:

$$u = \log\left(e^z k^\gamma h^{1-\gamma} - k'\right) - \psi h. \tag{1}$$

Here technology shocks evolve according to:

$$z_{t+1} = \rho z_t + \epsilon_{t+1}. \tag{2}$$

Calculate the quadratic approximation matrix Q and the linear approximation matrix B. Note: you don't need to calculate the actual steady state in this model, just use $\bar{c}$, etc.

Question 3.

In class, we saw that that hours were more variable in the data than in the RBC model. Give two possible reasons why.

Question 4.

According to the RBC model, what causes business cycles? Give one criticism of the answer.

Question 5.

Explain how the choice of λ in the HP filter affects:

a. The volatility of GNP in the RBC model.

b. The persistence of the business cycle in the RBC model.

Question 6.

This problem was suggested by a former student of this class. A stylized fact in the data is that the business cycle is relatively uncorrelated with capital stocks, but capacity utilization is procyclical. Let p be the fraction of capital utilized in a given period (under control of the planner). Therefore per capita output is a function of utilized capital (per capita): $y = e^z F(pk, h)$, where h is hours worked and F satisfies the usual assumptions. The technology shock z is such that:

$$z_{t+1} = \rho z_t + \epsilon_{t+1} \quad \epsilon_{t+1} \sim N\left(0, \sigma_\epsilon^2\right) \tag{3}$$

Suppose that heavy usage causes capital to depreciate faster, so that depreciation per unit of capital is a function of utilization rate: $\delta = \delta_k p^\phi$. Utility is: $U = u(c) - \alpha h$. No population growth or technology growth exists. All other assumptions are the same as the RBC model in class.

a. Write the value function for the social planning problem.

b. Calculate the first order condition(s). Interpret the first order condition for optimal capacity utilization.

c. For what values of ϕ is capacity utilization pro-cyclical, holding h fixed?

d. Calculate the relevant envelope equation(s).

e. Write the equations which determine the certainty equivalence steady state.

f. Calculate the certainty equivalence steady state level of p as a function of the parameters.

g. Give a strategy to calibrate ϕ. What long run average value would you match ϕ to?