Part I: Definitions

Define or explain three of the following terms/concepts (4 pts each):

- Ricardian Equivalence
- Quantity Theory of Money
- Composition Bias
- Sunspot equilibrium

Part II: Short Answers

Answer the following three short questions (10 points each)

1. Sticky Prices

   (a) Because correctly measured productivity shocks are so small, variable factor utilization helps real business cycle (RBC) models. Are such mechanisms important for sticky price (i.e. monetary) models of the business cycle? Discuss briefly.

   (b) Recall the Dynamic New Keynesian model we considered in class. In the steady state, the markup of price over marginal cost was $\mu$. Now suppose that the $M_t$ increases. Immediately after this, a few firms get to reset their prices. Do these firms set current markups that are greater than, equal to, or less than their steady state markups? Explain (if you are uncertain, then explain why...)

   (c) Evaluate the following claim:

   “A credible future deflation could cause a current expansion in employment and output.”

2. Economic Policy

   (a) Suppose that you could choose the central banker of a country. You can nominate either a respected economist who knows that a moderate rate of inflation is not very harmful (and could be beneficial in the short run) OR you could nominate a “quack” who believes (incorrectly) that even low amounts of inflation is disastrous for a country.

   Are there scenarios in which it is best to nominate the “quack”? Explain your answer briefly.

   (b) Chamley’s tax result says that under commitment, it is never optimal to tax capital in the long run (i.e. in the steady state).

   1. What is the intuition for his result?
   2. Why is it important for the government to be able to commit to this policy? (i.e. what changes if the government can’t commit?).
3. RBC Models

(a) The following parameters are used in many basic RBC models: $\alpha, \delta, \beta$. What do these parameters represent? Roughly what values are used for these parameters?

(b) For certain statistics, the RBC model does pretty well. For others it’s not so good.

1. Briefly describe one feature of business cycle data that the RBC model replicates well.
2. Briefly describe a feature of business cycle data where the RBC model does not fit well.

(c) One measure of technology shocks is the Solow residual defined as:

$$\%\Delta S = \%\Delta Y - \alpha \%\Delta K - (1 - \alpha) \%\Delta N$$

1. What is the motivation behind this expression?
2. What problems underlie this measurement of technology shocks?
Part III: Longer Questions:

International Business Cycles:

(30 points) Consider the following model:
There are two countries A and B. One agent lives in each country. Each agent has standard preferences:

\[ U^i = E_t \left[ \sum_{t=0}^{\infty} \beta^t (u(c^i_t) - v(n^i_t)) \right] \text{ for } i = A, B \]

where \(u', v' > 0\) and \(u'' < 0, v'' > 0\).

Production in each country is given by the production function

\[ y^i_t = Z^i_t (n^i_t)^{1-\alpha} \text{ for } i = A, B \]

here \(Z^i_t\) is country i’s productivity shock. Assume that \(\text{Cov}(Z^A_t, Z^B_t) = 0\) so that productivity shocks are uncorrelated across countries.

Goods can be transported across the countries borders at no cost.
Suppose that a social planner is allocating resources in this economy. The social planner has symmetric preferences over the two types so the objective function for the social planner is:

\[ \frac{1}{2} U^A + \frac{1}{2} U^B \]

1. What is the social planners resource constraint each period?

2. Set up the planner’s maximization problem as a Lagrangian (either current value or present value). Find the first order conditions.

3. What is the correlation of consumption across countries? (i.e. is it positive, negative?).

4. Suppose that country A gets a positive technology shock but B does not (so that \(Z^A_t > Z^A\) while \(Z^B_t = Z^B\)).
   (a) What is the relationship between \(n^A_t\) and \(n^B_t\)? What is the intuition for this result?
   (b) Suppose that total consumption rises in response to the technology shock, what does this imply about the correlation of output across these countries? Hint: think about the labor supply decisions of the agents.

5. In data, the correlation of output across countries is higher than the correlation of consumption. Does this present a puzzle from the standpoint of this model?

6. Suppose that we allowed for migration of labor. How would this change the equilibrium?
Heterogeneous Projects

(30 points) Consider an environment with many investment opportunities. Some are good and some are not so good. Specifically, there are many projects that each require one unit of investment to activate. Projects return $k$ units of capital the following period ($k$ will differ across projects).

The best projects are activated first. So, if $\hat{k}_t$ is the cutoff project in period $t$ (i.e. the last one activated), then the total amount of new capital in the following period ($K_{t+1}^{\text{new}}$) is:

$$K_{t+1}^{\text{new}} = \int_{k_1}^{\hat{k}_t} kf(k) \, dk$$

where $f(k)$ is the “number” of projects with return $k$. Total capital next period is simply:

$$K_{t+1} = K_t (1 - \delta) + K_{t+1}^{\text{new}}$$

and because each project requires one unit to activate, total investment is:

$$I_t = \int_{k_1}^{\hat{k}_t} f(k) \, dk$$

Every period a new set of projects ($f(k)$) becomes available.

Finally, suppose that a representative agent seeks to allocate resources to maximize:

$$E_t \left[ \sum_{t=0}^{\infty} \beta^t \ln(C_t) \right]$$

subject to the constraints:

$$A_t K_t^\alpha - C_t - \int_{k_1}^{\hat{k}_t} f(k) \, dk$$  \hspace{1cm} (1)

$$K_{t+1} = K_t (1 - \delta) + \int_{k_1}^{\hat{k}_t} kf(k) \, dk$$  \hspace{1cm} (2)

$$A_t = (1 - \rho) + \rho A_{t-1} + \varepsilon_t$$

where $A_t$ is a random technology shock.

1. What are the choice variables at time $t$? What are the state variables?

2. Set up the consumers maximization problem as a current value Lagrangian.\(^1\) Use $\lambda_t$ on the first constraint (1) and use $q_t$ on the second constraint (2). Find the relevant first order conditions.

3. What is the Euler equation for this problem? Interpret this equation.

4. Define $Q_t = \frac{q_t}{\lambda_t}$. Is $Q_t = 1$ in the steady state? Why or why not?

5. Is $I_t$ a function of $Q_t$ only or does it depend on variables beyond $Q_t$?

6. Does this model behave more or less like a standard “$Q$—Theory” model? (just give your intuition). Are their costs to investment that rise as $I_t$ differs from the steady state level? Explain.

\(^1\)I.e. $L = E_t \left[ \sum_{t=0}^{\infty} \beta^t \{ \ln(C_t) + \lambda_t (...) + q_t (...) \} \right]$

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