Macroeconomics Qualifier Examination
June 2004

Instructions
Answer all questions.
Weights are indicated as points in each case. The total possible number of points is 240, which corresponds to 240 minutes of available time (4 hours). Allocate your time wisely. Read the questions carefully and explain your reasoning. Less than easily legible answers, as well as answers to questions other than those being asked, will be ignored.

Part I

Question 1 (35 points)

Consider a standard Ramsey-Cass-Koopmans model of economic growth with CRRA utility $u(c_t) = \frac{c_t^{1-\theta} - 1}{1-\theta}$ and Cobb-Douglas production function $Y=K^{\alpha}(AL)^{1-\alpha}$.

(a) Consider the effect of increasing the discount rate ρ in the Ramsey model. Draw the phase diagram showing the dynamics of consumption and capital per effective labor. Draw the time paths for consumption and output per capita. Compare the savings rate at the old and new balanced growth path.

(b) Suppose there are many countries with different discount rates. Will the high savings countries have any incentive to invest in low savings countries?

(c) Consider instead the effect of raising capital income tax with lump-sum redistribution in the Ramsey model. Draw the phase diagram showing the dynamics of consumption and capital per effective labor. Draw the time paths for consumption and output per capita. Compare the savings rate at the old and new balanced growth path.

(d) Suppose there are many countries with different capital income tax rates (assume countries have same preference though). Will the high savings countries have any incentive to invest in low savings countries?

(e) Comment on the following statement: "According to the Ramsey model, capital should flow from the rich to poor countries."

Question 2 (20 points)

(a) In the menu cost model, suppose an economy has a high average inflation, so that firms have to adjust price frequently. Now, in face of some monetary disturbance, what will be the effect on real output in this economy relative to an economy with low average inflation? Explain intuitively.

(b) In the Lucas model, suppose an economy has high variance in aggregate demand shocks. Now, in face of some monetary disturbance, what will be the effect on real output in this economy relative to an economy with low variance in aggregate demand shocks? Explain intuitively.

(c) Suggest a test to compare the implications of the Lucas model versus the menu cost model.

Question 3 (30 points)

Consider the following Taylor model with staggered 2-period labor contract with non-indexed predetermined and fixed wage as follows:

Nominal wage determination: $w_t=(1/2)(p_t+E_{t-1}p_{t+1})+(a/2)(E_{t-1}y_t+E_{t-1}y_{t+1})$
Price setting behavior : $p_t=(1/2)(w_{t-1}+w_t)$
Aggregate Demand : $y_t=m_t-p_t$

That is, when signing the wage contract at the beginning of time t, the information valid is only for t-1 and before. In particular, m_t is not observed when the wage contract is signed at the beginning of time t. a is a constant.

(a) Explain what w_t is. (That is, distinguish it from the (average) wage at calendar time t.) Use a graph of wage setting structure, if it helps.

(b) Express w_t in terms of $E_{t-1}m_t$, $E_{t-1}m_{t+1}$, w_{t-1} and $E_{t-1}w_{t+1}$.

(c) Consider the following monetary process:

$$m_t = m_{t-1} + \mu + \varepsilon_t \text{ (contingent constant money growth)}$$

where μ is a constant and ε_t is an i.i.d. disturbance with mean zero and variance σ_ε^2. Use the method of undetermined coefficient <u>or</u> the method of factorization to solve for w_t and y_t.

Question 4 (35 points)

Consider the following political business cycle model. There are two parties, Party D and Party R. There are elections every 2 periods. Party D wins the elections with probability P and Party R with probability (1-P). P is given, fixed and known by everybody. Whenever one of the parties win the election, that party controls inflation directly to maximize its own objective function. Party D, which is more willing to tolerate inflation and cares more about unemployment, has the following objective function for each period t:

$$W_t^D = -(1/2)(\pi_t - a)^2 - bu_t$$

and Party R, which is less willing to tolerate inflation and cares not about unemployment, has the following objective function for each period t:

$$W_t^R = -(1/2)\pi_t^2$$

where a>0 and b>0, π_t is the inflation at time t which the elected party could directly control and u_t is the unemployment rate and is given by

$$u_t = -(\pi_t - \pi_t^e)$$

where π_t^e is the inflation expected by the general public in the economy. Expectations are formed rationally. During an election year, the timing is as follows: expectation is first formed, then elections take place, then policy (that is, π_t) is set by the party elected. During the non-election year, the timing is as follows: expectation is first formed, then policy (that is, π_t) is set by the party in office.

(a) Consider first the non-election years.
  - (i) Suppose Party D is in office. What will be Party D's discretionary policy (that is, what is the value of π_t that it will choose to maximize its objective function, taking π_t^e as given)? Since expectation is rational, what will be the value of π_t^e? Does $\pi_t^e = \pi_t$? What will be the value of u_t?
  - (ii) Suppose Party R is in office. What will be Party R's discretionary policy? Since expectation is rational, what will be the value of π_t^e? Does $\pi_t^e = \pi_t$? What will be the value of u_t?

(b) Consider next the election years.
  - (ii) If Party D actually wins the election, what will be Party D's discretionary policy (that is, what is the value of π_t that it will choose to maximize its objective function, taking π_t^e as given)? Since expectation is rational, what will be the value of π_t^e? Does $\pi_t^e=\pi_t$? What will be the value of u_t?
  - (iii) If Party R actually wins the election, what will be Party R's discretionary policy? Since expectation is rational, what will be the value of π_t^e? Does $\pi_t^e=\pi_t$? What will be the value of u_t?

(c) Empirically, it is observed in the United States that inflation is generally higher (in both election and non-election years) when the Democratic Party is in office, while unemployment rate is lower during the election year if the Democratoc Party wins, but unemployment rate is about the same during non-election year whether the Democratic Party or the Republican Party is in office. Is the above model compatible with these observations?

Part II

Question # 1 (60 points)

Consider a closed economy consisting of an infinite sequence of two period-lived, overlapping generations. N_t agents are born at time t, where $N_t = (1+n)N_{t-1}$, N_0 given, and population grows at the gross rate n. Agents have no endowments of goods or physical capital or fiat money. However, at each date each young agent is endowed with a single unit of labor, which is supplied inelastically. The markets for factors of production are competitive. Labor earns the prevailing real wage w_t at t. r_t denotes the real rental rate on physical capital at t.

In addition, at each date there is a single final good that can either be consumed, or saved. If invested, one unit of the good at t becomes one unit of physical capital at $t+1$. In addition, there is a **constant nominal supply of fiat money, *M>0***. Producing the final good requires using physical capital together with labor as inputs into a constant returns to scale production function. Let k_t denote the time t capital-labor ratio, and let $f(k_t) = A(k_t)^a$ denote the intensive production function. Physical capital depreciates at the rate δ each period after production takes place. Finally, all young agents have the following lifetime utility function:

$$u(c_{1t}, c_{2,t+1}) = \ln(c_{2,t+1}).$$

There is a generation of initial old endowed with $K_0 > 0$ and M.

(A) (8 points) Derive explicitly but briefly the equilibrium laws of motion for k_t and z_t. Find and describe briefly all the steady state equilibria.

(B) (12 points) Derive the feasible set of this economy at time t. Set up the social planner's problem and derive the Golden Rule allocation for this economy. Also, derive the conditions for the Golden Rule. Explain the meaning of each condition. Give an expression for the golden rule capital-labor ratio, k_{GR}. Find the conditions under which there is capital over accumulation in the non-trivial non monetary steady state equilibrium in this economy.

(C) (6 points) Is the non-trivial non monetary steady state equilibrium Pareto Optimal? Under what condition? Interpret this condition. Explain carefully.

(D) (6 points) Is the monetary steady state of this economy Pareto Optimal? Explain carefully. Derive and give an expression for the steady state value of z.

(E) (10 points) Derive explicitly the Jacobian of the system. Evaluate the Jacobian at the monetary steady state and show explicitly that this steady state equilibrium is a saddle with monotonic convergence.

(F) (8 points) Draw, BUT DO NOT DERIVE, the phase diagram for this economy on the (k_t, z_t) space, assuming that there is capital over accumulation in the non-trivial non monetary steady state equilibrium. Make sure that you label your diagram carefully.

(G) (10 points) Suppose that the monetary authority prints fiat money at the net rate σ each period. Is there a Mundell-Tobin effect in this model? Explain carefully. Is there a Mundell-Tobin effect in the optimal monetary growth model (CIA model)? How do these theoretical results compare to the empirical evidence? Do describe briefly the empirical evidence.

Question # 2 (45 points)

Consider an economy populated by infinitely-lived representative agent. In each period the household is endowed with one unit of labor, which he/she supplies inelastically. Let c_t denote consumption of the single final good at date t. The agent's lifetime preferences are given by

$$\sum_{t=0}^{\infty} \beta^t \ln(c_t)$$

The final good is produced using capital and labor as inputs into a constant return to scale production function. The households own both labor and capital, and they rent them out to the firms. Let k_t denote the capital-labor ratio at t, and let $f(k_t)$ denote the intensive production function. Assume that f is monotonically increasing and strictly concave, and that it satisfies the Inada conditions. Finally, assume that capital depreciates completely each period. There is no fiat money in this economy.

a) (10 points) Solve the Social Planner's problem ***using dynamic programming***. DO NOT TRY TO SOLVE FOR THE POLICY FUNCTION. Find the Euler's equation and show that the equilibrium law of motion for the capital-labor ratio satisfies

$$\frac{f(k_t)-k_{t+1}}{f(k_{t-1})-k_t} = \beta f'(k_t) \quad (1)$$

b) (14 points) Find the steady state equilibrium for this economy. Is this steady state allocation Pareto Optimal? Show and explain carefully. Compare it to the Golden Rule. Explain the difference between the competitive steady state equilibrium and the Golden Rule.

c) (16 points) Let

$$y_{t+1} = k_t \quad (2)$$

That is, you are augmenting the number of state variables but at the same time, you are reducing the order of the system. Use equations (1) and (2). You must derive the Jacobian explicitly and evaluate it explicitly at the steady state. Show that the steady state is a saddle, and that dynamical equilibrium paths approaching the steady state do so monotonically.

d) (5 points) Draw, BUT DO NOT DERIVE, the phase diagram for this economy on the (k_t, c_t) space. Label your diagram carefully.

Question # 3 (15 points)

Explain the Lucas' Critique. What is the negative side of the Lucas' critique? Your answer must include what is the difference between a reduced form equation and a model in its structural form.