Ph.D. Core Exam -- Macroeconomics **17 August 2009 -- 8:00 am to 3:00 pm**

Part A: Answer any <u>two</u> of the following five questions.

A1. Macro-Dynamics

The basic AD-AS model focuses on the interactions of several aggregate markets. In a simple closed-economy model, these are primarily the product, financial, and labor markets. The recognition that it takes longer for equilibrium to be established in some of these markets than in others results in interesting macro-dynamics, in which the responses of some variables to an exogenous shock are very different in the short turn than they are in the long run. The time paths of these variables following a shock may be non-linear, with "overshooting" occurring in some cases.

1. Define and explain equilibrium in each of these three markets (product, financial, and labor).

2. For an economy like that of the U.S., rank these markets in terms of the speed with which each one is likely to return to equilibrium following an exogenous change.

3. Use your ranking to show the likely effect of an increase in the money supply on (a) the price level, (b) nominal interest rates, (c) real income and employment, (d) real wages. You may find it useful to represent graphically the time paths of these variables.

4. Sketch out briefly how your answer to (3) might be affected by the expectations formation process.

A2. Consumption

Contemporary macroeconomics embodies some major advances from the basic consumption theory at the heart of the Keynesian model, in which consumption is a simple linear function of disposable income: $C_t = C_0 + c(YD_t)$, where $C_0 > 0$ and $0 < c < 1$. Using this model as a starting point, answer the following questions.

1. Explain why the simple Keynesian model might imply a rising level of government expenditure if aggregate demand is to exhaust growing aggregate supply.

2. How does either of the two major post-Keynesian theories of consumption (permanent income or life-cycle) resolve the preceding problem?

3. Even though both these theories are advances over the basic Keynesian model, they have some limitations of their own. Explain how they deal with (a) uncertainty about future income and length of life and (b) capital market imperfections such as constraints on borrowers.

Part A (continued)

A3. Comparative Statics

Consider the following model of aggregate demand for an economy with static inflationary expectations and a wealth effect in the goods market. Real wealth is held in the form of money balances and/or government bonds, i.e., $V = (M+B)/P$. The capital stock and technology are fixed.

(IS) $Y = E(Y-T, r, V, G)$ where $r=R$, $0<E_{Y-T}<1$, $E_r<0$, $0<E_V<1$, $E_G=1$.

(LM) $M/P = L(Y, R)$ where $L_Y>0$, $L_R<0$.

Analyze the effects on the endogenous variables of an open market purchase of government bonds by the central bank under the following two scenarios.

1. *Keynesian world with fixed wages and prices*: (a) Calculate the relevant derivatives using Cramer's Rule. (b) Explain how your answer changes if money demand is perfectly interest-elastic.

2. *Classical world with flexible wages and prices*: (a) Illustrate graphically and explain carefully how the economy moves to the new equilibrium. (b) Explain how your answer changes if government bonds are not considered wealth.

A4. Open Economy Macroeconomics

Consider the Mundell-Fleming model of an open economy. Analyze the effects of a domestic fiscal contraction under the following scenarios, using detailed verbal explanations and graphs.

1. *The domestic economy is small and exchange rates are fixed*: Compare and contrast the domestic effects of the fiscal contraction under (a) limited capital mobility and (b) perfect capital mobility. Explain how the degree of capital mobility influences the effectiveness of this policy.

2. *The domestic economy is one of two large countries, exchange rates are flexible, exchange rate expectations are static, and capital is perfectly mobile:* Analyze the effects of the fiscal contraction on (a) the domestic economy and (b) the foreign economy. Does the insulation property of flexible exchange rates hold for the foreign economy? Explain why (not).

Part A (continued)

A5. Statements

Pick any three (3) of the following statements and explain carefully why each is either true, false, or indeterminate. You are expected to use graphical and/or mathematical analysis to support your arguments. Your score depends on the quality and completeness of your explanations.

1. The Barro-Ricardian equivalence argument does not hold in an open economy.

2. An increase in the monetary base will lower the money multiplier as well as short-term interest rates.

3. In a small open economy subject to domestic random shocks, policymakers can always stabilize output in the short run by adopting fixed rather than flexible exchange rates.

4. Rational expectations models of aggregate demand/supply imply that a preannounced disinflation policy is costless to society.

5. According to the basic Barro-Gordon model, the time-consistent equilibrium inflation rate will be higher the higher the natural rate of unemployment.

Part B: Answer any <u>two</u> of the following three questions.

B1. Financial Intermediation

Consider the Diamond-Dybvig model with two assets. There are three periods: $t = 0, 1, 2$. Agents are ex-ante identical. They are endowed one unit of a single good at $t = 0$, and nothing at $t = 1, 2$. At the beginning of $t = 1$, a fraction π of agents learn that they prefer to consume only at $t = 1$, while the remaining fraction $(1-\pi)$ of agents prefers to consume only at $t = 2$. There is a linear production technology whereby one unit of the good invested in period 0 yields $R > 1$ units of the good at time 2. This technology is illiquid, in the sense that an investment that is interrupted in period 1 generates $r < 1$ units of consumption. In addition, there is a liquid storage technology, whose return is equal to 1 in both periods. Agents preferences are given by

$$u(c) = \frac{c^{1-\theta} - 1}{1 - \theta}$$

with $0 < \theta < 1$.

1. Write down the problem of an agent in autarky.

2. Suppose that in period 1, after agents learn their idiosyncratic consumption preference shock, a financial market opens where agents can trade claims for the returns on the illiquid production technology. Write down the problem of an agent in this setting. What will the equilibrium price of a bond be in this case? What is the consumption vector? Discuss.

3. Now, instead of a financial market, suppose agents form coalitions, which they call banks, and pool their resources. Write down the problem of the bank, the first order conditions, and the optimal consumption vector. Can multiple equilibria arise in this case? Carefully discuss.

4. What happens to the banking problem when $\theta = 1$? Compare to part 2 and discuss.

Part B (continued)

B2. Overlapping Generations

Consider an economy consisting of an infinite sequence of two-period lived, overlapping generations. N_t agents are born in period t, with $N_{t+1} = (1+n)N_t$. In each period there is a single final good that is produced using a constant returns to scale technology with capital and labor as inputs. Let k_t denote the time t capital-labor ratio, and let $f(k_t)$ denote the intensive production function. Let f have the Cobb-Douglas form

$$f(k_t) = k_t^{\alpha},$$

with $0 < \alpha < 1$. One unit of the final good that is not consumed at t converts into one unit of capital at $t+1$, and capital completely depreciates after consumption $(\delta = 1)$. Agents preferences are given by

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

1. Write down the household's maximization problem and derive the equations that characterize the solution.

2. The solution to the firm's problem has

$$\begin{cases} R_{t+1} = \alpha k_{t+1}^{\alpha-1} \\ w_t = (1-\alpha) k_t^{\alpha} \end{cases}$$

   What are the three market equilibrium conditions?

3. Derive an equation that defines a difference equation for the variable k. Looking at it, can we say anything about a steady-state solution?

4. Does this solution satisfy the First Fundamental Welfare Theorem of Economics? What is the Golden Rule in this particular case? How can we achieve the Pareto Optimal? Carefully explain <u>with</u> an augmented model.

Part B (continued)

B3. Optimal Growth

Consider the discrete-time optimal growth model. The household's intertemporal utility function is given by

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

Assume there is no population growth *(n = 0).* In each period there is a single final good that is produced using a constant returns to scale technology with capital and labor as inputs. Let k_t denote the time t capital-labor ratio, and let $f(k_t)$ denote the intensive production function. Let f have the Cobb-Douglas form

$$f(k_t) = k_t^{\alpha},$$

with $0 < \alpha < 1$. One unit of the final good that is not consumed at t converts into one unit of capital at $t+1$, and capital completely depreciates after consumption *($\delta = 1$).*

1. Write down the optimal growth problem (i.e., the central planner problem), the Bellman equation for this problem, and the first-order condition. Solve the first-order condition to get a difference equation in k_t. Graph it and find the steady-state.

2. Now assume the production function to be

   $$f(k_t, z_t) = z_t k_t^{\alpha},$$

   where $\{z_t\}_0^{\infty}$ is a sequence of independently and identically distributed random variables, which represent technological shocks. Repeat part 1 for our new production function [hint: here you will need to guess $k_{t+1} = \alpha\beta z_t k_t^{\alpha}$ and verify!]. Can we say anything about the behavior of k_t ? Carefully and thoroughly discuss.