

*Harvard University*  
*Department of Economics*

General Examination in Macroeconomic Theory

Fall 2009

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PLEASE USE A SEPARATE BLUE BOOK FOR EACH PART AND WRITE THE QUESTION NUMBER ON THE FRONT OF THE BLUE BOOK.

PLEASE PUT YOUR EXAM NUMBER ON EACH BOOK.

PLEASE DO NOT WRITE YOUR NAME ON YOUR BLUE BOOKS.

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For those taking the **GENERAL EXAM** in macroeconomic theory:

1. You have **FOUR** hours.
  2. Answer **ALL QUESTIONS** in Parts I, II, III, IV, and V.
  3. Time allotted for each part:
    - I. 48 minutes
    - II. 48 minutes
    - III. 48 minutes
    - IV. 48 minutes
    - V. 48 minutes
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**Part I (48 minutes) True/False/Uncertain.**

Explain your answer. For example, if the statement is false, provide a counter-example.  
Explanation determines grade.

1. A Bellman operator has no fixed point if the operator does not satisfy Blackwell's conditions: monotonicity and discounting.
2. Iterating a Bellman operator on any initial guess for the value function yields a sequence of functions that converges to a fixed point of the Bellman operator.
3. Geometric Brownian motion is unbounded above and below.
4. If at date  $t$  the corporate profit tax is expected to fall at date  $T > t$ , then investment will be rising at date  $t$ .
5. In the steady state of a Cobb-Douglas economy with no technology growth,  $\delta R = 1$ , where  $\delta$  is the (exponential) discount factor and  $R$  is the gross interest rate.
6. As the length of the time interval goes to zero, every discrete time stochastic process converges to an Ito Process.
7. In a complete markets economy, the Euler Equation implies that predictable changes in consumption will predict changes in income.

Answer all the following questions. Some are True/False/Uncertain and are explicitly denoted as such. The others are direct questions. Explain and detail your answers VERY carefully. The quality of your explanation determines your grade.

1. True/False/Uncertain. In the neoclassical growth model with exogenous labor, a lower intertemporal elasticity of substitution implies a higher saving rate.
2. True/False/Uncertain. In the neoclassical growth model with endogenous labor, a temporary increase in government expenditures leads to a temporary increase in output, labor and capital.
3. True/False/Uncertain. In the standard RBC model, a positive productivity shock generates on impact an increase in labor supply, consumption, investment, real wages and real interest rates.
4. Explain what the the employment-lottery model is. Can this model generate an aggregate elasticity of labor supply which is larger than the individual labor supply elasticity?
5. Explain what happens when the RBC model is extended to incorporate endogenous capital utilization.
6. Explain using the Shopping time model of money how sustained deficits can lead to inflation.
7. In the Shopping-time model of money, an permanent increase in the growth rate of money supply leaves the long run real interest rate unchanged and decreases the supply of labor.
8. True/False/Uncertain. According to the unpleasant monetarist arithmetic result, an open market operation whereby the central bank decreases the money supply by selling government bonds eventually leads to a decrease in inflation.

**I. Neoclassical Growth Model (24 minutes)**

1. In the standard neoclassical growth model (of the Ramsey type), what is the transversality condition (TVC) that connects the real interest rate to the growth rate of real GDP? Explain where this condition comes from.

2. Suppose that the economy has uncertainty in the form of a multiplicative random shock to the production function. Does the TVC in 1. apply to the risk-free real interest rate? Does the TVC apply to the expected real rate of return on claims on capital? Explain.

3. How do the results in 2. relate to empirical observations on rates of return and long-run growth rates?

**II. Public Debt (24 minutes)**

1. What is Ricardian Equivalence? Does this result hold in the standard neoclassical growth model? Does it hold in the Blanchard-style model, in which individuals die off probabilistically at the rate  $p$  per year?

2. Explain how Ricardian Equivalence depends on whether taxes are lump-sum or distorting. If taxes are not lump-sum—but levied, say, on consumption—what is the reasoning behind the tax-smoothing idea? Under tax-smoothing, how do fiscal deficits respond to a recession or a temporary surge in government spending? How does tax-smoothing depend on whether state-contingent government bonds are available?

Question for fall 2009 macro theory generals

**BE SURE TO ANSWER ALL THREE PARTS OF THE QUESTION**

In what way does an economy's wage-setting mechanism affect the trade-off that monetary policymakers face between stabilizing inflation at some desired rate and stabilizing real economic activity (say, the rate of output) at the welfare-maximizing level *even in the short run* – that is, wholly apart from the dynamic processes by which inflation in one time period carries over inertially to inflation in subsequent periods? More specifically,

**A.** First suppose that firms are monopolistically competitive, that they price the goods and services they sell not every period but only at randomly determined intervals (along the lines first suggested by Calvo), and that their production is subject to random technology shocks. Is the monetary policy that renders inflation today equal to whatever inflation is expected for the future (say, zero for simplicity) the same as the monetary policy that renders output today equal to the level that comes as close as possible to the welfare-maximizing level given whatever other distortions the economy faces? Why or why not?

**B.** Now suppose instead that the wage-setting process is such that *real* wages are less responsive to the level of employment than ordinary competitive labor supply relationships would imply. Does monetary policy now face a short-run trade-off between stabilizing inflation at the desired level and stabilizing the gap between output at the best-available level? Why or why not?

**C.** Which of the following two arguments do you find more persuasive? Why?

(1) “In the presence of this kind of real wage rigidity (as in part B), monetary policy should take a more flexible approach to controlling inflation than would otherwise be the case. In particular, adverse supply shocks – an increase in oil prices, for example, or a productivity slowdown – should be accommodated with a larger transitory increase in inflation than would otherwise be optimal.”

(2) “A flexible approach to controlling inflation in such circumstances would only lead to real wages becoming yet more rigid. It's therefore better to be strict about controlling inflation, so that firms and employees will understand the implications of setting wages in too rigid a way.”

In answering each part of the question, be as explicit as you can about your reasoning, as well as about the assumptions on which your reasoning relies.

**Economics 2010d: International Macro**  
**Spring 2009: Kenneth Rogoff**

Please answer ALL THREE questions.

1. *Speculative Attacks: A first-generation model* This exercise is based on Krugman (1979). Suppose that the demand for money in a small open economy is characterized by

$$m_t - e_t = -\eta \dot{e}_t, \quad (1)$$

where  $m$  is the log of the money supply,  $e$  is the log of the exchange rate,  $y$  is the log of output (assumed to follow some known exogenous process), and  $\dot{e}_t \equiv de_t/dt$ . As long as the (log) exchange rate is fixed at  $\bar{e}$ , the (log) money supply must be set at

$$\bar{m}_t = \bar{e}. \quad (2)$$

A simplified version of the central bank's balance sheet (in levels not logs) is

$$M_t = B_{H,t} + \bar{E}B_{F,t}. \quad (3)$$

**Domestic credit policy**

Suppose that the central bank is required to expand its *nominal* holdings of domestic government debt at rate  $\mu$ , AS LONG AS THE EXCHANGE RATE IS FIXED. Thus

$$\frac{\dot{B}_H}{B_H} = \dot{b}_H = \mu, \quad B_{F,t} > 0, \quad (4)$$

where  $b_H \equiv \log B_H$ .

(a) Explain why when the exchange rate is fixed at  $\bar{E}$ , then the change in foreign reserves must be given by

$$-\bar{E}\dot{B}_F = \dot{B}_H.$$

(b) Suppose, however, that central bank policy is expected to CHANGE when the central bank runs out of reserves, that is, once  $B_{F,t} = 0$ . Assume that once reserves run out, the central bank will start printing domestic credit at a different rate  $\mu'$ , so that

$$\frac{\dot{B}_H}{B_H} = \dot{b}_H = \mu', \quad B_{F,t} = 0.$$

Explain why the “shadow exchange rate” (the rate that would prevail at time  $t$  should a run clean out central bank reserves at time  $t$ ) is now given by

$$\tilde{e}_t = b_{H,t} + \eta\mu'. \quad (5)$$

What does the attack look like if agents believe that  $\mu' = 0$ ?

(c) Can this model explain the fact that interest rate differentials are very small until very shortly before a speculative attack?

2. The model below is derived from the model of moral hazard and lending.

Entrepreneurs with utility function  $U = C_2$  live in a small country that can borrow abroad at world interest rate  $r$ . Each entrepreneur has initial wealth  $Y_1$ , which can be used to invest in a project that yields output  $Z$  with probability  $\pi(I)$ , and yields nothing with probability  $1 - \pi(I)$ ;  $\pi'(I) > 0$ ,  $\pi''(I) < 0$ . Initial wealth  $Y_1$ , however, is insufficient to achieve the efficient level of investment  $\bar{I}$ , defined implicitly by  $\pi'(\bar{I})Z = 1 + r$ . Thus entrepreneurs would like to borrow  $D = \bar{I} - Y_1$ , but they are constrained by the fact that foreign creditors can only observe whether the project actually succeeds or fails, and cannot observe investment  $I$  directly. Potential creditors worry that once the entrepreneur has been given funds, she will sneak them into secret foreign bank accounts rather than invest.

Under this setup, including the information constraints, equilibrium investment is governed by the following two equations:

$$\pi(I)P(Z) = (1 + r)(I - Y_1) \quad (6)$$

$$\pi'(I)[Z - P(Z)] = 1 + r, \quad (7)$$

where  $I - Y_1 = D$  gives the amount the entrepreneur borrows, and  $P(Z)$  is the payment to the creditor if the project succeeds (obviously,  $P(Z) < Z$ ).

Equations (6) and (7) govern the determination of  $I$  and  $P(Z)$ .

(a) Illustrate why in this model, richer countries may invest more and have lower marginal products of capital.

(b) Suppose that in addition to first-period endowment  $Y_1$ , each entrepreneur has observable second-period endowment income  $Y_2$ . Assuming this endowment can be accepted as first-period collateral for a loan, how will this affect investment?

(c) Can a model such as this potentially explain why savings and investment might be highly correlated across countries?

**(3) Please give short answers to any TWO of the following THREE questions.**

(a) Assume a small country owes an extremely large amount of debt to foreign creditors. In principle, can it ever pay for the foreign creditors to forgive part of the debt? If not, why not? If yes, what are the key assumptions? How does your answer depend on the country's underlying incentives for paying the debt?

(b) In what sense is the recent US financial crisis quantitatively similar to other severe banking crises experienced around the world in the post-World War II era? In what sense is it different?

(c) What role did the Gold Standard play in the international transmission of the Great Depression? Does adherence to the Gold Standard plausibly explain why countries took so long to emerge from the Great Depression?