

FINAL EXAM

The exam consists of two parts. There are 100 points total. Part I has 20 points and Part II has 80 points.

You have 2 hours.

Some parts of the exam are harder than others. If you get stuck on one part, do the best you can without spending too much time, and then work on other parts of the exam.

## PART I. Multiple choice (20 points)

In your blue book, give the best answer to 4 of the following 5 questions. Note:

– If you wish, you may add a BRIEF explanation of your answer to AT MOST ONE question. In that case, your grade on that question will be based on your answer and explanation together. This means that an explanation can either raise or lower a grade.

– If you answer all 5 questions, your overall score will be based on your average, not on your 4 best scores.

1. In his paper on Japanese monetary policy, Bernanke discusses the possibility of:

- A. The government dropping money from helicopters – that is, money-financed tax cuts.
- B. The government buying helicopters and other goods with money – that is, money-financed government purchases.
- C. Getting “helicopter speed” – that is, direct central bank interventions to raise the velocity of money.
- D. All of the above.

2. The permanent income hypothesis implies that:

- A.  $C_{t+1} - C_t$  is uncorrelated with  $C_t$ .
- B.  $C_{t+1}$  is uncorrelated with  $C_t - C_{t-1}$ .
- C.  $C_{t+1} - C_t$  is uncorrelated with  $C_t - C_{t-1}$ .
- D.  $C_{t+1}$  is uncorrelated with  $C_t$ .
- E.  $C_{t+1} - C_t$  is uncorrelated with  $Y_{t+1} - Y_t$ .
- F.  $C_{t+1}$  is uncorrelated with  $Y_t$ .
- G. (A) and (C).
- H. (A), (C), and (E).
- I. (B) and (D).
- J. (B), (D), and (F).
- K. All of the above.

3. Consider a consumer maximizing  $U(C_1) + U(C_2)$ , with  $U'(\bullet) > 0$ ,  $U''(\bullet) < 0$ , and  $U'''(\bullet) > 0$ , who can save or borrow at a real interest rate of zero. Then, letting  $E[\bullet]$  denote expectations conditional on period-1 information, if the consumer is optimizing:

- A.  $E[C_2] < C_1$  and  $E[U'(C_2)] < U'(C_1)$ .
- B.  $E[C_2] < C_1$  and  $E[U'(C_2)] = U'(C_1)$ .
- C.  $E[C_2] < C_1$  and  $E[U'(C_2)] > U'(C_1)$ .
- D.  $E[C_2] = C_1$  and  $E[U'(C_2)] < U'(C_1)$ .
- E.  $E[C_2] = C_1$  and  $E[U'(C_2)] = U'(C_1)$ .
- F.  $E[C_2] = C_1$  and  $E[U'(C_2)] > U'(C_1)$ .
- G.  $E[C_2] > C_1$  and  $E[U'(C_2)] < U'(C_1)$ .
- H.  $E[C_2] > C_1$  and  $E[U'(C_2)] = U'(C_1)$ .
- I.  $E[C_2] > C_1$  and  $E[U'(C_2)] > U'(C_1)$ .
- J. Because the consumer can borrow at a zero interest rate, he or she will make  $C_1$  and  $C_2$  arbitrarily large.

4. Consider a setting where lenders are risk neutral and have required rate of return  $r$ . Agency costs in investment will result in:

- A. The expected rate of return that lenders receive (net of any agency costs paid by lenders) being less than  $r$ .
- B. The expected rate of return that lenders receive (net of any agency costs paid by lenders) being greater than  $r$ .
- C. The expected marginal product of capital being less than  $r$ .
- D. The expected marginal product of capital being greater than  $r$ .

5. Among the concepts that Bernanke, Gertler, and Gilchrist discuss in “The Financial Accelerator and the Flight to Quality” are:

- A. “Information-insensitive assets” and “delegated monitoring.”
- B. “Pecking order” and “balance sheets.”
- C. “Sunspots” and “lender of last resort.”
- D. “Modigliani-Miller” and “multi-factor asset pricing models.”
- E. “Zero lower bound” and “sunspots.”

## PART II. 80 points

### DO ALL 3 PROBLEMS.

**(25 points) 1.** Consider a household that will live from 0 to T choosing its path of consumption to maximize its lifetime utility, which is given by:

$$\int_{t=0}^T e^{-\rho t} u(C(t)) dt,$$

where  $u(\bullet)$  takes the constant-relative-risk-aversion form:

$$u(C) = \frac{C^{1-\theta}}{1-\theta}, \quad \theta > 0.$$

The household has no initial wealth; its labor income is constant and equal to  $\bar{Y}$ ,  $\bar{Y} > 0$ ; and the real interest rate is constant and equal to  $\bar{r}$ ,  $\bar{r} > \rho$ . As usual, the present discounted value of the household's consumption cannot exceed the present discounted value of its lifetime resources.

- What is the present value Hamiltonian?
- Find the conditions that characterize the solution to the household's maximization problem.
- Sketch the paths of the household's asset holdings and of  $\ln C$  from 0 to T. (Note: The problem is not asking you to solve explicitly for asset holdings and  $\ln C$  as functions of t.)

**(20 points) 2.** Consider the q-theory model. Assume that initially the economy is in steady state. Let  $K^{*OLD}$  denote the steady-state value of K, and let  $\pi^{OLD}(\bullet)$  denote the  $\pi(\bullet)$  function.

At some time, which we will call time 0 for simplicity, there is a permanent, unexpected shift of the  $\pi(\bullet)$  function. The new function is  $\pi^{NEW}(K) = A$  for all K, where  $A > \pi^{OLD}(K^{*OLD})$ .

- How, if at all, do the  $\dot{q} = 0$  and  $\dot{K} = 0$  loci change at  $t = 0$ ?
- How, if at all, do q and K change at  $t = 0$ ?
- Describe the behavior of q and K after  $t = 0$ .

Explain your answers.

(exam continues on next page)

**(35 points) 3.** Consider an economy that lasts for two periods and that consists of equal numbers of two types of agents, Type A and Type B. The objective function of a representative agent of Type  $i$  is

$$C_1^i + \beta E \left[ C_2^i - \frac{1}{2} a (C_2^i)^2 \right], \quad a > 0.$$

where  $C_t^i$  is the consumption of an agent of Type  $i$  in period  $t$ . Assume that the  $C_t^i$ 's are always in the range where marginal utility is positive.

Agents of Type  $i$  receive an endowment of  $W_1^i$  in period 1 and  $W_2^i$  in period 2. The  $W_1^i$ 's are certain and the  $W_2^i$ 's are uncertain.

Endowments cannot be stored or saved in any way. Thus equilibrium requires  $C_1^A + C_1^B = W_1^A + W_1^B$  and  $C_2^A + C_2^B = W_2^A + W_2^B$ .

a. Suppose the only asset that can be traded is a riskless bond. Specifically, consider an asset that will pay 1 unit for sure in period 2.

i. Set up the problem of an agent of Type  $i$  choosing how much of the asset to buy. The agent takes  $P$ , the price of the asset in period 1 in units of period-1 endowment, as given. The amount bought can be positive or negative (that is, the agent can buy or sell the asset).

ii. Find the demand of an agent of Type  $i$  for the asset as a function of  $P$  and of any relevant parameters (for example,  $a$ ,  $\beta$ ,  $W_1^i$ , and the mean and variance of  $W_2^i$ ).

iii. What is the equilibrium price of the asset?

b. Suppose agents cannot trade a safe asset, but can trade two risky assets, A and B. The payoff to Asset  $i$  is  $W_2^i$ . Let  $P_i$  denote the period-1 price of Asset  $i$  in units of period-1 endowment. (Thus, if an agent of Type  $i$  buys  $Q_A^i$  of Asset A and  $Q_B^i$  of Asset B, his or her consumption is  $W_1^i - P_A Q_A^i - P_B Q_B^i$  in period 1, and  $W_2^i + Q_A^i W_2^A + Q_B^i W_2^B$  in period 2.)

i. Set up the problem of an agent of Type  $i$  choosing how much of each of the two assets to buy. The agent takes the prices of the assets in period 1 as given. (As in part (a), the amounts bought can be positive or negative.)

ii. Find the first-order conditions for the problem you set up in part (b)(i).

iii. Assume  $W_1^A = W_1^B$ , and that  $W_2^A$  and  $W_2^B$  have the same distribution as one another and are independent. If  $P_A = P_B$ , will a Type-A agent demand more of Asset A or of Asset B? (A good logical explanation is enough to receive full credit.)

iv. Continue to make the assumptions in part (b)(iii). Get as far as you can in describing the equilibrium quantities ( $Q_A^A$ ,  $Q_B^A$ ,  $Q_A^B$ , and  $Q_B^B$ ). (As in part (iii), a good logical argument is enough to receive full credit.)