14.02 Principles of Macroeconomics
Fall 2009

Quiz 1
Thursday, October 8th
7:30 PM – 9 PM

Please, answer the following questions. Write your answers directly on the quiz. You can achieve a total of 100 points. There are 5 multiple-choice questions, followed by 2 free response questions. You should read all of the questions first.

Good luck!

NAME: _____

MIT ID NUMBER: _____

TA: _____

CLASS TIME: _____

EMAIL: _____

(Table is for corrector use only)

	1	2	3	4	5	6	7	8	Total
Multiple Choice Questions									
Long Question 1									
Long Question 2									
Total									

1 Multiple Choice (30 points)

Answer the following questions. You DO NOT need to justify your answer.

1. (6 Points) Consider an economy with two goods and two periods. Data are

   Good 1

   $p_t^1 = 1$

   $p_{t+1}^1 = 1$

   $q_t^1 = 1$

   $q_{t+1}^1 = 1.1$

   Good 2

   $p_t^2 = 1$

   $p_{t+1}^2 = 1.4$

   $q_t^2 = 1$

   $q_{t+1}^2 = 1.3$

   where q_t^1 stands for the quantity of good 1 produced in period t, q_t^2 stands for the quantity of good 2 produced in period t, p_t^1 stands for the price of good 1 in period t and p_t^2 stands for the price of good 2 in period t.

   The office of national accounts wants to calculate the real GDP growth rate in this economy using the chain index and they hire you to do so. What is the correct growth rate you should report to the office of national accounts?

   (a) 19.7%

   (b) 20.8%

   (c) 20.1%

2. (6 Points) When we characterize labor supply as an upward sloping relationship between hours worked and wages, we assume that

   (a) the substitution effect dominates the income effect.

   (b) the income effect dominates the substitution effect.

   (c) the income and the substitution effect cancel out making the relationship between hours worked and wages unambiguous.

3. (6 Points) According to the Solow growth model, which of the following statements is FALSE?

   (a) A country which experiences higher population growth than another will have a lower output per worker in steady state.

   (b) Steady state consumption in a country which saves more will always be higher than steady state consumption of a country with a lower savings rate.

   (c) Capital accumulation alone can not sustain long run growth in capital per worker.

4. (6 Points) Consider a consumer who follows a PIH consumption rule and who is a saver in the first period (i.e., in the first period he consumes less than his current income). Which of the following statements is TRUE?

   (a) An increase in the interest rate in the first period will have no effect in the first period's consumption since current consumption only depends on current income.

   (b) An increase in the interest rate will make the price of the first period's consumption compared to the second period's consumption more expensive, which means that the first period's consumption will decrease unambiguously.

   (c) An increase in the interest rate makes the price of the first period's consumption compared to the second period's consumption more expensive but makes the consumer richer, hence the effect of the first period's consumption after an increase in the interest rate is ambiguous.

5. (6 Points) The relationship between investment and the interest rate will be negative:

   (a) Only for firms who finance investment through borrowing.

   (b) Because the interest rate determines the opportunity cost of investing, and is a component of the user cost of capital.

   (c) Because the interest rate decreases the marginal product of capital making firms want to install less capital.

2 Consumption with Borrowing Constraints (35 points)

Consider a PIH consumer, Anna, who receives an income of \$4 when she is young and an income of \$10 when old. Anna is born with no assets, so $a = 0$. The real interest rate that Anna faces for borrowing and saving is equal to r.

1. (7 points) Write down Anna's intertemporal budget constraint, *i.e.* the budget constraint that relates Anna's lifetime income with Anna's lifetime consumption. Explain briefly what this budget constraint tells us.

2. (7 points) Assume that preferences are logarithmic, that is $U(c^y, c^o) = \ln c^y + \beta \ln c^o$, where $\beta \in [0, 1]$. Use Anna's optimality condition, $c^o = \beta(1 + r)c^y$, and the budget constraint you found in part 1 to find Anna's consumption when young and old as a function of the discount factor, β, the real interest rate, r, the income in period 1 and the income in period 2. Calculate Anna's savings (or borrowing) when young. Under what condition will Anna be a borrower in the first period? Explain briefly how Anna's consumption when young differs from an agent who follows a Keynesian consumption rule, where consumption at time t is equal to $c_t = 0.9Y_t$, where Y_t is income at time t.

3. (7 points) Suppose that Anna's income when young increases by ε but her income when old remains constant. Calculate the increase in Anna's consumption when young, Δc^y, and calculate Anna's marginal propensity to consume when young ($\Delta c^y / \Delta y^y$). Compare this to the marginal propensity to consume of a Keynesian consumer and briefly comment on the differential response of the two consumers to transitory shocks.

4. (7 points) Now suppose that Anna faces liquidity constraints, which means Anna can save but is unable to borrow when she is young. Draw the budget constraint in the c^y, c^o axis. Using the same income stream as above and setting $r = 0, \beta = 1$, calculate Anna's optimal consumption decision when young. Explain briefly how this compares to the consumption when Anna is young and faces no liquidity constraints.

5. (7 points) Suppose as above that Anna faces liquidity constraints when young and her income when young increases by ε but her income when old remains constant. Calculate the increase in Anna's consumption when young, Δc^y and calculate Anna's marginal propensity to consume when young ($\Delta c^y / \Delta y^y$). How does Anna's marginal propensity to consume compares to the marginal propensity to consume of a Keynesian consumer? Comment.

3 Technological Change and the Labor Market (35 points)

In country B there is a firm that produces the unique good of the economy using the following production function:

$$Y = F(L_s, L_u) = \left(AL_s^{1/2} + L_u^{1/2}\right)^2$$

where A is a technological parameter, L_s is the number of hours of skilled workers the firm hires monthly, and L_u is the number of hours of unskilled workers the firm hires monthly.

There are two groups of agents in the economy, one group is composed of skilled agents and the other group is composed of unskilled agents. Both groups are equally sized ($N^S = N^U = N$) and have the same preferences over consumption and leisure which are represented by the following utility function

$$U(c, l) = \ln c + \eta \ln l$$

where η is a positive constant. The only source of income of the consumers is their wage income, and the two groups of consumers only differ in the wage they receive, which is w^S for skilled workers and w^U for unskilled workers. The monthly time endowment of a worker is T. Both the firm and the consumers are price takers, meaning they take the wages, w^S, w^U, and the price of the final good, P, as given.

1. (3 points) Show that the production function satisfies constant returns to scale in the two labor types.

2. (5 points) Using the firm's optimality condition we have seen in class, and using the fact that the marginal product of worker of type s is

$$AL_s^{-1/2}\left(AL_s^{1/2}+L_u^{1/2}\right)$$

and the marginal product of labor of a worker of type u is

$$L_u^{-1/2}\left(AL_s^{1/2}+L_u^{1/2}\right),$$

find the relative demand of skilled workers to unskilled workers (L^S/L^U) as a function of the relative wage (w^S/w^U) and the technological parameter.

3. (4 points) Using the time constraint $T = n + l$, where n is number of hours worked,write the budget constraint of a consumer of type s and the budget constraint of a consumer of type u as a function of leisure, consumption, the wage rate of the type, the price P, and T.

4. (5 points) Using the time constraint $T = n + l$, the budget constraint, and the fact the marginal utility of consumption and the marginal utility of leisure are given by

$$\begin{aligned} MU(c) &= 1/c \\ MU(l) &= \eta/l, \end{aligned}$$

find the optimal labor supply of individuals and the optimal demand of the final good for skilled and unskilled consumers.

5. (5 points) Using the labor supplies for the two groups of consumer and the relative labor demand of the firm, find the equilibrium relative wage (w^S/w^U).

6. (5 points) What is the effect of a technological increase (an increase in A) in the wage gap between skilled and unskilled workers? Explain briefly what happens to the labor demand of the two types of workers.

7. (4 points) Now imagine that as a result of a national trend, more and more people go to college so the ratio of skilled to unskilled workers rises (a rise in N^s/N^u). What will happen to the relative wage between skilled and unskilled workers as a result of this national trend?

8. (4 points) Finally assume that the current technological level, A, is endogenous and is a function of the ratio between skilled and unskilled workers. In particular, assume $A = (N^s/N^u)^\beta, \beta > 0$. What will happen to the wage ratio as a result of the national trend mentioned before?

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