Department of Applied Economics Johns Hopkins University

Economics 602
Macroeconomic Theory and Policy
Midterm Exam
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Fall 2010
October 25, 2010

NAME: _____

The Exam has a total of four (4) problems and pages numbered one (1) through twelve (12). Each problem's total number of points is shown below. Your solutions should consist of some appropriate combination of mathematical analysis, graphical analysis, logical analysis, and economic intuition, but in no case do solutions need to be exceptionally long. Your solutions should get straight to the point – **solutions with irrelevant discussions and derivations will be penalized.** You are to answer all questions in the spaces provided.

You may use one page (double-sided) of notes. You may **not** use a calculator.

Problem 1	**/ 20**
Problem 2	**/ 30**
Problem 3	**/ 25**
Problem 4	**/ 25**
TOTAL	**/ 100**

Problem 1: European and U.S. Consumption-Leisure Choices (20 points). Europeans work fewer hours than Americans. There are likely very many possible reasons for this, and indeed in reality this fact arises from a combination of many reasons. In this question, you will consider two reasons using the simple (one-period) consumption-leisure model.

a. **(10 points)** Suppose that both the utility functions and pre-tax real wages W/P of American and European individuals are identical. However, the labor income tax rate in Europe is higher than in America. In a **single** carefully-labeled indifference-curve/budget constraint diagram (with consumption on the vertical axis and leisure on the horizontal axis), show how it can be the case that Europeans work fewer hours than Americans. Provide any explanation of your diagram that is needed.

Problem 1 continued

b. **(10 points)** Suppose that both the pre-tax real wages W/P and the labor tax rates for both American individuals and European individuals are identical. However, the utility function $u^{AMER}(c,l)$ of Americans differs from that of Europeans, $u^{EUR}(c,l)$. In a **single** carefully-labeled indifference-curve/budget constraint diagram (with consumption on the vertical axis and leisure on the horizontal axis), show how it can be the case that Europeans work fewer hours than Americans. Provide any explanation of your diagram that is needed.

Problem 2: Patience and the Dynamics of Stock Prices and Consumption (30 points). Suppose the economy is in a steady state at the start of the year 2040. The steady-state level of consumption prior to the start of the year 2040 is c^{SS}, and suppose that the economy has been in this steady state for several years. Thus**,** $c^{SS} = c_{2039} = c_{2038} = c_{2037} = c_{2036} = \ldots$. Furthermore, suppose that the steady-state **real** interest rate in the several years prior to the start of the year 2040 is $r^{SS} > 0$.

Perhaps due to several years of economic tranquility, suppose that at the start of the year 2040, the representative consumer **becomes more patient than he used to be before 2040. Furthermore, it is not until the start of the year 2040 that the representative consumer understands that he has become more patient** (thus, the consumer never "anticipated" anytime prior to 2040 that he would "become more patient" in the year 2040).

Denote the representative consumer's subjective discount factor from the year 2040 onwards as β, which, as just described, is a different value than it used to be before 2040; denote the subjective discount factor in the pre-2040 period as β^{PRE}. Despite the change in the representative consumer's patience, both β and β^{PRE} are numbers strictly between zero and one.

In both the pre-2040 and post-2040 periods, the representative consumer's utility function in each period is $u(c_t) = \ln c_t$. If we view each time period as being one year, then, **starting from the beginning of period 2040** (i.e., the year 2040), the representative consumer's lifetime utility function is

$$\ln c_{2040} + \beta \ln c_{2041} + \beta^2 \ln c_{2042} + \beta^3 \ln c_{2043} + \ldots$$

For simplicity, suppose that the nominal price of consumption is **always one in every time period** (that is, $\ldots = P_{2037} = P_{2038} = P_{2039} = P_{2040} = P_{2041} = P_{2042} = \ldots = 1$ **forever**), and the nominal dividend paid on each share of stock is **always zero in every time period** (that is, $\ldots = D_{2037} = D_{2038} = D_{2039} = D_{2040} = D_{2041} = D_{2042} = \ldots = 0$ **forever**). The budget constraints faced by the representative consumer starting from the year 2040 are thus

$$\begin{aligned} c_{2040} + S_{2040}a_{2040} &= Y_{2040} + S_{2040}a_{2039} \\ c_{2041} + S_{2041}a_{2041} &= Y_{2041} + S_{2041}a_{2040} \\ c_{2042} + S_{2042}a_{2042} &= Y_{2042} + S_{2042}a_{2041} \\ &\ldots \end{aligned}$$

and so on in subsequent years. The rest of the notation is as in Chapter 8: a_t denotes the consumer's stock holdings at the end of a given year *t*, Y_t denotes the consumer's nominal income during a given year *t*, and S_t denotes the per-share nominal price of stock during a given year *t*.

(OVER)

Problem 2 continued

a. (2 points) In no more than one sentence/phrase, define/describe an economic steady state.

b. (6 points) Define the **rate of stock price growth between the years 2038 and 2039** as $\frac{S_{2039}}{S_{2038}} - 1$. Was the rate of stock price growth between the years 2038 and 2039 positive, negative, zero, or is it impossible to determine? Carefully justify your answer.

c. (4 points) As described above, the representative consumer is more patient starting in 2040 (and beyond) than before 2040. In terms of the subjective discount factors β and β^{PRE}, does this mean that $\beta < \beta^{PRE}$, $\beta > \beta^{PRE}$, $\beta = \beta^{PRE}$, or is it impossible to tell how β compares to β^{PRE}?

Problem 2 continued

d. (6 points) Regardless of any events that happen in the year 2040 or the several years following 2040, suppose that **many** years after the year 2040, the economy is once again in a steady state. In this **eventual post-2040 steady state,** is the rate of stock price growth from one year to the next positive, negative, zero, or is it impossible to determine? Carefully justify your answer.

e. (6 points) Is the rate of stock price growth you found in part d larger than, smaller than, or equal to the rate of stock price growth between the years 2038 and 2039 you found in part b? Or is it impossible to determine? Carefully justify your answer.

f. (Harder – 6 points) In the **eventual post-2040 steady state** (i.e., many years after 2040), is consumption larger than, smaller than, or equal to consumption in the steady state prior to the year 2040? Or is it impossible to determine? Carefully justify your answer.

Problem 2f continued (if you need more space)

Problem 3: Two-Period Economy (25 points). Consider a two-period economy (with no government and hence no taxes), in which the representative consumer has no control over his income. The lifetime utility function of the representative consumer is $u(c_1, c_2) = \ln c_1 + c_2$, where ln stands for the natural logarithm (that is not a typo – it is only c_1 that is inside a ln(.) function, c_2 is **not** inside a ln(.) function).

Suppose the following numerical values: the **nominal** interest rate is $i = 0.05$, the nominal price of period-1 consumption is $P_1 = 100$, the nominal price of period-2 consumption is $P_2 = 105$, and the consumer begins period 1 with zero net assets.

a. **(3 points)** Is it possible to numerically compute the **real** interest rate (r) between period one and period two? If so, compute it; if not, explain why not.

b. **(14 points)** Set up a **sequential** Lagrangian formulation of the consumer's problem, in order to answer the following: i) is it possible to numerically compute the consumer's optimal choice of consumption in period 1? If so, compute it; if not, explain why not. ii) is it possible to numerically compute the consumer's optimal choice of consumption in period 2? If so, compute it; if not, explain why not.

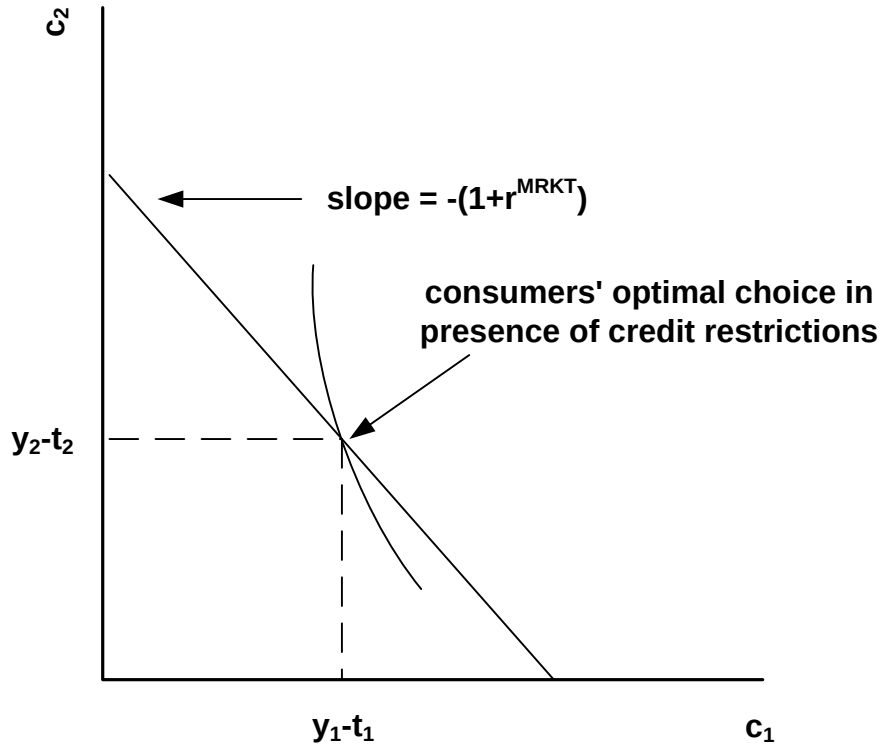
Problem 3b continued (if you need more space)

c. **(8 points)** The rate of consumption growth between period 1 and period 2 is defined as $\frac{c_2}{c_1} - 1$ (completely analogous to how we have defined, say, the rate of growth of prices between period 1 and period 2). Using **only** the consumption-savings optimality condition for the **given** utility function, **briefly** describe/discuss **(rambling essays will not be rewarded)** whether the real interest rate is **positively related to, negatively related to, or not at all related to the rate of consumption growth between period one and period two.** (**Note:** No mathematics are especially required for this problem; also note this part can be fully completed even if you were unable to get all the way through part b).

Problem 4: The Credit Crunch and Government Loan Programs (25 points). Consider the two-period framework of fiscal policy from Chapter 7, in which both the representative consumer and the government live for the entire two periods. In real terms, the government spends g_1 and g_2 in periods 1 and 2, and collects from the representative consumer total tax revenues t_1 and t_2 (which are collected lump-sum). The **market** real interest rate is r^{MRKT}, which is part of the slope of the **consumer's LBC** shown in the diagram below. Note that the diagram below is NOT of the economy-wide resource frontier – for the analysis in this problem, you are to use the consumer's LBC.

There is a credit crunch going on, which **prevents consumers from borrowing from private-market lenders at all** during period 1. (If consumers could borrow from private market lenders, the real interest rate on private-market loans would be r^{MRKT}.) For simplicity, suppose that at the beginning of period 1, both the representative consumer and the government have zero net assets – that is, $a_0 = 0$ and $b_0 = 0$. And, as usual in analysis of the two-period framework, assume that both the government and the representative consumer end period 2 with zero net assets – that is, $a_2 = 0$ and $b_2 = 0$.

Fiscal policy makers are considering various policy options to try to ease the consequences of the credit crunch. Suppose, perhaps for political reasons, that one option that is **NOT** being considered at all is changing government spending in either or both period 1 or period 2.



(OVER)

Problem 4 continued

a. **(4 points)** One option Congress is considering is to lower lump-sum taxes in period 1. Would this cause taxes in period 2 (t_2) to rise, decline, or remain unchanged? Or is it impossible to determine? Briefly explain (you may refer to the diagram above if necessary).

b. **(6 points)** If Congress does enact the fiscal policy reform described in part a, would the economy's consumption in period 1 (c_1) rise, fall, or remain unchanged? Or is it impossible to determine? Briefly explain (you may refer to the diagram above if necessary).

An alternative proposal (besides the fiscal reform described in part a) being considered by Congress is to **directly lend to consumers.** Denote by L the quantity of **loans** that Congress would/could make directly to consumers in period 1 **(which are distinct from consumers' assets that are measured in the variables a_0, a_1, and a_2)**, and suppose that the government would charge a real interest rate r^{GOV} that is **lower** than would be available on private markets – that is, $r^{GOV} < r^{MRKT}$. If consumers did borrow from the government in period 1, they would have to repay these loans, inclusive of interest at the rate r^{GOV}, in period 2. The period-1 and period-2 budget constraints of the representative consumer and the government under this direct lending facility would read:

$$c_1 + a_1 = y_1 - t_1 + L$$
$$c_2 + a_2 + (1 + r^{GOV})L = y_2 - t_2 + (1 + r^{MRKT})a_1$$
$$g_1 + b_1 + L = t_1$$
$$g_2 + b_2 = t_2 + (1 + r^{GOV})L + (1 + r^{MRKT})b_1$$

Problem 4 continued

c. **(5 points)** In the diagram in the statement of the problem (above), **clearly and carefully sketch how the consumer's LBC is modified** by the introduction of the government loan program. Provide any (brief) explanation for your sketch that is required, and clearly **label** the element(s) you sketch. (**Hint:** before sketching the modified LBC, think about how the "usual" derivation of the LBC from Chapter 3 and 4 gets altered in this case?)

d. **(Harder – 10 points) Based only on your analysis in parts a, b, and c,** which of the two fiscal policy options (the tax reform of part b or the direct lending program of part c) would make the representative consumer better off in a lifetime utility sense (i.e., in terms of welfare)? Carefully describe the logic behind your conclusion, referring, if necessary, to the diagram above.

Problem 4d continued (if you need more space)

END OF EXAM