Department of Economics University of Maryland

Economics 325
Intermediate Macroeconomic Analysis
Midterm Exam – Part 1
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NAME: _____

Part 1 of the Exam has a total of two (2) problems and pages numbered one (1) through six (6). 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	**/ 30**
Problem 2	**/ 20**
TOTAL PART 1	**/ 50**
TOTAL PART 2	**/ 50**
TOTAL	**/ 100**

Problem 1: Core Inflation and Non-Core Inflation in the Two-Period Economy (30 points). Two distinct measures of inflation – called core inflation and non-core inflation – generally attract attention by policy-makers and the media. The core inflation rate is the rate of growth of prices of so-called "core goods" (such as food, clothing, and shelter), while the non-core inflation rate is the rate of growth of prices of so-called "non-core goods" (generally energy items).

Consider our usual two-period economy (with no government), in which the representative consumer has no control over his **nominal** income. Rather than there being only one "type" of good the consumer purchases each period, however, suppose that each period there are two "types" of goods: core good and non-core goods. The lifetime utility function of the representative consumer is

$$u\left(c_1^{CORE}, c_1^{NONCORE}, c_2^{CORE}, c_2^{NONCORE}\right) = \ln\left(c_1^{CORE}\right) + \ln\left(c_1^{NONCORE}\right) + \ln\left(c_2^{CORE}\right) + \ln\left(c_2^{NONCORE}\right),$$

where ln stands for the natural logarithm, c_1^{CORE} stands for consumption of core goods in period 1, $c_1^{NONCORE}$ stands for consumption of non-core goods in period 1, and similarly for c_2^{CORE} and $c_2^{NONCORE}$.

The representative consumer begins period one with zero assets (i.e., $A_0 = 0$). The period-by-period budget constraints of the representative consumer are thus

$$P_1^{CORE} c_1^{CORE} + P_1^{NONCORE} c_1^{NONCORE} + A_1 = Y_1$$
$$P_2^{CORE} c_2^{CORE} + P_2^{NONCORE} c_2^{NONCORE} + A_2 = Y_2 + (1+i)A_1$$

where P_1^{CORE} denotes the **nominal** price of core goods in period 1, $P_1^{NONCORE}$ denotes the **nominal** price of non-core goods in period 1, and similarly for P_2^{CORE} and $P_2^{NONCORE}$. As usual, Y_1 and Y_2 denote **nominal** income in periods 1 and 2, respectively, and *i* is the nominal interest rate.

Finally, we can construct as usual the representative consumer's nominal lifetime budget constraint, which here is:

$$P_1^{CORE} c_1^{CORE} + P_1^{NONCORE} c_1^{NONCORE} + \frac{P_2^{CORE} c_2^{CORE}}{1+i} + \frac{P_2^{NONCORE} c_2^{NONCORE}}{1+i} = Y_1 + \frac{Y_2}{1+i}$$

This nominal LBC has the same interpretation as always: the PDV of all lifetime nominal consumption (which here takes into account both consumption of core and non-core goods) is equal to the PDV of all lifetime nominal income. That is, in a lifetime sense, all consumption spending equals all income regardless of "how many" goods there are to purchase.

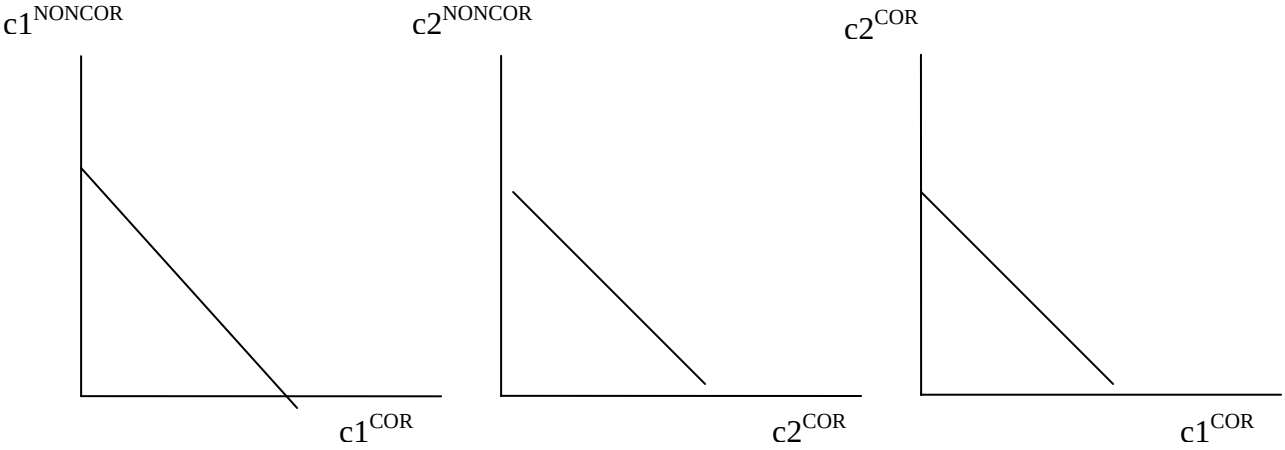
(OVER)

Problem 1 continued

a. **(18 points)** Using an appropriate **nominal** Lagrange formulation (you are free to choose either a lifetime formulation or a sequential formulation), derive **four** optimality conditions: one between period-1 core consumption and period-1 non-core consumption; one between period-2 core consumption and period-2 non-core consumption; one between period-1 core consumption and period-2 core consumption; and one between period-1 non-core consumption and period-2 non-core consumption. These optimality conditions should be based on the utility function given above. Show all important steps.

Problem 1a continued (if you need more space)

b. **(6 points)** In each of the following three diagrams, appropriately label the slope of the budget line in terms of variables defined above. **Briefly** describe how you determined the relevant slopes (you may refer to your work in part a if needed).



Problem 1 continued

Suppose that the Fed changes the nominal interest rate, and suppose that this change in policy does not at all affect P_1^{CORE}, $P_1^{NONCORE}$, P_2^{CORE}, or $P_2^{NONCORE}$, nor does it affect Y_1 or Y_2.

c. **(3 points)** At the resulting new optimal choice, will this change in monetary policy affect consumers' MRS between period-1 core and period-1 non-core consumption? If so, briefly explain why/how; if not, briefly explain why not. (You may refer to the diagrams in part b if needed.)

d. **(3 points)** At the resulting new optimal choice, will this change in monetary policy affect consumers' MRS between period-1 core and period-2 core consumption? If so, briefly explain why/how; if not, briefly explain why not. (You may refer to the diagrams in part b if needed.)

Problem 2: Quasi-Linear Utility (20 points). In the static consumption-leisure model, suppose the representative consumer has the following utility function over consumption and leisure,

$$u(c,l) = \ln(c) + A \cdot l \,,$$

where, as usual, c denotes consumption and l denotes leisure. In this utility function, $\ln(\cdot)$ is the natural log function, and A is a number (a constant) smaller than one that governs how much utility the individual obtains from a given amount of leisure. Suppose the budget constraint the individual faces is simply $c = (1-t) \cdot w \cdot n$, where t is the labor tax rate, w is the **real** hourly wage rate, and n is the number of hours the individual works. (Notice that this budget constraint is expressed in real terms, rather than in nominal terms.)

a. **(3 points)** Does this utility function display diminishing marginal utility in consumption? Briefly explain.

b. **(3 points)** Does this utility function display diminishing marginal utility in leisure? Briefly explain.

c. **(14 points)** Assume (as usual) the representative consumer maximizes utility. For the given utility function, **plot this representative consumer's labor supply function**, explaining the logic behind your plotted function. Also, how would a decrease in the tax rate t affect the optimal amount of labor supply (i.e., increase it, decrease it, or leave it unchanged)? **Carefully explain your logic/derivation. (Note: Be sure to base your analysis here on the utility function that is *given* above.)**

Problem 2c continued (if you need more space)

END OF PART 1 OF EXAM