

Economics 325

**Intermediate Macroeconomic Analysis**

**Problem Set 1**

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Spring 2009

Due: Wednesday, February 25, 2009

**Instructions:** Written (typed is strongly preferred, but not required) solutions must be submitted no later than 11:00am on the date listed above (either in class or in the Economics Department Main Office, Tydings Hall 3105). Your solutions, which likely require some combination of mathematical derivations, economic reasoning, graphical analysis, and pure logic, should be thoroughly presented and not leave the reader (i.e., your TAs and I) guessing about what you actually meant.

**You must submit your own independently-written solutions.** You are permitted (in fact, encouraged) to work in groups to think through issues and ideas, but your “writing up” of solutions should be done independently of anyone else. **Under no circumstances will multiple verbatim identical solutions be considered acceptable.**

There are three problems in total, each with multiple subparts.

**Problem 1: Optimal Choice in the Consumption-Savings Model During a Credit Crunch: A Numerical Analysis (60 points).** Consider a two-period economy (with no government and hence neither government spending nor taxation), in which the representative consumer has no control over his income. The lifetime utility function of the representative consumer is  $u(c_1, c_2) = \ln c_1 + \ln c_2$ , where  $\ln$  stands for the natural logarithm. We will work here in purely real terms: suppose the consumer's real income in period 1 is  $y_1 = 10$  and the consumer's real income in period 2 is  $y_2 = 22$ . Suppose that the real interest rate between period 1 and period 2 is ten percent (i.e.,  $r = 0.10$ ), and also suppose the consumer begins period 1 with **real** net wealth (inclusive of interest) of  $(1+r)a_0 = 2$ .

Set up the lifetime Lagrangian formulation of the consumer's problem, and use it to answer part a, b, and c. Show all steps in your logic/arguments.

- a. **(8 points)** 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.
- b. **(8 points)** 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.
- c. **(6 points)** Is it possible to numerically compute the consumer's real asset position at the end of period 1? If so, compute it; if not, explain why not.
- d. **(6 points)** Is it possible to numerically compute the consumer's level of **borrowing or savings** (be explicit about the sign) during period 1? If so, compute it; if not, explain why not.

For parts e and f of this problem, suppose that lenders to this consumer impose **credit constraints** (a "credit crunch") on the consumer. Specifically, they impose the tightest possible credit constraint – the consumer is not allowed to have any debt at all at the end of period one, which means that the consumer's real wealth at the end of period one must be nonnegative ( $a_1 \geq 0$ ).

- e. **(10 points)** With this credit constraint in place, compute numerically the consumer's optimal choice of period-one and period-two consumption? Briefly explain, either logically or graphically or both. (**Hint:** is it even possible to set up a Lagrangian "as usual" here?)
- f. **(8 points)** Compared to your analysis in parts a, b, c, and d, does the credit constraint enhance or diminish welfare (i.e., does it increase or decrease total lifetime utility)? Justify your answer with some appropriate combination of logic, graphs, and/or mathematics.

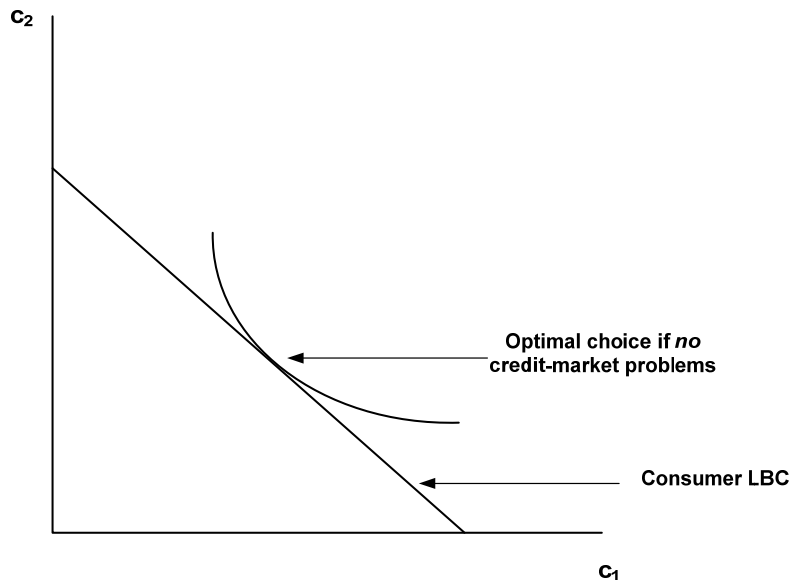
Suppose now that the consumer experiences a temporary increase in real income in period one to  $y_1 = 18$ , with real income in period two still  $y_2 = 22$ .

- g. **(6 points)** Calculate numerically the effect of this positive surprise in income on  $c_1$  and  $c_2$ , supposing that there is **no** credit constraint on the consumer.
- h. **(8 points)** Finally, suppose that the credit constraint you analyzed in parts e and f is back in place. In this case, will the credit crunch affect the consumer's choices (compared to part g, that is)? (**Note:** in this part, there is no need to compute anything – all that is required is a logical and/or graphical argument.)

**Problem 2: A Contraction in Credit Availability (16 points).** The graph below shows our usual two-period indifference-curve/budget constraint diagram, with period-1 consumption plotted on the horizontal axis, period-2 consumption plotted on the vertical axis, and the downward-sloping line representing, as always, the consumer's LBC. Throughout all of the analysis here, assume that  $r = 0$  **always**. Furthermore, there is no government, hence never any taxes.

Suppose that the representative consumer has lifetime utility function  $u(c_1, c_2) = \ln c_1 + \ln c_2$ , and that the **real** income of the consumer in period 1 and period 2 is  $y_1 = 12$  and  $y_2 = 8$ . Finally, suppose that the initial quantity of net assets the consumer has is  $a_0 = 0$ . **EVERY** consumer in the economy is described by this utility function and these values of  $y_1$ ,  $y_2$ , and  $a_0$ .

- (8 points)** If there are no problems in credit markets whatsoever (so that consumers can borrow or save as much or as little as they want), compute the numerical value of the optimal quantity of period-1 consumption and period-2 consumption. In solving this problem, you should set up an appropriate Lagrangian to do so and show/explain all steps in your logic.
- (8 points)** Now suppose that because of problems in the financial sector, no consumers are allowed to be in debt at the end of period 1 because banks will not allow them to be. With this credit restriction in place, compute the numerical value of the optimal quantity of period-1 consumption. **ALSO**, on the diagram below (which you should reproduce in your solutions), qualitatively and **clearly** sketch the optimal choice with this credit restriction in place (qualitatively sketched already for you is the optimal choice if there are no problems in credit markets). Your sketch should indicate **both** the new optimal choice **and** an appropriately-drawn and labeled indifference curve that contains the new optimal choice. (**Note:** the analysis here is largely logical/qualitative, with very little mathematics required.)



**Problem 3: Analyzing the Fiscal Stimulus Plan (24 points).** In this problem, you will analyze a couple of broad aspects of the Obama administration’s fiscal stimulus plan using the two-period model of the government presented in Chapter 7.

Let’s interpret “period 1” to be the two-year period January 1, 2009-December 31, 2010, and “period 2” to be January 1, 2011 and beyond (note: there is no requirement in the two-period model that the two “periods” be of equal time length). Equivalently, you can interpret “period 1” to be the “short run,” and period 2 to be the “long run.”

Under pre-existing fiscal plans (i.e., if the fiscal plans under the Bush administration were simply rolled over into the present and the future), the fiscal deficit during 2009-2010 (i.e., “period 1”) would be approximately \$1.4 trillion. Also, the federal government debt as of the beginning of 2009 is approximately \$10 trillion. In terms of the notation of our Chapter 7 framework, this means  $b_0 = - \$10$  trillion and  $t_1 - g_1 = -\$1.4$  trillion (note the minus sign).

Interest rates are extremely low right now, so let’s make the further assumption that  $r = 0$ .

- a. **(3 points)** Under current fiscal plans (i.e., if the Obama administration did not change any aspects of fiscal policy whatsoever), compute the numerical value of the fiscal surplus or deficit that would need to be run in 2011 and beyond (i.e., in “period 2”). Present your logic and provide brief economic explanation.
- b. **(3 points)** Under current fiscal plans (i.e., if the Obama administration did not change any aspects of fiscal policy whatsoever), compute the numerical value of the government’s asset/debt position at the end of 2010 (i.e., at the end of “period 1”). **Be clear about the sign.** Present your logic and provide brief economic explanation.

Under Obama’s plan, the combined 2009-2010 fiscal deficit would be approximately \$2 trillion.<sup>1</sup>

- c. **(3 points)** Under the Obama plan, compute the numerical value of the fiscal surplus or deficit that would need to be run in 2011 and beyond (i.e., in “period 2”). Present your logic and provide brief economic explanation.
- d. **(3 points)** Under the Obama plan, compute the numerical value of the government’s debt/asset position at the end of 2010 (i.e., at the end of “period 1”). **Be clear about the sign.** Present your logic and provide brief economic explanation.

A point of contention regarding the stimulus plan has been whether it should be composed mostly of increases in government spending or mostly of tax cuts. In what follows, you will analyze the two polar extreme possibilities.

- e. **(4 points)** Suppose that the fiscal stimulus is composed entirely of increased government spending in the years 2009-2010 (i.e., in “period 1”), with no changes in fiscal policy whatsoever beyond that. Assuming that net exports and investment are both zero AND assuming that Ricardian Equivalence holds, will the increase in

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<sup>1</sup> Thus, the Obama plan would *raise the fiscal deficit* by about \$600 billion in 2009 and 2010 combined. This is smaller than the approximately “\$800 billion stimulus plan” that has captured headlines; this is simply because part of the stimulus plan takes effect beyond 2010 (which itself has been a point of contention).

- government spending raise total GDP during the years 2009-2010? Carefully explain your logic, including what role Ricardian Equivalence plays in your logic.
- f. **(4 points)** Suppose that the fiscal stimulus is composed entirely decreases in lump-sum taxes in the years 2009-2010 (i.e., in “period 1”), with no changes in fiscal policy whatsoever beyond that. Assuming that net exports and investment are both zero AND assuming that Ricardian Equivalence holds, will the tax reduction raise total GDP during the years 2009-2010? Carefully explain your logic, including what role Ricardian Equivalence plays in your logic.
- g. **(4 points)** You are an adviser to the Obama administration’s fiscal policy makers. Suppose that any advice you offer is based solely on the goal of raising total GDP in the years 2009-2010. Which of the two scenarios outlined in part e or part f would you advise the government to follow? Briefly explain.