

**NAME: ANSWER KEY**

---

## **Intermediate Macroeconomic Theory**

Economics 232-002

Summer, 2008

### **Midterm Exam #3**

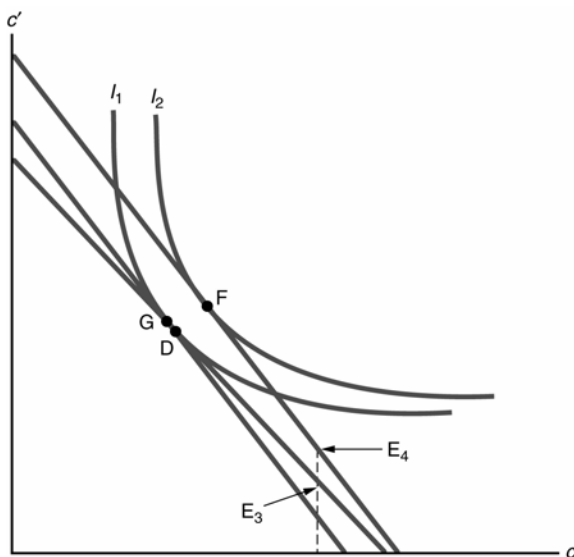
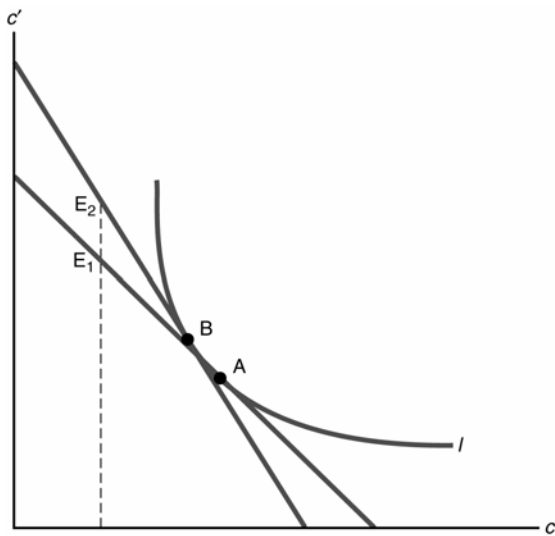
1. (30 points) Suppose that a consumer's future income increases, and the real interest rate increases as well. In a diagram, determine how the consumer's optimal choice of current consumption and future consumption changes and how savings change. Show how your results depend on income and substitution effects and consider the case where the consumer is initially a lender and where he or she is initially a borrower.

### **ANSWER**

In this problem, there is a simultaneous increase in both future income and the real interest rate. The increase in future income is a positive income effect for both borrowers and lenders. The increase in the real interest rate includes a pure substitution effect and a pure income effect. The substitution effect induces the consumer to consume less in the current period and more in the second period. The direction of the pure income effect part of the real interest rate change depends on whether the consumer is a borrower or a lender. Lenders are better off with a higher real interest rate and borrowers are worse off with a higher real interest rate.

The top figure below shows the case of a borrower. The consumer starts out with endowment  $E_1$  and picks point A on indifference curve  $I$ . The diagram shows the case in which the positive income effect of the increase in  $y$  is exactly canceled out by the negative income effect of the increase in  $r$ . In this particular case,  $c$  falls and  $c'$  increases. Since current income is fixed, the consumer must increase saving. For the borrower, this amounts to a reduction in borrowing. The consumer therefore picks point B, which is also on indifference curve  $I$ , but which is parallel to a budget line that passes through  $E_2$ .

The bottom figure below shows the case of a lender. The consumer starts out with endowment  $E_3$ . The consumer chooses point D that is a tangency of indifference curve  $I_1$  with the budget line that passes through point  $E_3$ . The disturbance shifts the budget line out to the line that passes through  $E_4$ , the new endowment point. The substitution effect moves the consumer from point D to point G on  $I_1$ . The pure substitution effect induces a reduction in  $c$  and an increase in  $c'$ . The net income effect is then represented by a parallel shift in the line through G to the new budget line. In this case, the two income effects move in the same direction. Therefore both  $c$  and  $c'$  increase from point G to point F. Second-period consumption unambiguously increases. First-period consumption (and therefore savings) may either rise or fall. The bottom figure below shows the case in which  $c$  increases. If  $c$  increases,  $s$  must fall.



2. (40 points) A consumer's income in the current period is  $y=100$ , and income in the future period is  $y'=120$ . He or she pays lump-sum taxes  $t=20$  in the current period and  $t'=10$  in the future period. The real interest rate is 0.1 or 10% per period.
- (10 points) Determine the consumer's lifetime wealth.
  - (10 points) Suppose that current and future consumption are perfect complements for the consumer and that he or she always wants to have equal consumption in the current and future periods. Draw the consumer's indifference curves.
  - (10 points) Determine what the consumer's optimal current-period and future-period consumption are, and what optimal saving is, and show this in a diagram with the consumer's budget constraint and indifference curves. Is the consumer a lender or a borrower?
  - (10 points) Now suppose that instead of  $y=100$ , the consumer has  $y=140$ . Again, determine optimal consumption in the current and future periods and optimal saving, and show this in a diagram. Is the consumer a lender or a borrower?

### ANSWER

Given information:

$$y = 100$$

$$y' = 120$$

$$t = 20$$

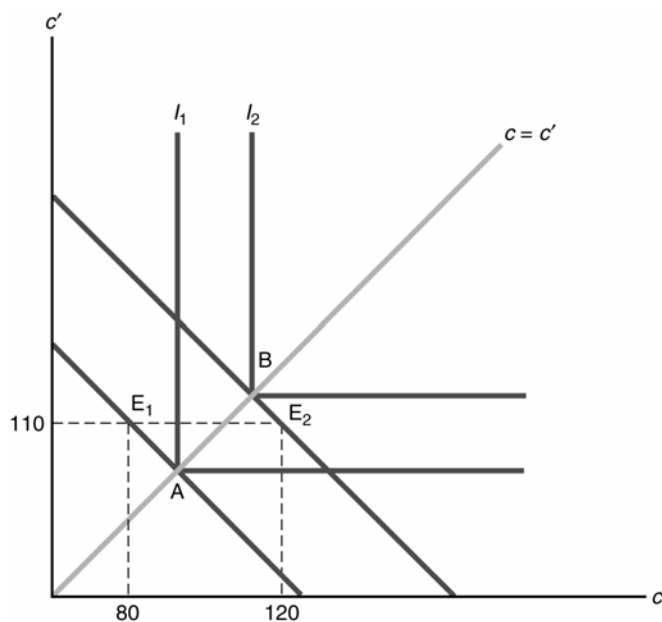
$$t' = 10$$

$$r = 0.1$$

- (a) To calculate wealth, we compute:

$$w = y - t + \frac{y' - t'}{1 + r} = 80 + \frac{110}{1.1} = 180$$

- (b) In the perfect complements case, the indifference curves are like  $I_1$  and  $I_2$  in the figure below.



- (c) The consumer's optimal consumption bundle is at point A. Point A simultaneously solves:

$$c = c', \text{ and}$$

$$c + \frac{c'}{1+r} = c + 0.91c' = 180$$

Upon solving, we find that  $c = c' = 94.2$ . Savings is therefore given by:

$$s = y - t - c = 80 - 94.2 = -14.2$$

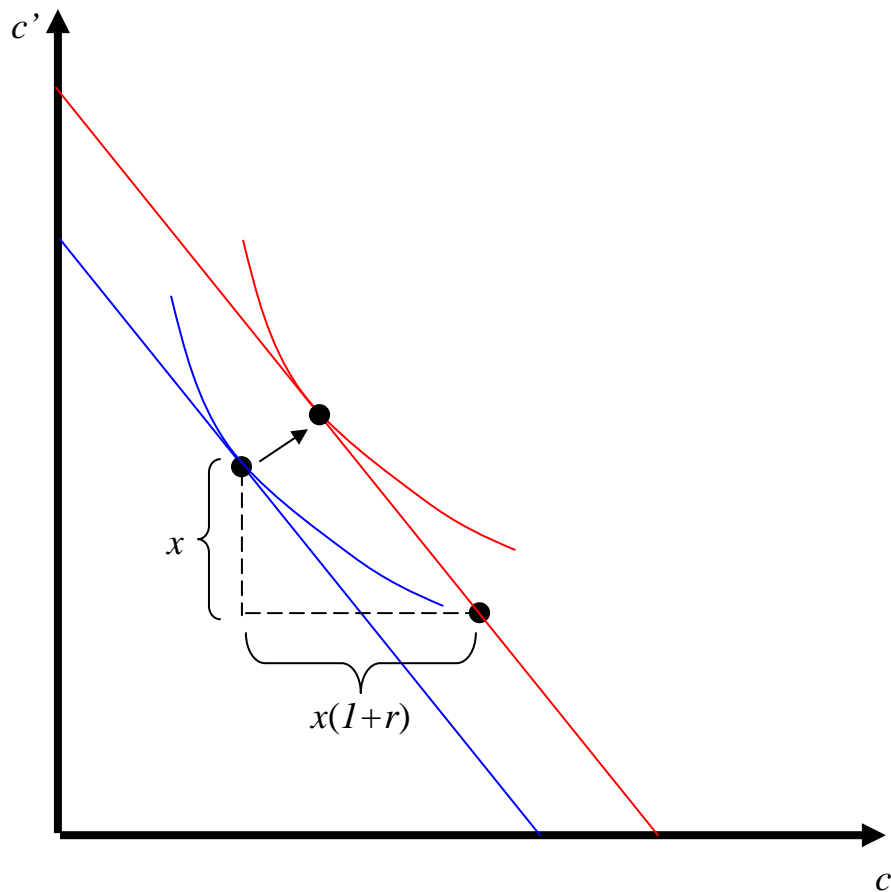
The consumer is a borrower. In the figure above, the endowment point is  $E_1$  and the consumer chooses A.

- (d) First-period income rises from 100 to 140. We now recompute  $w = 220$ . Solving as in part (c), we find that  $c = c' = 115.2$ , and  $s = 4.8$ . In the figure above, the endowment point is  $E_2$  and the consumer chooses B.

3. (15 points) An employer offers his or her employee the option to reduce income next year by  $x$  units and increase this year income by  $(1+r)x$  units, where  $r$  is representing the real interest rate satisfying  $r > 0$ .
- (7 points) Would the employee take this option (use a diagram)?
  - (8 points) Determine, using a diagram, how this shift in income will affect consumption this year and next year and saving this year. Explain your results.

**ANSWER**

Yes, the employee would take this option, because she is going to have a higher lifetime budget in such a case. Both current and future consumption are going to increase. Savings are also going to increase because of consumption smoothing.



4. (15 points) Explain Ricardian Equivalence. Under which conditions Ricardian Equivalence doesn't hold (give an example by using a diagram)?

**ANSWER**

Ricardian Equivalence claims that timing of taxes doesn't matter. It wouldn't hold when there are imperfections in the credit market; e.g., different real interest rates for borrowers and lenders. The following is the related diagram.

