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Exam 2
Fall 2007

DO NOT OPEN THIS EXAM UNTIL YOU ARE TOLD TO DO SO.

Instructions

Write your SUID in the upper right corner of this exam. Do NOT write your name.

SHOW ALL YOUR WORK. Answers without supporting work will receive little or no credit.

Do all your work on this exam. If you need extra space, write on the backs of the pages. However, if you do write an answer on the back of a page, *be sure you've noted that near the question.*

There are 72 points on the exam and you'll have 80 minutes to work on it. Budget your time accordingly.

Some helpful PV formulas:

(1) $\frac{B_t}{(1+r)^t}$

(2) $\frac{B}{r}$

Part 1 (36 points total)

A household buys two goods, X and Y, and likes to have exactly 3 units of the Y good for each unit of X. Initially, the price of X is $200, the price of Y is $100, and the household spends $40,000.

Question 1a (12 points)

Please derive the household's demand equations for X and Y. Then calculate its initial consumption of each good. Draw the household's budget constraint and include the numerical values of its intercepts. Also sketch several of its indifference curves and show its initial equilibrium on the diagram. Be sure to show your work and label everything.

Question 1b (12 points)

Suppose that an improvement in manufacturing technology could reduce the price of good X to $100 (X might be something like solar cells). Calculate how the reduction in Px would change the equilibrium values of X and Y. Also determine how much the household would gain from the price decrease by computing the compensating variation.

Question 1c (12 points)

Now suppose that the technology discussed in 1(b) does not exist yet and would require time and money to develop. A government agency is considering whether to fund the project. If it goes ahead, development will take 20 years and will cost $40 million in each year (years 1-20). During years 1-20, there will be no change in Px. In year 21, Px will drop to $100 and will remain at that level forever. There are 10,000 identical households in the community and each will benefit if Px is reduced. To keep things simple, you may treat the households as living forever.

Please sketch the relevant cash flow diagram(s) and determine whether it would be a good idea for the agency to fund the project. Please use an interest rate of 5%.

Part 2 (12 points)

A consumer buys two goods, A and B. His preferences can be represented by the Cobb-Douglas utility function shown below. Also shown are his demand equations and his expenditure function.

$U = A^{0.2} * B^{0.8}$
$A = 0.2*M/Pa$
$B = 0.8*M/Pb$
$M = U * (Pa/0.2)^{0.2} * (Pb/0.8)^{0.8}$

Initially Pa = \$4, Pb = \$8, and the consumer spends \$1000 on the two goods in total.

Suppose the government imposes a \$1 tax on good A and a \$2 tax on good B. The price of A rises to \$5 and the price of B rises to \$10 (equivalent to a 25% tax on each good). Please calculate the revenue raised by the policy and the compensating variation. Which is larger? Briefly explain what that means.

Part 3 (24 points total)

Suppose a large organization needs to upgrade and modernize its offices. It is considering two options: renovating its existing building, or moving to a new building in a different city. Renovating its current building will have to be done gradually and will cost $500 million per year for 10 years (years 1-10). Moving to a different city can be done immediately (year 0) and will cost $2.5 billion. However, moving will also cause the organization's annual costs to be permanently higher by $100 million a year (starting in year 1).

Question 3a (12 points)

Please draw cash flow diagrams for the two options and evaluate the present value cost of each. Which option is better? Why? Throughout the problem you should use 5% as the interest rate. By the way, this question is loosely based on a decision currently faced by the United Nations.

Question 3b (12 points)

Now suppose that the city that would otherwise lose the competition in question 3(a) wanted to make itself more attractive by offering to reduce the organization's property taxes for 50 years (years 1-50 in either case). What is the minimum annual tax credit it would have to offer in order to tip the decision in its favor? That is, if it offers $X per year for 50 years, how large should X be?