14.03 Fall 2004

Problem Set 3

Professor: David Autor

Due Friday, October 29, 2004 by 5pm

1 Sugarnomics

Comment on the following quotes from articles in the reading list about the US sugar quota system.

1. "In terms of minutes of work required to make enough money to buy one pound of sugar, the United States is the third-lowest in the entire world."

   VanDriessche's quotation implies that sugar in the US is relatively inexpensive. Are there any alternative explanations for this fact?

2. VanDriessche's points out that, "these low, stable sugar prices have been achieved at no cost to taxpayers since 1985 and no payments to sugar growers whatsoever."

   (a) This statement is technically correct. Explain why it is misleading.

   Now consider an alternative sugar policy that guaranteed farmers the same surplus as does the U.S. sugar program, but achieved this through direct taxation and transfers, i.e., sugar would be sold at the world price of $0.068 per pound and farmers would be paid out of general revenue.

   (b) Please draw a diagram similar to that used in class showing the likely demand and supply conditions under this alternative program.

   (c) How much sugar would be consumed in the U.S. How much sugar would be grown in the U.S.? How much HFCS would be produced? What would be

the deadweight loss associated with this policy? [You may want to assume that there is some deadweight loss associated taxation – perhaps \$0.25 on the dollar.]

(d) Can you think of any political economy reasons why farmers might oppose this alternative program?

2 True/False questions

For each of the following statements say whether it's true/false/uncertain and give a short explanation.

1. A farmer that owns 100 acres of land and grows sugar earns $\$, 3000$ per year when the price of sugar is \$0.22. He claims that if the price of sugar is allowed to drop to its world level \$0.07 he will earn only $\$1,000$. Therefore, he concludes, the value of his land will fall to a third of its initial value.

2. Consider an economy where only two goods are produced: cars and motorcycles. If one unit of capital can produce more cars than motorcycles then it is efficient to employ all the available capital in the production of cars.

3. An economy is populated by individuals who have the same preferences. We can conclude that there is no welfare gain from allowing them to trade.

3 Taxation

A consumer has the following indirect utility function:

$$V(p_x, p_y, I) = -\frac{p_x + 2\sqrt{p_x p_y}}{I} - \frac{p_y + \frac{1}{2}\sqrt{p_x p_y}}{I}$$

1. Find the consumer's expenditure function.

2. Suppose that income is fixed at $I = 100$. Suppose that prices were $p_x = 4$ and $p_y = 9$. Suppose that the government puts in a tax of 5 on good x , but rebates enough to the consumer so that the consumer is as well off as he was before the tax. Assume that the consumer chooses his bundle without considering the rebate he is about to receive. Illustrate this scenario with a carefully labeled graph. Your graph should show:

(a) the consumer's original budget set, indifference curve, and consumption bundle;

(b) the 'taxed' budget set

(c) the 'rebated' budget set that leaves the consumer as well off as the pre-tax budget. (Note: don't worry about drawing the price ratios exactly to scale.)

3. Calculate the deadweight loss of taxation in this example. That is, what is the difference between the revenue collected by the government and the amount of the rebate?

4. How would your answer to 1. change if the government also taxed good y by 11.25, keeping the tax on x at 5? [Hint: think before you start calculating.]

4 Policy analysis

In the 1980's the US government imposed quotas on the importation of cars without imposing restrictions on the contruction of foreign-owned car factories in the US. This question is intended for you to analyze the welfare impact of this policy.

The demand for cars in the US has the following form:

$$C^D = 9P^{-1}$$

where C is million of cars.

1. What is the price elasticity of demand of this function?

2. The supply of cars in the US takes the following form:

$$C^S = P$$

Imagine the economy is closed to imports. What is the price of cars in a closed economy? What is the quantity of cars sold at this price? In a demand/supply graph indicate the equilibrium price and quantity and show the area representing consumer and producer surplus.

3. Now imagine that the international price of cars is $P^* = 2$. If there were no restrictions how many cars would be imported, how many would be produced?

How many would be consumed? What would be the change in consumer surplus with respect to 2.? What would be the change in producer surplus with respect to 2.? (give quantitative answers)

4. The US imposes a quota on imports of 1 million cars from abroad. What is the price paid by consumers to buy a car in the US following the introduction of the quota? Assume that the quota rights are assigned to Japanese car producers [that is, quantity imported is capped at 1 million and Japanese producers can charge whatever price clears the market]. What is the change in producer surplus in this market with respect to 3.? What is the change in consumer surplus in this market with respect to 3.? What is the dead-weight loss caused by the introduction of the quota (compared to the open economy case)?

5. Imagine that due to the high US price for cars some Japanese car producers open plants in the US. So now the supply of cars in the US is the sum of the US producers supply and the Japanese producers supply. Imagine for simplicity that the Japanese manufacturers that start producing in the US supply a total of 0.5 million cars and that their cost of production is 2 per car (that is the Japanese manufacturers produce exactly 0.5 million carsas long as the price is at least 2 and they would produce 0 otherwise). What is the price of cars in the US following the entry of Japanese producers? Draw the supply function in this market and show the equilibrium in this market. Indicate in this graph the US producer surplus in this market. Qualitatively, what is the change in consumer surplus in this market with respect to 4. does it increase or decrease and why? What is Japanese producer surplus in this economy?

5 General equilibrium in a pure exchange economy

Imagine a small country, CanLand, with two individuals, Ann and Bob, and two goods, canned corn (C) and canned ham (H). Ann and Bob's utility functions are given by:

$$\begin{aligned} U^A &= .2 \ln C + .8 \ln H \\ U^B &= .8 \ln C + .2 \ln H \end{aligned}$$

The economy as a whole is endowed with 100 units of canned corn and 50 units of

canned ham. Assume for simplicity's sake that the price of canned corn is normalized to $P_c = \$1$. So, you can define the price ratio as $P \equiv \frac{P_H}{P_c} = P_H$.[HINT Remember that for Cobb-Douglas utility functions like the one above $U = x^{\alpha}y^{1-\alpha}$ expenditure shares are constant that is $p_x x = \alpha I$ and $p_y y = (1-\alpha)\, I$]

1. Solve for the marginal rates of substitution between canned corn and canned ham for Ann and Bob, and show the condition that represents allocative efficiency in C and H. [Recall that $\partial \ln X = \frac{dX}{X}$.]

2. Now calculate Ann and Bob's demands (uncompensated) for C and H as a function of Prices P and Income I.

3. Assume that Ann has an endowment of C equal to α and an endowment of H equal to β. Using Ann and Bob's respective MRS between the two goods, and the given societal endowment, solve for the equilibrium price ratio in terms of α and β. This equilibrium price ratio will clear the market for both goods given the prices and endowments. [Note that Bob's endowment of C is equal to $100 - \alpha$ and his endowment of H is equal to $50 - \beta$. Income I for each individual is equal to their endowment of each good multiplied by its price.]

4. Now assume Ann has 80 units of canned corn and 10 units of canned ham. Using your answer from Part 3, calculate the quantities consumed by each individual in equilibrium. Draw the equilibrium in an Edgeworth Box diagram, making sure to label the equilibrium point and price vector. [If you were not able to solve Part 3, explain the properties of the solution to this problem, refering to the Edgeworth box.]

6 Linear utility and general equilibrium

George and John have the following utility functions over capable campaign managers (C) and political "attack dogs" (D).

$$\begin{aligned} U_G &= C + 3D \\ U_J &= C + D \end{aligned}$$

George is endowed by his party with 6 campaign managers and 5 political "attack dogs". John is endowed by his party with 7 campaign managers and 4 political "attack

dogs". Imagine George and John are allowed to exchange campaign managers and attack dogs.

1. Draw the edgeworth box for this economy clearly indicating where the initial allocation lies and what the sides of the box measure.

2. Indicate the set of points in the Edgeworth box that are a Pareto improvement with respect to the endowment point.

3. In the Edgeworth box indicate the possible final allocations of C and K after trade has taken place (that is the set of Pareto Optima in this economy).

4. Explain the intuition for this unusual solution. [Hint: What is odd about their utility functions? Consider the 5 axioms.]