

Economics 463
Problem Set Questions
Fall 1996

- 1) Suppose that the marginal utility of apples is $5A$, where A is the number of apples consumed, i.e. $MU_A = 5A$, and $MU_B = 3B$ is the marginal utility of bananas. Find the marginal rate of substitution of apples for bananas. Next suppose that the price of an apple is 25 cents and the price of a banana is 10 cents. If the consumer is maximizing utility, what is the ratio of apples to bananas consumed. Finally, suppose that the consumer has 5 dollars to spend on apples and bananas. How many of each does the consumer choose?
- 2) Suppose there are two consumers A and B. The marginal rate of substitution of A is $MRS^A = Y^A/X^A$, and that of B is $MRS^B = Y^B/X^B$. Draw an Edgeworth Box and show all the points at which exchange efficiency occurs. Draw in an indifference curve for each consumer so that the two indifference curves intersect off the contract curve. If this intersection is the initial position of the two consumers show which Pareto efficient points can be reached by voluntary trades.
- 3) Suppose that there are two industries and two consumers. Each industry uses both capital K and labor L in the production process, and each produces a different good, X in one and Y in the other. Consumers get utility from X and Y . Both goods are private.
 - a) Write down and explain intuitively the conditions for this economy to be Pareto efficient.
 - b) Define the production possibility frontier and relate it to the efficiency conditions.
 - c) Define both the grand utility possibility frontier and a utility possibility frontier and relate them to the efficiency conditions.
 - d) Explain under what circumstances a society might prefer an inefficient allocation of resources to an efficient allocation. (Hint: your answer will be made simple if you use the appropriate diagram.)
- 4) Suppose that there are two industries, one producing X and the other producing Y , which each use both capital K and labor L in the production process. The marginal rate of technical substitution in the Y industry is $MRTS^Y = 4K_y/3L_y$ and in the X industry is $MRTS^X = 7K_x/2L_x$. Define Pareto efficiency and determine the relationship between the capital-labor ratios in the two industries when production is efficient. Draw the contract curve for efficient production and explain the relationship of the contract curve to the production possibilities frontier.
- 5) Define and draw the utility possibility frontier. In your picture explain what is meant by Pareto efficient. Social welfare functions can be used to pick out a point on the utility possibility frontier. Show that there are trade-offs between fairness and efficiency and demonstrate that some efficient points need not be as good, given the social welfare function, as some inefficient points.
- 6) Explain the First and Second Fundamental Theorems of Welfare Economics.
- 7) Explain what is meant by a) nonrival and b) nonexcludable. How do these terms relate to the provision and financing of public goods?

- 8) Suppose there are two consumers, labeled 1 and 2, each of whom has a dollar of money income which can be spent on either private good x or public good g . Assume that the dollar cannot be divided between the two goods. That is, each consumer must either spend her whole dollar on the private good or spend it all on the public good. The utility function of each consumer i is given by $U_i = x_i + \beta(g_1 + g_2)$. If $\beta < 1$, what do you expect to be the level of public goods supplied by the two consumers? Suppose $\beta \geq 1$. How does your answer change?
- 9) There are two consumers A and B. Consumer A is willing to pay $3-2F$ dollars for a unit of flowers for the public square and B is willing to pay $5-5F$ dollars for a unit of flowers. If the cost of flowers is constant at \$1 per unit then how many flowers should be placed in the square?
- 10) At the quantity of public good determined in question 5 suppose each individual pays half the cost of an additional unit of the public good, that is, if another unit is purchased each person pays 50 cents. Is this distribution of the costs a Lindahl equilibrium? If not, find the Lindahl equilibrium prices.
- 11) There are three consumers A, B and C. Consumer A is willing to pay $8-3F$ dollars for a unit of flowers for the public square, B is willing to pay $2-3F$ dollars for a unit of flowers, and C is willing to pay $9-3F$ for a unit of flowers. If the cost of flowers is constant at \$1 per unit what is the pareto optimal quantity of flowers to put in the square? Now suppose that each individual pays one third of the cost per unit. Identify the median voter. Demonstrate whether or not the most preferred quantity of the median voter is the efficient quantity. State and explain the conditions under which the quantity favored by the median voter will be the winner of a majority rule election.
- 12) There are three consumers A, B and C. Consumer A is willing to pay $40-.25F$ dollars for a unit of flowers for the public square, B is willing to pay $75-.25F$ dollars for a unit of flowers, and C is willing to pay $60-.25F$ for a unit of flowers. If the cost of flowers is constant at \$100 per unit what is the pareto optimal quantity of flowers to put in the square? Suppose that individual A pays \$25 per unit, individual B pays \$50 per unit cost and C pays \$25. Will the group unanimously agree to the efficient level of F ? If not, what must each person pay per unit for agreement to occur? Now suppose that individual B lies about his preferences; stating a willingness to pay of $30-.25F$. If unanimous agreement occurs how many units of flowers are provided and what does each person pay? Compare this situation to the case where each tells the truth.
- 13) The marginal damages from pollution by a firm are $MD = 10Q$, where Q is units of the final output. Marginal private cost of output is $MPC = 10 + 20Q$, and demand for the output is $MV = 25 - 5Q$. Find the equilibrium quantity of output in a competitive market, find the efficient output, and find the Pigouvian tax which induces firms to produce the efficient level of output.
- 14) The demand schedule for widgets is $P = 110 - 10Q$ where p is the price and Q is the quantity. The supply (marginal cost) schedule of the firm which produces widgets is $MC = 10 + 15Q$, and each unit of widgets produced causes \$25 additional damage to the environment that is $MD = 25$. If the firm has the property rights to the environment how much would the injured parties be willing to pay the firm to bribe it not to produce the last unit sold? How much would they pay to stop production of all units beyond the efficient level? Note that to answer this question you must find the efficient level of output. Show this amount on a diagram. How much must the firm receive from the injured parties to decide against producing the last unit sold? Finally, if the government were to impose a Pigouvian tax on this firm what size should the tax be, and how much revenue would be raised?
- 15) Demonstrate that a system of marketable pollution permits will reduce pollution to a given level at

the least cost to society. Describe other advantages of marketable pollution permits.

16) Show using indifference curves and budget constraints the impact of a guaranteed minimum income level on the individual's labor supply decision when a dollar of earnings reduces benefits by a dollar. What happens if a dollar of earnings reduces benefits by less than a dollar? Why might people object to reducing benefits by less than a dollar for every dollar of earned income?

17) If the goal of a transfer program is to raise the welfare/utility of the recipient by the most possible for a given expenditure by the government, how should the transfer be made? In cash or in kind? Why? Explain your answer with reference to the theory of consumer choice. What other concerns might influence the method of the transfers?

18) Explain what is meant by excess burden. Be sure to explain the source of the excess burden. It may help to use an indifference curve diagram in your explanation. Suppose we want to calculate the excess burden in terms of dollars. Show on a diagram the excess burden of a tax on X paid by the seller when the marginal cost per unit of X is constant. Explain how the excess burden is related to the price elasticity, the total expenditure on X, and the tax rate.

19) The demand for a good is $X = 400 - 15P$ and the supply is $X = 5P$ where X is number of units and P is price per unit. Impose a tax of \$4 per unit on the demander of this good. Determine the new equilibrium and the loss in consumer and producer surplus. Find the ad valorem tax rate which would produce this same equilibrium.

20) The compensated price elasticity of demand for Y is -2. Five units of Y are sold at a price of \$2 with a tax rate of 10%. Calculate the excess burden of the tax and indicate it on a diagram. Now recalculate the excess burden if the tax rate is 20%. Compare this result to the previous excess burden and explain in two sentences why this is important.

21) Demonstrate the effect of a tax on wage income on the individual's decision of how many hours to work. Be sure to state any assumptions you make.

22) Demonstrate the effect of a tax on interest income on the individual's decision to save when wages are earned in only one period. Will savings ever rise as a consequence of the tax? Be sure to explain the income and substitution effects clearly and intuitively. How would your answer change if wages were earned in both periods?

23) The demand for a good is $X = 80 - 3P$ and the supply is $X = P$ where X is number of units and P is price per unit. Calculate the price elasticities of demand and supply. Which side of the market will bear the largest share of the burden of a tax imposed on the demander? How does your answer change if the tax is imposed on the seller? Impose an ad valorem tax of 25% on the demander of this good. Determine the new equilibrium. Find the per unit tax which would produce this same equilibrium.

24) Suppose that expenditure on movies is tax deductible. Explain how deductibility affects the after-tax price and quantity of movies. If some taxpayers face a tax rate of 15% and others a tax rate of 28% will the deductibility of movie expenditures help one group more than the other. Explain your answer.

25) Suppose that expenditure on savings bonds is tax deductible, and interest earnings from savings bonds is tax exempt. A consumer spends \$100 on savings bonds and itemizes deductions. How much does the consumer save in taxes if she faces a tax rate of 15%? Now suppose that the consumer borrowed the

money to buy the savings bond, and interest on the loan is tax deductible, but expenditure on the bond is not. If the interest rate on the loan is 10% what must be the interest rate on the bond for the consumer to profit from tax arbitrage?

26) Define the user cost of capital and explain what is meant by tax neutrality on the decision to invest. If a firm minimizes cost or maximizes profit how will it decide on the appropriate level of capital? Discuss the ways in which tax law may influence the investment decision, that is, explain provisions of the tax law which alter the user cost, e.g. the investment tax credit, estimation of depreciation, and deductibility of interest paid.

27) Define the terms horizontal and vertical equity. Give examples.

28) Define lifetime and annual equity. What type of tax is lifetime equitable? What type is annually equitable? Explain.

29) Comment on the usefulness of horizontal and vertical equity as notions of fairness with regard to the tax system. (Hint: it is a good idea to define these terms first.)

30) Define Adjusted Gross Income by explaining what sources of income it includes and what it excludes. What types of expenditures are deductible from income for tax purposes under the U. S. Personal Income Tax code? What are the implications of deductibility of expenditures?