

#### 14.41 Problem Set #5

Due: December 9th, 2005

1a) In the market for Thneeds<sup>1</sup>, the demand curve is:  $Q=50-3P$  and the supply curve is:  $Q=2P$ . Assume for now that there are no externalities or pre-existing market distortions, so these represent the true social marginal benefit and marginal cost curves. The government decides to raise revenue by taxing consumers  $5/3$  for every Thneed purchased.

- i) Graph the supply and demand curves, and indicate how the curves shift after implementation of the tax. Label deadweight loss, tax revenue, consumer and producer surplus. Show the price paid by consumers and the price received by producers, and use these to indicate the burden borne by each party due to the tax.
  - ii) Calculate the change in consumer and producer surplus from the tax. Also, using the pre-tax market price, and the prices paid by consumers and received by producers, calculate the “burden” of the tax borne by each party (i.e. how much of the  $5/3$  tax is paid by consumers, how much is paid by producers).
  - iii) Check your answer by using the formulas for change in producer and consumer price as provided in the appendix to chapter 19. (Note: to use the formulas, you will first have to calculate the elasticity of supply and demand)
  - iv) Using your diagram from (a), calculate the deadweight loss from the tax. Then, use the formula for deadweight loss as provided in the appendix to chapter 20 to confirm your answer.
  - v) Intuitively, why is there deadweight loss from a tax? That is, what exactly does deadweight loss represent?
- b) Since the Thneed is such a wonderful product (“It’s a shirt. It’s a sock. It’s a glove. It’s a hat. But it has other uses, yes, far beyond that.”), the government wanted Thneeds to be affordable to everyone. Hence, prior to implementing the tax, the government had capped the price of Thneeds at \$8. Now, once the tax is implemented, how does the burden of the tax change from (a) – i.e. what is the burden borne by consumers and producers, and how does it differ from (a ii)? Explain why this is so.

c) Realizing that the price cap was a bad idea, the government instead decides that it wants to encourage Thneed production by offering subsidies. Specifically, it will tax consumers the same amount as before for Thneed consumption, but it will provide a subsidy of  $5/6$  to Thneed producers for every unit sold.

- i) Intuitively, how should deadweight loss under this scheme differ from (a)?
- ii) This business-friendly government hopes that by offering businesses a subsidy, it will reduce producer’s share of the burden from taxation. Is this true - will producers now bear a smaller proportion of the total burden from taxation? Why or why not?
- iii) If, due to administrative reasons, it was expensive to implement the subsidy for producers, what specific tax scheme could the government use instead to raise the same amount of revenue (and end up with the same market outcome) as if the subsidy existed?

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<sup>1</sup> What’s a “thneed”? “A Thneed’s a Fine-Something-That-All-People-Need.” Thneeds are made from Truffala Trees, of course. For further information, please see *The Lorax* by Dr. Seuss.

2) Consider a particular economy in which two people (A and B) must allocate their income between three goods: gasoline, donuts, and yachts. Person A has 100 in income, and person B has 200. Their demand functions for the various goods are as follows:

	<b>A</b>	<b>B</b>
<b>Gasoline (in gallons)</b>	30	$200/(5P_g)$
<b>Donuts (in dozens)</b>	$(100-30P_g)/P_d$	$600/(5P_d)$
<b>Yachts (in square feet)</b>	0	$200/(5P_y)$

- a) Find the aggregate demand function for each good as a function of prices
- b) Using the demand functions, calculate the elasticity of demand for each good with respect to its price. (Your answers may be in terms of prices).
- c) The government decides to raise revenue by taxing the consumption of these three goods, but it would like to do so in the most efficient way possible (and it cannot implement different tax rates on different people). Using your answers from (b), and given prices  $P_g=2$ ,  $P_d=3$ ,  $P_y=3$ , which good should be taxed the most, and which good should be taxed the least – and why (what is the intuition behind this)? Use the Ramsey Rule to determine the following three quantities, where  $\tau_i$

represents the most efficient per-unit tax placed on good  $i$ :  $\frac{\tau_g}{\tau_d}$ ,  $\frac{\tau_g}{\tau_y}$ ,  $\frac{\tau_y}{\tau_d}$  (assume

that supply is perfectly elastic). In what ways might the specific tax system that results from this rule be inequitable?

- d) Suppose the gasoline supplier lobby is quite strong and influential, and as a result the government decides only to tax donuts and yachts. If the government needs to raise 50, what are the exact tax rates it should implement to meet its budget requirement in the most efficient way possible?
- e) If the government still needs to raise 50 using commodity taxes on gasoline, donuts, and/or yachts - but cares only about person A - what tax scheme would it use to raise required revenue? What if the government cares only about person B?

3.) Consider a simplified version of the world, where there are only two agents (Chris and Jim) and two periods. Each agent works in the first period, earns after-tax income of \$100, from which he can either consume or invest. In the second period, the agent collects a 110% gross return on his investment [*i.e.*,  $r=0.1$ ], consumes all of it, and dies. Their utilities are given by:

$$U_{Chris} = \sqrt{C_1} + \sqrt{C_2}$$

$$U_{Jim} = \sqrt{C_1} + \frac{1}{2}\sqrt{C_2}$$

- a) Which agent is more impatient? Why?
- b) Write down the intertemporal budget constraints and solve for the optimal consumption bundle of each agent. Graph the budget sets, indifference curves, consumption bundles, and savings of the agents.
- c) The government is worried about Jim's behavior and wants to promote savings. It therefore decides to subsidize savings at rate  $s$ . In other words, the agents earn a gross return of  $(1+r)*(1+s)$  on anything they save. What subsidy will the government choose in order to make sure that Jim consumes equally in both periods? [You can ignore the government's budget constraint].
- d) The government doesn't want to drastically alter Chris's behavior, so it decides to implement an IRA-style plan: it will only subsidize up to a certain dollar amount of savings. Find the minimum amount savings to be subsidized (at the rate found in (c)) so that Jim changes his relative consumption (that is,  $C_1/C_2$ ) and not Chris. Prove that Chris will not change his relative consumption. [Hint: write down the new 2-part budget constraint and solve for Chris's decision.] Graph the budget sets, indifference curves, consumption bundles, and savings of the agents.
- e) Suppose that Jim instead had the following utility function:

$$U_{Jim} = 25C_1 + \ln(C_2)$$

Does the subsidy you found in part (c) still increase savings for Jim? What subsidy would increase savings so that consumption is equal in both periods? Give intuition for this result.

- f) Explain the results in (e) in terms of income and substitution effects.
- g) In general, is it possible for consumption in period 2 to fall in absolute terms when savings are subsidized? Why or why not? [Hint: Think of the consumption in each period as a "good", and the subsidy as a change in the price of the good.]

4.) You are spending the summer in Washington D.C. as an intern for your state representative. In between photocopying and fetching coffee, the representative gives you some actual work. Her constituents are calling for a tax cut, and it seems that the most popular possibilities are 1) a 15% cut in the capital gains tax (*e.g.*, a cut from 30% to 15%), and 2) a 15% cut in the estate tax. Write a policy brief (1 page max) that addresses the following implications of each tax cut:

- a. Horizontal equity
- b. Vertical Equity
- c. Efficiency

Which of these two tax cuts do you recommend, and why?

Because this is a policy brief, your answer will be evaluated on how clearly and concisely you present the main points as well as substance.