Cason Konzer ECN 370 Homework #3, Fall 2022

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ECN 370
Homework 3
Due: Thursday, October 20th by the end of the day

Directions: Please complete this homework on a separate piece of paper and email your answers to me at ccdougla@umich.edu. A .pdf file is preferred, though any file works in practice.

1. People in a subdivision pay annual dues to a neighborhood association. This association refunds the dues to selected homeowners who do a particularly nice job in beautifying their yards.

a. Why might the neighborhood association provide this refund?

By having a particularly nice yard the neighbors benefit. If the association provides yard keeping dues those who keep up on their yards get less benefit.

b. At the most recent homeowner's association meeting, homeowners voted to end this practice because they felt it was unfair that some people would not have to pay the fee. What is likely to happen to the overall level of neighborhood beautification? Explain.

Those who kept up on their yard for the benefit of the refund are now less motivated to keep up. In general the overall beautification would thus decrease. With this said the association may now be able to fund a landscaping service for the neighborhood. It is thus possible that the overall beautification stay stagnant or even increases.

c. Can you think of an alternative program besides refunding the neighborhood association dues that would have the same effect on beautification, but would be viewed as "more fair"?

An alternate program may consist of a standard beauty requirement. Either homeowners meet the requirement or otherwise the association hires a company to do so

$ charges the homeowner.

2. Let's work through some math regarding the public goods problem, like we did in class. **Follow my hints for each part of the question and refer to your notes from Lecture #9.**

The town of Springfield funds a local fireworks display on the 4th of July. Flanders, a resident of Springfield has utility over a private good (y) and the fireworks display (f) that is given by: $U = 4 \times log(y) + 2 \times log(f)$. You can assume that the fireworks display is a public good. Note that *log* means "natural logarithm." That is, log(2) means the natural logarithm of 2, which is approximately 0.69. Natural logarithm is a function that has the properties that a utility function needs.

It follows from the utility function that the marginal rate of substitution between fireworks and the private good for Flanders (F) is the same:

$$\frac{MU_f^F}{MU_y^F} = MRS_{f,y}^F = \frac{\frac{2}{f}}{\frac{4}{y}}$$

Kudos if you know how to get this from the utility function!

Assume that Flanders has $100 to spend on either the private good or the fireworks display, so **y = 100 – 2*f***, meaning what he doesn't spend on the public good is spent on the private good, as each firework costs $2 and each unit of the private good costs $1. In other words, the marginal cost of a firework is $2, and the marginal cost of a private good is $1.

a. How many fireworks does Flanders choose to buy if he acts alone? **Hint: Recall that the consumer's optimal choice is such that the marginal rate of substation equals the ratio of the relative prices. Think of fireworks as good "x" and the private good as good "y" and use the formula: MRS=Px/Py.**

$MRS = \frac{P_f}{P_y} = \frac{\$2}{\$1} = 2 = \frac{2}{f} \cdot \frac{y}{4} = \frac{y}{2f}$; $4f = y$

$4f = 100 - 2f$; $6f = 100 \Rightarrow f = \frac{100}{6} \approx \boxed{17 \text{ fireworks}}$

b. What is the optimal level of fireworks from an efficiency standpoint? **Hint: Recall that when one person buys the public good, the other person gets the same benefit from it as the person who buys the public good does. Thus, the optimal condition for a public good satisfies: $MRS^{Homer}+MRS^{Flanders}$=Px/Py. Assume that Homer and Flanders have the same MRS so that $MRS^{Homer}+MRS^{Flanders}=2*MRS^{Flanders}$**

Assume $MRS = 2 = 2 \cdot \frac{2/f}{4/y} \Rightarrow 1 = \frac{2}{f} \cdot \frac{y}{4} = \frac{y}{2f} \Rightarrow 2f = y$

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$2f = 100 - 2f$; $4f = 100 \Rightarrow f = \frac{100}{4} = \boxed{25 \text{ fireworks}}$

c. How does the optimal level compare with the level of fireworks if Flanders purchases individually? Why is there a difference? Explain.

The optimal level is higher that that of the individual level. This is because we account for the benefit Homer gains from Flander's purchase of fireworks. There is thus a larger social benefit from his purchase.

d. Suppose Flanders cares about Homer. Does this make it more likely that the efficient quantity will be produced? What is Flanders doesn't care about Homer? What could the government do?

If Flanders cares about Homer, he may be then more likely to purchase additional Fireworks for Homer's benefit. This would make it more likely for the Efficient quantity to be produced. If Flander's does not care about Homer, he would be best off to optimize his individual utility. The government could impose a tax to provide fireworks, of which is based on individual demand for fireworks. Note that this approach is susceptible to free riders. :D

3. Andrew, Beth, and Cathy live in Lindhville. Andrew's demand for bike paths, a public good, is given by $Q = 12 - 2P$. Beth's demand is $Q = 18 - P$, and Cathy's demand is $Q = 8 - P/3$. The marginal cost of building a bike path is MC = 21.

$P_A = 6 - Q/2$; $P_B = 18 - Q$; $P_C = 24 - 3Q$

The town government decides to use the following procedure for deciding how many paths they want: they look at each resident's individual demand curve and build and build the largest number asked for by any resident. Yeah, that is kind-of a weird decision-making process, but it is the government we are talking about. To pay for these paths, it then taxes Andrew, Beth, and Cathy at the prices (per bike path) a, b, and c respectively, where $a + b + c = MC$. That is, the sum of a, b, and c covers the cost of one bike path.

a. If the taxes are set so that each resident shares the cost evenly $(a = b = c)$, how many paths will get built? **Hint:** If each resident shares the cost of a bike path evenly, each bike path costs each resident 21/3 = 7. How many bike paths does each resident want at each price?

$Q_A = 12 - 2(7) = -2$ Andrew wants -2 bike paths,

$Q_B = 18 - 7 = 11$ Beth wants 11, an

$Q_C = 8 - 7/3 = 5\,2/3$ Cathy wants 5 2/3.

b. Are all the residents happy with the outcome in a? Why or why not?

Andrew is for sure not happy, as he paid for something he had no demand for. Beth may be indifferent, as she got her requested bike paths, but less than twice her request. Beth is happy as she got exactly as many paths as she would have demanded.

c. Now, instead of building the largest number of bike paths asked for by any resident, the government is going to build the socially optimal number of bike paths. What is the social optimum number of bike paths? If you vertically aggregate the individual demand curves, the market demand curve for this public good is, $P = 48 - 4.5Q$. The note below explains how to do this.

$21 = 48 - 4.5Q$; $4.5Q = 27$; $Q = 6$

The socially optimal number of bike paths is 6.

Note: You can get the market demand curve for a public good from the individual demand curves as we did in class, even though in class we added them up graphically rather than using equations. In both cases, we used vertical aggregation, adding up prices for each quantity. That is, we solve each demand curve for *P* in terms of *Q* and then adding the demand curves together. The reason for this is that when one individual provides a unit of the public good, *everyone* gets to consume it. Doing so means you are adding up price at each possible quantity. So if Andrew is willing to pay $1 for one bike path, Beth is willing to pay $2 for one bike path, and Cathy is willing to pay $3 for one bike path, the community jointly is willing to pay $6 for one bike path. If this one bike path is built, Andrew, Beth, and Cathy all get to use it.

d. Show how the government can finance the socially optimal quantity of bike paths found in part c. using Lindahl pricing by setting the correct taxes *a*, *b*, and *c*. **HINT:** How much is each resident willing to contribute to get the number of bike paths from part c.?

given $Q=6$, $P_A = 6 - \frac{6}{2} = 3$

$P_B = 18 - 6 = 12$

$P_c = 24 - 3(6) = 6$

By charging acording to willingness to pay, Andrew will pay $3 per path, $18 total, Beth will pay $12 per path $72 total, and Cathy will pay $6 per path, $36 total.

e. Are the residents happy under part d.? Why or why not?

$Q_A = 12 - 2(6) = 0$

$Q_B = 18 - 6 = 12$

$Q_c = 8 - \frac{6}{3} = 6$

We find a similar situation where Andrew demands 0 bike paths but must pay for 6, thus he is unhappy. Beth gets less than she wants, so she is unhappy, But Cathy is Exuberant as she gets exactly what she wants.

f. Any idea on how to implement this Lindahl pricing in practice? Knowing individual demand curves is difficult and high willingness-to-pay individuals have incentive to lie and claim to be low willingness-to-pay individuals, like we discussed in class. How do you prevent this from happening?

One unethical way to solve this problem is to overly monitor society such that government knows more truely the benefit each individual gains from the bike paths. I believe an iterative approach will also solve this problem, if individuals are unhappy with a public good, and want it to be better, they may then be incentivised to report a willingness to pay higher than that of their previous report. Following, the next roll out of the good may be better.