Econ 131
Spring 2019
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Problem Set 3 Solution

DUE DATE: April 24

Student Name:

Student ID:

GSI Name:

- **You must submit your solutions using this template.**
- **Although you may work in groups**, each student must submit individual sets of solutions. You must note the names other students that you worked with. Write their names here:

1. **Essay**

The following article from 2012 describes the effects of removing the mandate to purchase health insurance in Washington State in the 1990s and its lessons for Obamacare.

`https://www.seattletimes.com/seattle-news/why-washington-states-health-reform-faltered`

Are the effects described consistent with the theory of adverse selection in insurance that we discussed in class?

The Trump tax cut also removed the fine for not purchasing health insurance in Obamacare in 2019 and after? Are we going to see the same effects as those described for Washington State in the article?

2. True/False Statements

Determine whether each statement is true, false, or uncertain and explain why. Answers with no explanation will receive no points.

(a) Suppose that candidates X and Z run for president. Candidate X is elected president after winning 51% of the vote. Then once in office, he appoints more conservative members to the Supreme Court than candidate Z would have. This means that a majority of American voters preferred more conservative Supreme Court members. (Assume that everyone is fully informed about the candidates plans and the President does not need Senate approval to appoint Supreme Court members.)

UNCERTAIN. This is possibly true. It's also possible that voters are single-issue voters on several topics and that X assembles a coalition large enough to win and then does things that only a minority of voters support. For example, X could get elected by 26% of voters who care only about conservative Supreme Court members and another 25% of voters who care only about low tax rates on high-earners (which X supports but Z does not). Then it's possible that only 26% of voters support conservative Supreme Court member appointments.

(b) If moral hazard effects are large, then private insurance is preferable to social insurance.

FALSE: Moral hazard effects affect private and social insurance equally. Because of such effects, it is not desirable to provide full insurance and that's true for both private and social insurance.

(c) It is possible that graduating from UC Berkeley increases your adult earnings but that the things you learn at Berkeley (in class and from your peers) do not.

TRUE. This is education as a screening device. It is possible that Berkeley is good at identifying high intrinsic (i.e. not-affected-by-Berkeley) talent and/or that only people with high intrinsic talent can get good grades and graduate. Thus graduating from Berkeley allows one to signal to the world ones high intrinsic talent, even if the things that one learns are actually useless. [However this is not likely true! See Clark and Martorell (2014) for high-school learning being key, not merely graduation.]

(d) A transfer of \$1bn for road maintenance funding from the federal government to the State of California has the same impact on California road maintenance spending as a \$1bn cut in federal taxes paid by California residents.

TRUE under the standard model (as long as the desired spending for road maintenance at the state level is above \$1bn. Not true in the short-run as the state government takes time to adjust in response to Fed grants or Fed taxes changes (the so-called Flypaper effect that money sticks where it lands).

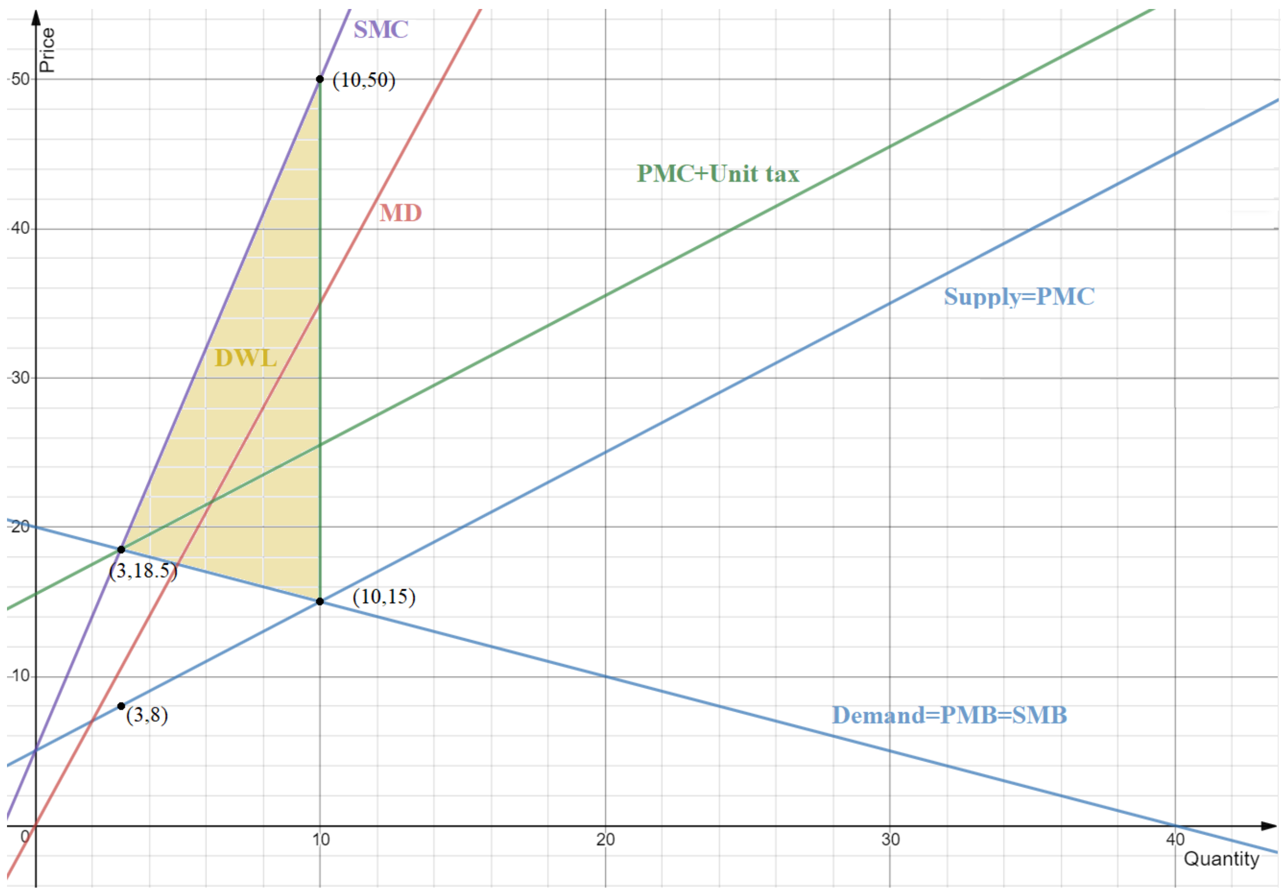
(e) According to the Tiebout model, local public good provision is efficient and tailored to the tastes of local residents. Hence, it is better to have a fully decentralized government.

TRUE if all public goods are local and society does not care about redistribution. False if there are global public goods (like national defense). False if society cares about redistribution (see class notes).

3. Externalities XX SOLUTION

A coal-fired power plant releases air pollution into the atmosphere for every unit of electricity produced. The inverse demand function for coal-fired electricity is $P_d = 20 - \frac{1}{2}Q$, which represents the marginal benefit curve where Q is the quantity consumed when consumers pay price P_d. The inverse supply curve for coal-fired electricity is $P_s = 5 + Q$, which represents the marginal private cost curve when the power plant produces Q units. The marginal damage from emissions is given by $MD = 3.5Q$, which describes the cost of greenhouse gas emissions and local air pollution when the industry generates Q units of coal-fired electricity.

a) Illustrate the market for the coal fired electricity with a supply/demand graph. Be sure to draw the curves for demand, supply, marginal damage, and social marginal cost.



b) What are the equilibrium price and quantity for coal fired electricity when there is no correction for the externality?

Setting $P_d = P_s$ results in $P_{priv} = 15$ and $Q_{priv} = 10$.

c) How much coal fired electricity should the market supply at the social optimum?

We see that $SMC = P_s + MD = 5 + Q + 3.5Q = 5 + 4.5Q$ Setting $P_d = SMC$, $20 - 0.5Q = 5 + 4.5Q$, gives $15 = 5Q^*$, ie $Q^* = 3$ and $P^* = 18.5$

d) How large is the deadweight loss from the externality?

DWL here is the added cost to society by producing more than the social optimum. The price difference between $P = 5 + 4.5Q$ and $P = 5 + Q$ at $Q = 10 is (5 + 45) - (5 + 10) = 35$. The change in quantity between the private Q and optimal Q is 7 $DWL = 1/2 * 35 * 7 = 122.5$

e) Is it possible for the government to achieve the social optimum by imposing a per-unit fee on emissions? If not, explain why it is not possible. If so, how large must the emission fee be if the market is to produce the socially efficient amount of coal fired electricity? Also, draw the firm's supply curve with the new emission fee on your graph.

It is possible: We want $SMC = P_S$ at Q^*. We choose a tax so that $P^* = 5 + Q^* + t$, ie $18.5 = 5+3+t$, so $t = 10.5$. That tax is equal to the amount of marginal damage at the socially optimum quantity.

4. Public Goods

A home slightly south of campus has two residents: Arlen and Ben. All cleaning of the home is done solely through the individual efforts of the two residents, who, after eating and sleeping and socializing have **49** hours a week to devote to some combination of studying and cleaning. Arlen's utility over studying and cleaning is given by $U_A = 20 \log S_A + 4 \log C$ and Ben's utility over studying and cleaning is given by $U_B = 20 \log S_B + 5 \log C$, where C is the total cleaning done in the apartment, given by the sum of each individual's contribution: $C = C_A + C_B$.

a) How much time do Arlen and Ben each spend studying and cleaning?

Solution:

If each resident optimizes his own function, he will choose the amount of cleaning that maximizes his own utility, taking into consideration the cleaning done by the other resident.

Arlen's studying time, S_A, can be rewritten as $49 - C_A$ because all the time not spent on cleaning (C) can be spent on studying.

The public good enjoyed by Arlen can be rewritten as $C_A + C_B$ because public goods provided by either one are consumed by both.

Therefore, Arlen's utility function can be rewritten as

$$U_A = 20 \cdot log(49 - C_A) + 4 \cdot log(C_A + C_B).$$

Set $\partial U / \partial C_A$ equal to zero:

$$-20/(49 - C_A) + 4/(C_A + C_B) = 0$$
$$20/(49 - C_A) = 4/(C_A + C_B)$$

Cross-multiply, $20(C_A + C_B) = 4(49 - C_A)$, and expand: $20C_A + 20C_B = 196 - 4C_A$.
Solving for C_A yields $C_A = (196 - 20C_B)/24$.
The same procedure for Ben yields $C_B = (245 - 20C_A)/25$

These are response functions. They allow each resident to calculate his optimal C as a function of the contribution to C made by the other resident.

Plugging Ben's response functions into Ben's response function yields

$$
\begin{aligned}
C_A &= \frac{196 - 20C_B}{24} \\
C_A &= \frac{196 - 20 \cdot \frac{245 - 20C_A}{25}}{24} \\
24 \cdot C_A &= 196 - 196 - 0.8C_A \\
23.2 \cdot C_A &= 0 \\
C_A &= 0
\end{aligned}
$$

Then Ben will spend $C_B = (245 - 20 \cdot 0)/25 = 9.8$ hours cleaning and $S_B = 49 - 9.8 = 39.2$ hours Studying, while Arlen will spend 49 hours studying and won't contribute to cleaning at all.

b) What is the socially optimal amount of time that they should spend? If your answer differs from part a), why?

Solution:

The social planner maximizes $U_A + U_B$ by choosing $\{S_B, S_A, C_A, C_B\}$ subject to the budget constraints $49 = S_A + C_A$ and $49 = S_B + C_B$. This is equivalent to maximizing the following Lagrangian:

$$
\begin{aligned}
max_{\{S_B,S_A,C_A,C_B\}} L = [20log(S_A) + 4log(C_B + C_A)] + [20log(S_B) + 5log(C_B + C_A)] \\
+ \lambda_1(49 - S_A - C_A) + \lambda_2(49 - S_B - C_B)
\end{aligned}
$$

Which gives first-order conditions:

(i) $\frac{20}{S_A} - \lambda_1 = 0$

(ii) $\frac{9}{C_B+C_A} - \lambda_1 = 0$

(iii) $\frac{20}{S_B} - \lambda_2 = 0$

(iv) $\frac{9}{C_B+C_A} - \lambda_2 = 0$

(v) $49 - S_A - C_A = 0$

(vi) $49 - S_B - C_B = 0$

There are a bunch of constraints, but they simplify quickly. Notice from (ii) and (iv) that $\lambda_1 = \lambda_2 = \frac{9}{C_B+C_A}$. Then using $\lambda_1 = \lambda_2$, we know from (i) and (ii) that $\frac{20}{S_A} = \frac{20}{S_B}$ or $S_A = S_B$ which we can define as S_i. Then from (v) and (vi) we know that $C_A = C_B = 49 - S_i$, and so $S_i = 49 - C_i$. Then, from (i) and things we have derived we know that $\frac{9}{C_B+C_A} = \frac{20}{S_i}$, or $C_i = \frac{9}{40}S_i = 100 - C_i$. Solving, we get $C_i = 9$ or $C = C_A + C_B = 9 + 9 = 18$ and $S_A = S_B = 40$.

Intuitively, in the computation in part (a), we set the marginal utility of the last hour of cleaning to each resident equal to the marginal utility of studying for that resident. In part (b), we set the sum of the marginal utilities of the last hour of cleaning - the social marginal utility of cleaning - equal to the marginal utility of studying for either resident. Since the social marginal utility of cleaning exceeds the individual marginal utilities of that hour of cleaning, a central planner optimally chooses more time on cleaning than individuals would if they were acting alone.