ECON 111: Fall 2021
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Practice Midterm

You should attempt these problems in 80 minutes. Solutions will be posted on the evening of September 25.

1. (15 points) Suppose that Sherlock Holmes and John Watson are each able to produce investigative reports and medical reports. In a single day, Sherlock is able to produce 10 investigative reports or 4 medical reports, or produce any combination of 10 investigative reports and 4 medical reports at a constant opportunity cost. Similarly, in a single day Watson is able to produce 6 investigative reports or 6 medical reports, or produce any combination of 6 investigative reports and 6 medical reports at a constant opportunity cost.

   (a) (3 points) Sketch each of John Watson's and Sherlock Holmes' production possibilities frontiers (labeling your axes).

   (b) (3 points) Who has the comparative advantage in producing medical reports? Who has the absolute advantage in producing medical reports? Briefly justify your answers.

   (c) (3 points) Sketch the joint PPF for Holmes and Watson (labeling your axes).

   (d) (2 points) What prices of a medical report (in terms of investigative reports) are Holmes and Watson willing to agree to?

   (e) (1 point) Suppose that Watson is only interested in obtaining investigative reports. What is the best price that Watson can receive for a medical report (in terms of investigative reports) from among those prices you found in part (d)?

   (f) (3 points) Suppose that Holmes and Watson trade at the price you found in part (e). How many investigative reports is Watson able to achieve by trading with Holmes?

2. (25 points) Let us now consider the market for alcohol in a small town in Pennsylvania. The demand and supply curves are given, respectively, as follows:

$$P = 35 - 5Q_d$$
$$P = 5 + Q_s$$

Prices are in U.S. dollars per liter and quantity is in liters.

(a) (2 points) Sketch the market supply and demand curves (labeling your axes appropriately). Compute the equilibrium price and quantity.

(b) (2 points) Suppose that, due to a poor harvest season, the price of hops (an input for alcohol) rises. How would this affect the equilibrium price and quantity after the market adjusts?

(c) (2 points) Suppose that the change from part (b) still occurs. How does the price elasticity of demand at the new equilibrium compare to the equilibrium from part (a)?

(d) (2 points) Suppose that instead of the change from part (b), the price of cigarettes, a complement of alcohol, rises in response to an increased tax on tobacco products. How do you expect this to affect the new equilibrium price and quantity after the market adjusts?

(e) (3 points) Ignore all previous changes from parts (b)-(d). Suppose that, due to the coronavirus pandemic, you observe an increase in the equilibrium quantity of alcohol. Suppose that you also notice an increase in the price of alcohol. What can you conclude about the affects of the pandemic on supply and demand?

Ignore all previous changes from parts (b)-(e). Suppose that alcohol consumption leads to a constant, negative marginal externality of \$6 per liter.

(f) (3 points) Sketch the marginal social benefit curve alongside the supply and demand curves (in a new sketch). Compute the socially efficient quantity of alcohol. How does it compare to the market quantity of alcohol?

(g) (3 points) In your sketch, shade the region corresponding to deadweight loss. Compute the amount of deadweight loss associated with this inefficient level of alcohol consumption.

(h) (2 points) A local policymaker suggests that a tax can solve the problem of deadweight loss in this situation. What level of tax would you suggest in order to achieve the socially efficient quantity of alcohol as a market outcome? Demonstrate that the tax you propose works by computing the new equilibrium quantity after the tax is imposed.

(i) (3 points) Which side of the market bears a higher tax incidence in this case? Explain why the tax incidence falls more heavily on one side of the market.

(j) (3 points) What other policies can you suggest that might help to alleviate the inefficient level of alcohol consumption in this town? Would your policy result in deadweight loss? Are there barriers that might prevent your policy from working effectively?

3. (10 points) The very small town of Swingsville has three citizens: Lester Young, Coleman Hawkins and Ben Webster. These three are trying to decide whether to invest in some streetlights. Now, given where they live and how often they are out at night, the three receive different benefits from the lighting of the streets.

   Suppose that Mr. Young, Mr. Hawkins and Mr. Webster know, with great precision, the benefit they receive from lights and can give exact monetary values to the benefit they receive from different amounts of lights. The table below summarizes their benefits (in terms of dollars) for different numbers of lights.

Number of Lights	Young's Benefit	Hawkins' Benefit	Webster's Benefit
1	$450	$270	$180
2	850	510	340
3	1200	720	480
4	1500	900	600
5	1750	1050	700
6	1950	1170	780
7	2100	1260	840
8	2200	1320	880

   Suppose that each streetlight costs $300.

   (a) (2 points) What is Mr. Young's, Mr. Hawkin's and Mr. Webster's marginal benefit moving from 2 lights to 3 lights? Explain.

   (b) (2 points) Suppose that Mr. Young, alone, buys lights. Given the table above and the price of streetlights, how many lights would Mr. Young be willing to buy?

   (c) (3 points) If Young were to buy the lights, would Hawkins and Webster benefit? Why might it be hard for Mr. Young to get them to pay once the lights are in place?

   (d) (3 points) Now suppose that each agree to split the costs of each light provided equally. How many lights would be provided if they take a vote on each light and at least two of them have to agree to the number chosen?

(a) The sketches are given below:

Figure 1: Waton's PPF

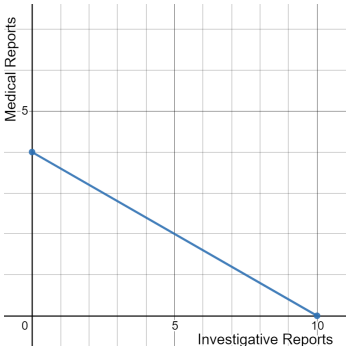

Figure 2: Holmes' PPF

(b) Watson has both the comparative and absolute advantage in medical reports (he is a doctor, afterall). He has the absolute advantage since he can produce more medical reports in a single day than Holmes. He has the absolute advantage since his opportunity cost of a medical report is 1 investigative report, which is *lower* than Holmes' opportunity cost of a medical report, which is $\frac{10}{4}$ investigative reports.

(c) The joint PPF is given below:

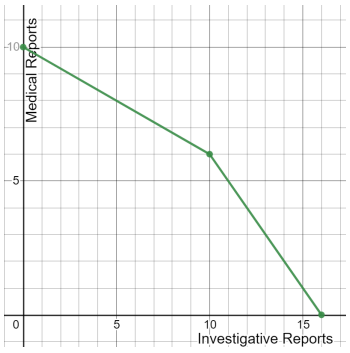

Figure 3: Holmes and Watson: Joint PPF

(d) Holmes is willing to trade at most $\frac{10}{4}$ investigative reports for a medical report. Watson wants to receive at least 1 investigative report per medical report. Thus the possible trade prices are: $[1, \frac{10}{4}]$ investigative reports for one medical report.

(e) Given the price range found in part (d), we see that Watson would most prefer to receive $\frac{10}{4}$ investigative reports per medical report.

(f) If Watson produces 4 medical reports and 2 investigative reports, he can trade the 4 medical reports for all 10 of Holmes' investigative reports (provided Holmes agrees to the trade). Hence the greatest amount of investigative reports that Watson can receive is 12.

1. (a) A sketch of supply and demand is given below:

Figure 4: Demand (blue) and Supply (red)

The equilibrium price is \$10 and the equilibrium quantity is 5 liters.

(b) Since the price of an input rose, supply should shift inward. An example is given in the following figure:

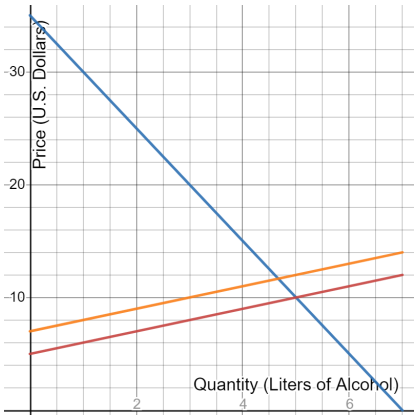

Figure 5: An example of new supply (yellow)

The figure demonstrates that equilibrium quantity should fall while equilibrium price should rise.

(c) Recall the formula for the price elasticity of demand at a point:

$$\frac{\Delta Q_d}{\Delta P}\frac{P}{Q}$$

Now, the ratio $\frac{\Delta Q_d}{\Delta P}$ does not change at the equilibrium after the shift in supply. However, given that price has risen and quantity has fallen, the price elasticity of demand should rise after the change from part (b).

(d) Since the price of a complement rose, the demand for alcohol should shift inward. The following figure illustrates the change:

Figure 6: The shift in demand (purple)

We see that both price and quantity should fall in response to the price change in cigarettes.

(e) The following figure illustrates the solution:

Figure 7: An example of a shift in demand (purple)

Since both price and quantity rose, we can conclude that demand increased as a result of the pandemic. However, the change in supply is unclear. Supply have have risen or fallen as a result of the pandemic.

(f) A sketch including the marginal social benefit curve is given below: The socially efficient quantity is 4 liters

Figure 8: Demand (blue), supply (red) and marginal social benefit (green)

of alcohol.

(g) Deadweight loss is shaded in the following figure:

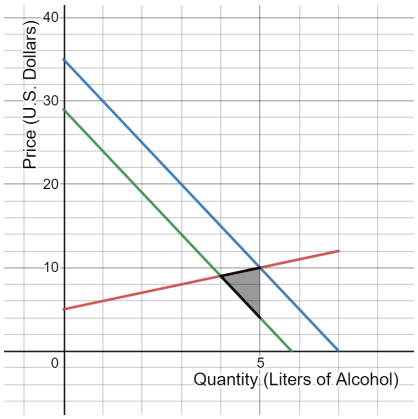

Figure 9: Deadweight loss (gray)

The amount of deadweight loss is \$3.

(h) The tax should equal the value of the negative externality. In this case, a tax of \$6 should achieve the socially efficient quantity of alcohol.

(i) Computing the incidences, we have:
Consumer incidence = 15 - 10 = 5
Producer incidence = 10 - 9 =1
The tax incidence falls more heavily on the demand side since the price elasticity of demand at the original equilibrium is:
$\epsilon_{p,d} = -\frac{1}{5}\frac{10}{5} = -\frac{2}{5}$
Similarly, the price elasticity of supply is:
$\epsilon_{p,s} = 1 \cdot \frac{10}{5} = 2$
Since supply is much more elastic than demand, we see that any tax should primarily burden the demand side of the market.

(j) One example of a policy would be to impose a stern limit on the amount of alcohol sales at \$4. One issue with this approach is that it may create incentives for agents to engage in black market transactions of alcohol in the area. The policy also seems difficult to enforce, as suppliers may alter their accounts to allow for a greater volume of sales. This policy would result in the socially efficient quantity of alcohol, provided agents did not work to undermine its effectiveness. Therefore, it would not result in deadweight loss.
This problem has many potential solutions.

2. (a) Mr Young's marginal benefit is \$350, Mr Hawkins' marginal benefit is \$210, and Mr Webster's marginal benefit is \$140. The total marginal benefit to moving from 2 lights to 3 lights is then the sum of these individual marginal benefits, which is \$700.

   (b) Given that the price of each streetlight is \$300, Mr Young would purchase streetlights until his marginal cost exceeds his marginal benefit. In this case, Mr Young would purchase 4 street lights (although, he is indifferent between purchasing and not purchasing the 4th street light). The 5th street light has a higher marginal cost (\$300) than his marginal benefit (\$250), and so he would not purchase a 5th street light.

   (c) Hawkins and Webster would indeed benefit from Young purchasing the lights. Here, street lights are an example of a public good. They are nonrival, so Young's usage of the street lights cannot prevent Hawkins and Webster from also using them. Similarly, street lights are also nonexcludable, as anybody is allowed to walk down the streets in the evening free of charge. In this case, Hawkins and Webster have no incentive to pay Young once the lights are in place, as they are able to reap all of the benefits regardless of whether they choose to pay Young. Thus, Hawkins and Webster should free-ride in response to Young's purchasing of the lights.

   (d) The important part to remember about this problem is that the marginal cost of a light to each individual person is now \$100. Thus, we should find the greatest number of lights such that at least two individuals have a marginal benefit that is at least as large as \$100. Applying this idea, we see that 6 lights would be provided. When moving from 5 to 6 lights, Young and Hawkins would both vote "yes" to the 6th light, since each of their marginal benefits is greater than \$100. Webster would vote "no" to the 6th light, since his marginal benefit of the 6th light is only \$80.
   However, when voting on the 7th light, both Hawkins and Webster would choose to vote "no" since each of their marginal benefits is lower than \$100. Hence the 7th light would not be provided, despite Young voting "yes" on it.