

ECON/ENVR/SOSC 2310 Assignment 2

(Suggested Solution)

Notes:

In total 100 points

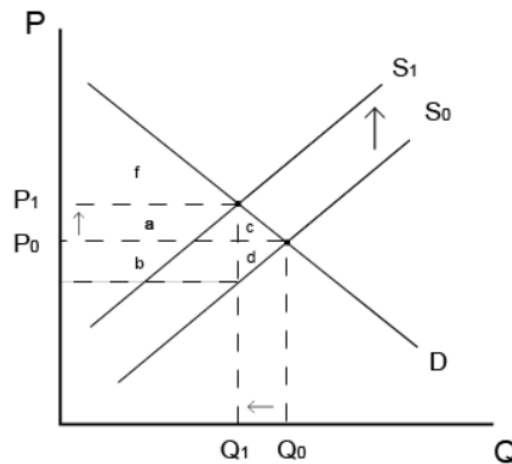
1. True or false, explain (14')

a. Often, the tax revenue collected by the government equals the reduced welfare of buyers and sellers caused by the tax. (3')

False. With a tax, the supply curve shifted to the left (a decrease) from S_0 to S_1 . Price increased from P_0 to P_1 quantity decreased from Q_0 to Q_1 .

Tax revenue collected by government: $a+b$

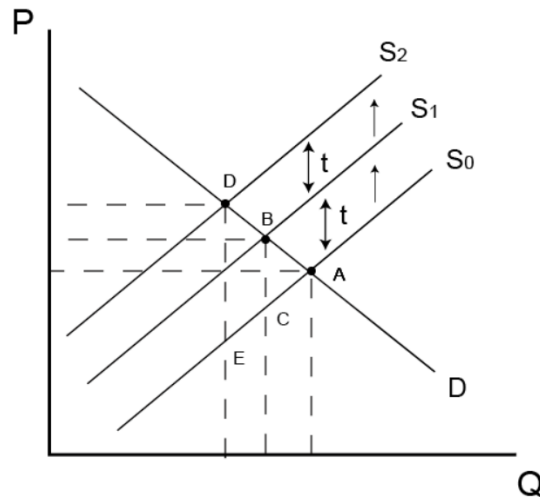
Reduced welfare: $a+b+c+d$. Therefore, it is not equals, as there is a deadweight loss $c+d$.



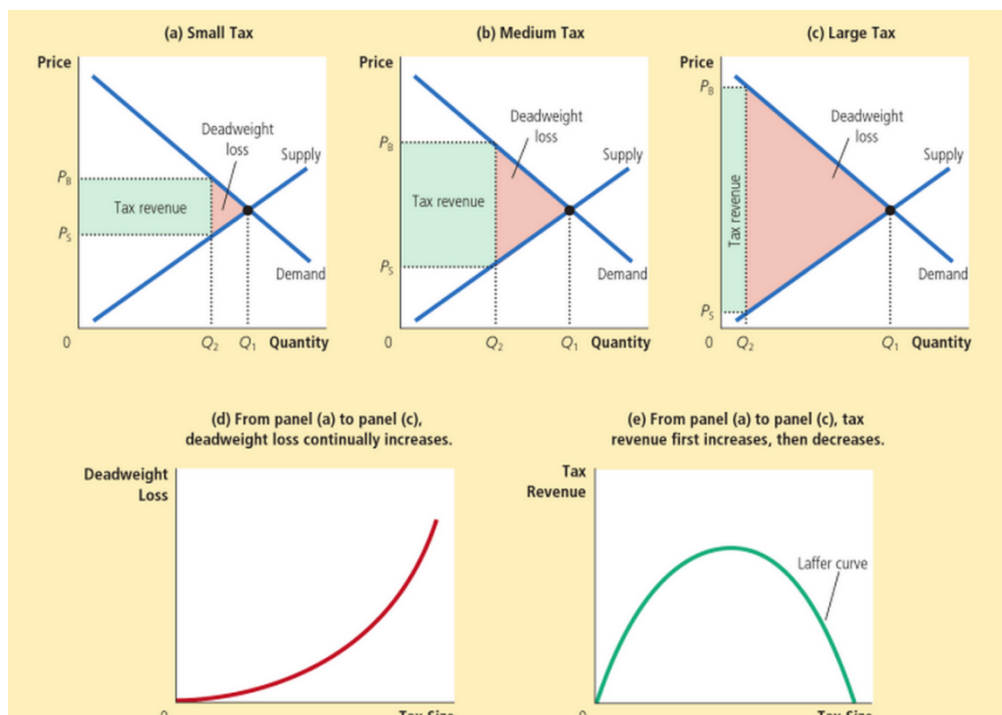
b. The deadweight loss of a tax rises even more rapidly than the size of the tax. (4')

True (for proportion growth) / False (for net increase), (*but in English, "rapidly" is about the proportion increase rather net increase, so TA might tell this to students as tips after grading*).

As the tax rises, the DWL also increase. If we double the size of tax, from t to $2t$, the base doubled from BC to $2BC=DE$, height doubled from t to $2t$. Therefore, the deadweight loss raised by a factor of four instead of double, it would shrink the market and reduce the welfare.



This occurs because the deadweight loss is the area of a triangle, and the area of a triangle depends on the square of its size. If we double the size of a tax, for instance, the base and height of the triangle double, so the deadweight loss rises by a factor of 4. If we triple the size of a tax the base and height triple, so the deadweight loss rises by a factor of 9. By contrast, tax revenue first rises with the size of a tax, but then, as the tax gets larger, the market shrinks so much that tax revenue starts to fall. See below graph.



c. When weighing the costs and benefits of pollution, the costs always exceed the benefits because the benefit equals zero. (3')

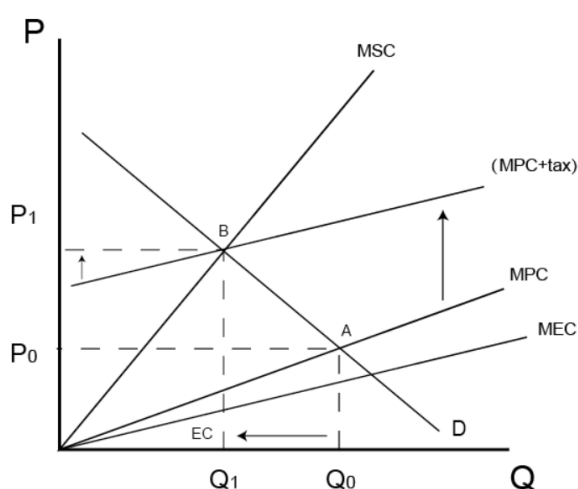
False.

The last part of the statement said “the benefits of pollution always equal to zero”. This part is not correct since the pollution can generate positive commercial value to the firm that control or handle the pollution. Therefore, to the whole society, the benefit of the pollution is not always equal to zero.

d. When there is a negative externality, the government can use quota or tax to reduce the external cost to zero and maximize social welfare. (4')

False.

The graph here shows the case of tax, but that's the exact case with quota. The government can use tax or quota to turn the equilibrium from A to B (Q_1), to maximize the social welfare, but it cannot reduce the external cost to zero since there is still EC even at Q_1 .



2. (18') Suppose that a market is described by the following supply and demand equations:

$$Q_S = 2P, Q_D = 300 - P$$

- Solve for the equilibrium price and the equilibrium quantity. (1')
- Suppose that a tax of T (per unit of the good) is placed on buyers. Solve for the new equilibrium. What happens to the price received by sellers, the price paid by buyers, and the quantity sold? (3')
- Use your answers to part (b) to solve for tax revenue as a function of T . Graph this relationship for T between 0 and 300. (4')
- Solve for deadweight loss as a function of T . Graph this relation for T between 0 and 300. (4')
- The government wants to maximize its tax revenue. The government now levies a tax on this good of \$200 per unit. Is this a good policy? Why or why not? Can you propose a better policy? (6')

a. $Q_S=2P$, $Q_D=300-p$
In equilibrium, $Q_S=Q_D$,

$$\therefore 2P=300-P,$$

$$P_1=100,$$

$$\therefore Q_{D1}=Q_{S1}=Q_1=200$$

b. Denote $P_D=P_S+T$

$$Q_S=2P_S$$

$$Q_D=300-P_D=300-(P_S+T)$$

In equilibrium, $Q_S=Q_D$,

$$\therefore 2P_S=300-P_S-T$$

$$P_{S1}=(300-T)/3$$

$$P_{S1}=100-T/3, P_{D1}=P_{S1}+T=100+2T/3$$

\therefore Price received by seller decreased from 100 to $100-T/3$,

Price paid by buyer increased from 100 to $100+2T/3$

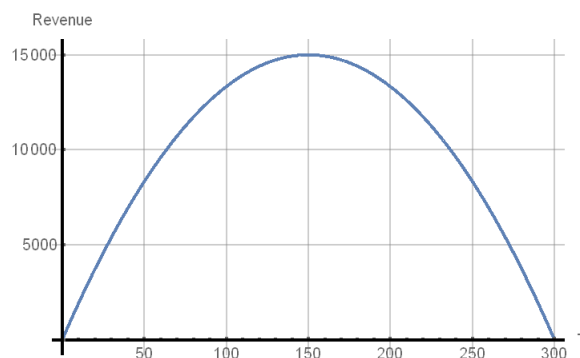
$$Q_{T1}=Q_{D1}=Q_{S1}=2T/3,$$

\therefore Quantity decreased from 200 to $200-2T/3$

$$c. \text{ Tax Revenue} = T \times Q_T = T (200-2T/3) = 200T-2T^2/3$$

\therefore When $T=0$ or $T=300$, Tax Revenue=0

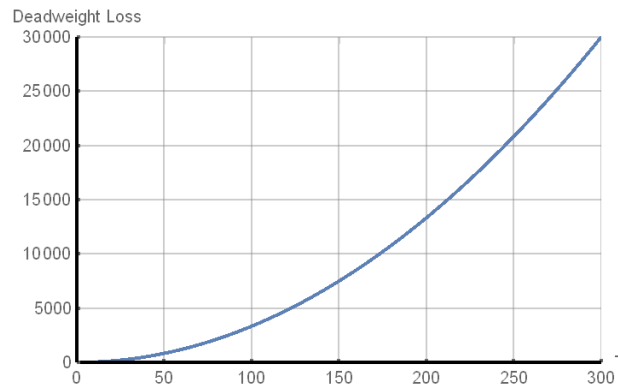
When $T=150$, tax revenue is maximized, since FOC $d(TR)/dT=200-4T/3$,
When $200-4T/3=0$, $T=150$, tax revenue is max.



$$d. \text{ Deadweight loss: } T(Q_1-Q_T)/2 = T \times 200 - (200-2T/3)/2 = T^2/3$$

When $T=0$, $DWL=0$,

When T increases, DWL also increases and is faster than T .



e. Tax Revenue max: $200T - 2T^2/3$,

$d(TR)/dT = 200 - 4T/3$, $d(TR)/dT = 0$

When $200 = 4T/3$, $T_1 = 150$

For $T = \$200$, Tax Rev = $\$13333.333$

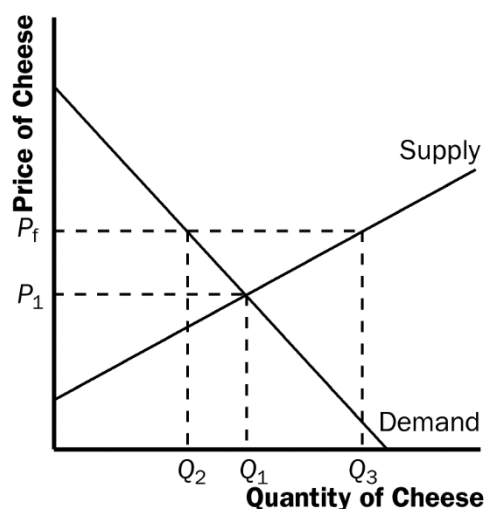
For $T = \$150$, Tax Rev = $\$15000$

\therefore To max government tax revenue, setting $T = \$150$ is better than $\$200$.

3. The government has decided that the free-market price of cheese is too low. (20')

a. Suppose the government imposes a binding price floor in the cheese market. Draw a supply and demand diagram to show the effect of this policy on the price of cheese and the quantity of cheese sold. Is there a shortage or surplus of cheese? (3')

The imposition of a binding price floor in the cheese market is shown in Figure. In the absence of the price floor, the price would be P_1 and the quantity would be Q_1 . With the floor set at P_f , which is greater than P_1 , the quantity demanded is Q_2 , while quantity supplied is Q_3 , so there is a surplus of cheese in the amount $Q_3 - Q_2$. There is a surplus of cheese.



b. Farmers complain that the price floor has reduced their total revenue. Is this possible? Explain. (3')

This is possible.

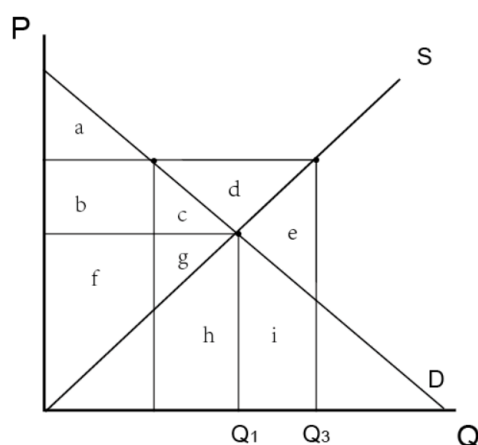
The farmers' complaint that their total revenue has declined is correct if demand is elastic. With elastic demand, the percentage decline in quantity would exceed the percentage rise in price, so total revenue would decline.

c. In response to farmers' complaints, the government agrees to purchase all the surplus cheese at the price floor. Compared to the basic price floor, who benefits from this new policy? Who loses? (7')

If the government purchases all the surplus cheese at the price floor, producers benefit and taxpayers lose. Producers would produce quantity Q_3 of cheese, and their total revenue would increase substantially. But consumers would buy only quantity Q_2 of cheese, so they are in the same position as before. Taxpayers lose because they would be financing the purchase of the surplus cheese through higher taxes.

d. Since the government cannot resell the surplus cheese to the market (this will change the market price), so it decides to store and spoil them. Conduct a welfare analysis. (7')

	Competitive(Q_1)	Q_3	Δ
CS	$a+b+c$	a	$-b-c$
PS	$f+g$	$b+c+d+f+g$	$b+c+d$
Gov.expense		$-c-d-e-g-h-i$	$-c-d-e-g-h-i$



$\therefore \text{welfare} = \text{CS} + \text{PS} - \text{gov.expense},$

At $Q_1 = a + b + c + f + g,$

At $Q_3 = a + b + f - e - h - i,$

$\Delta = \text{DWL} = -c - g - h - i - e,$

\therefore Social welfare is not maximized.

4. The below figure indicates the supply and curve for domestic steel market in US. Point E refers to the domestic market's equilibrium point when trade with other countries is not allowed.

(1) Fill in the Column (1) of Table 1 when the US steel market is not open to the rest of world.

(2) Fill in the Columns (2) and (3) of Table 4 when free trade is allowed, and the world price of steel is P_w .

(3) Fill in the Columns (4) and (5) of Table 4 when the US government sets a tariff for steel import from other countries.

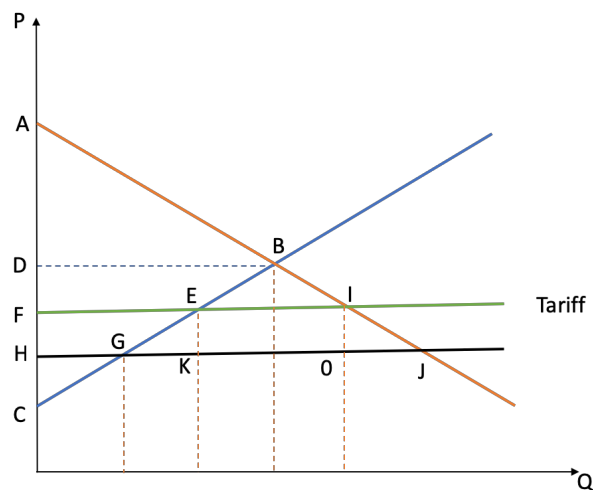


Table 1. Welfare Analysis for the Steel Market

	Before Free Trade	After Free Trade	Change (2) – (1)	Trade with Tariff	Change (4) – (2)
	(1)	(2)	(3)	(4)	(5)
CS	ADB	AHJ	DBJH	AFI	FIJH
PS	DBC	HGC	FEGH	FEC	FEGH
SW	ABC	AHJ+HGC	BGJ	AFI+FEC+EIOK	EGK+IOJ

(2.5' for each cell in column 1, 2 and 4. 1' for each cell in column 3 and 5 with a max deduction of 5.5')

5. (20') LAS VEGAS — A gunman on a high floor of a Las Vegas hotel rained a rapid-fire barrage on an outdoor concert festival on Sunday night, leaving at least 59 people dead, injuring 527 others, and sending thousands of terrified survivors fleeing for cover, in one of the deadliest mass shootings in American history. More details of the attack can be found: <https://www.nytimes.com/2017/10/02/us/las-vegas-shooting.html>

a. Would fewer people owning guns mean there would be fewer gun-related deaths? (4')

Correlation does not mean causation. If students use number to show there is positive relationship between guns and gun-related deaths, he/she will not get a high point. You can use 'correlation does not mean causation' to directly answer this question.

It is possible that people who do not use guns are normal people, and dangerous people still own guns.

b. Do you support gun control or not? Use an economic model to show your arguments. (note that people have very strong opinions and political beliefs regarding guns, here you need to think about economic argument.) (8')

Support: (1) Take gun as a good with negative externality.

(2) Game theory analysis on public and criminals.

Not support: (1) Banning or controlling the use of guns would simple shift the customers' demands in the gun market to its substitutes' market.

(2) The demand for guns is inelastic.

c. What can and should government do to keep the public safe? (8')

(1) Increase the spending on the security market.

(2) Educate the citizens.

(3) Make strict laws on using, storing, producing, reporting and recycling of the guns.