

**Seminar Group Exercises: Basic Micro and Externalities****Exercise 1. Taxing a Simple Gasoline Market**

Suppose we have collected data about the consumption of gasoline in Greater Las Vegas. In a market survey, Las Vegas consumers have revealed how much gasoline they would consume at different prices. From this data, we have aggregated a hypothetical demand schedule for Greater Las Vegas, revealing consumers' willingness to pay at varying amounts of gasoline consumption. We assume the relationship between price and quantity demanded to be completely linear (a straight line). The demand schedule is presented in the table below:

Demand Schedule for Gasoline in Greater Las Vegas

<i>Price (\$/gallon)</i>	\$1.50	1.60	1.70	1.80	1.90	2.00	2.10	2.20	2.30	2.40	2.50	2.60
<i>Quantity demanded (thousand gallons per week)</i>	30	28	26	24	22	20	18	16	14	12	10	8

We have also collected data from the gasoline suppliers, who have revealed how much gasoline they would be willing to produce at different prices. Their hypothetical supply schedule is presented in the table below. Once again, we also assume this relationship to be completely linear:

Supply Schedule for Gasoline in Greater Las Vegas

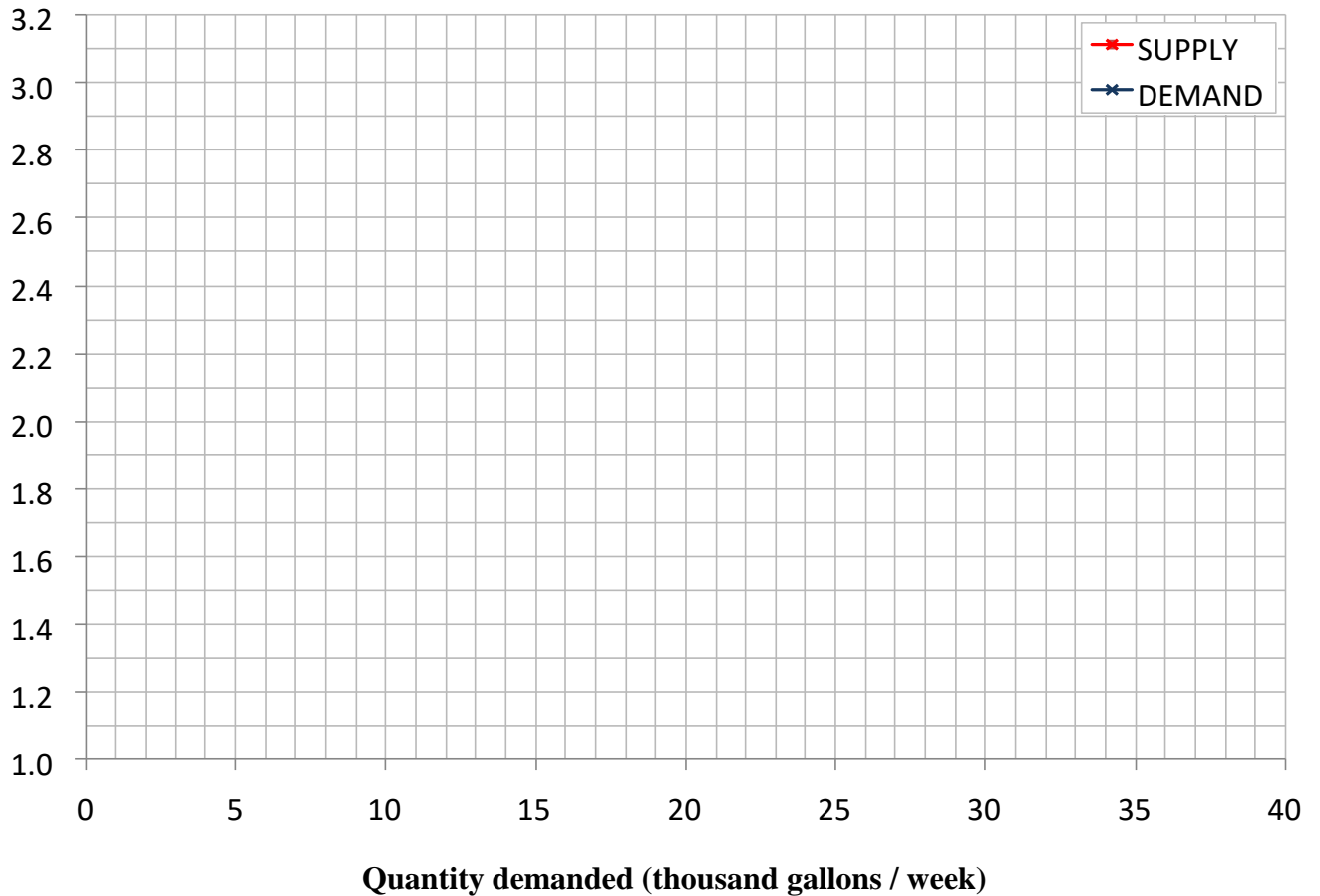
<i>Price (\$/gallon)</i>	\$1.70	1.80	1.90	2.00	2.10	2.20	2.30	2.40
<i>Quantity supplied (thousand gallons per week)</i>	8	12	16	20	24	28	32	36

## TASKS

- 1 Draw the demand curve **D** for gasoline onto diagram 1 (extend it all the way to the y-axis).
- 2 Draw the supply curve **S** for gasoline onto diagram 1 (extend it all the way to the y-axis).

**Diagram 1**

**Price (\$/gallon)**



- 3 What is the resulting market price (equilibrium price) for gasoline?

Market price: \_\_\_\_\_ \$/gallon

- 4 What is the equilibrium market *quantity* of gasoline?

Market quantity: \_\_\_\_\_ thousand gallons / week

- 5 Mark the area of consumer surplus on diagram 1. Then calculate the amount of consumer surplus (*tip: you'll need to use the formula for the area of a triangle*).

Consumer surplus: \$ \_\_\_\_\_ / week

- 6 Mark the area of producer surplus on diagram 1. Then calculate the amount of producer surplus (*tip: you'll need to use the formula for the area of a triangle*).

Producer surplus: \$ \_\_\_\_\_ / week

- 7 Mark the total economic welfare (TEW) in diagram 1.

TEW: \$ \_\_\_\_\_ / week

**Now assume** that the Nevada state government would like to reduce gasoline consumption in Greater Las Vegas, in the hope of improving local air quality and health across the region. To this end, the Nevada legislature has just passed a state gasoline tax of 30¢/gallon. In effect, this tax is an *additional cost* to the producers supplying the gasoline. The demand curve remains unchanged from section (1).

- 8 Fill in the table below with the new supply schedule, and then draw the resulting new supply curve **S'** on diagram 1

Supply schedule for gasoline including tax in Greater Las Vegas

Price (\$/gallon)	\$1.70	1.80	1.90	2.00	2.10	2.20	2.30	2.40
Quantity supplied (thousands of gallons/week)								

- 9 What is the resulting market price (equilibrium price) for gasoline when tax is included?

Market price (incl. tax): \$ \_\_\_\_\_ /gallon

10 What is the resulting market quantity for gasoline when tax is included?

Market quantity (incl. tax): \_\_\_\_\_ thousand gallons / week

11 Mark the new area of consumer surplus on diagram 1, and calculate the new consumer surplus:

Consumer surplus (incl. tax): \$ \_\_\_\_\_ \$ / week

12 Mark the area representing tax revenue on diagram 1, and calculate the amount of tax revenue collected:

Tax revenue collected: \$ \_\_\_\_\_ \$ / week

13 Mark the new area of producer surplus on diagram 1, and calculate the new producer surplus:

Producer surplus (incl. tax): \$ \_\_\_\_\_ \$ / week

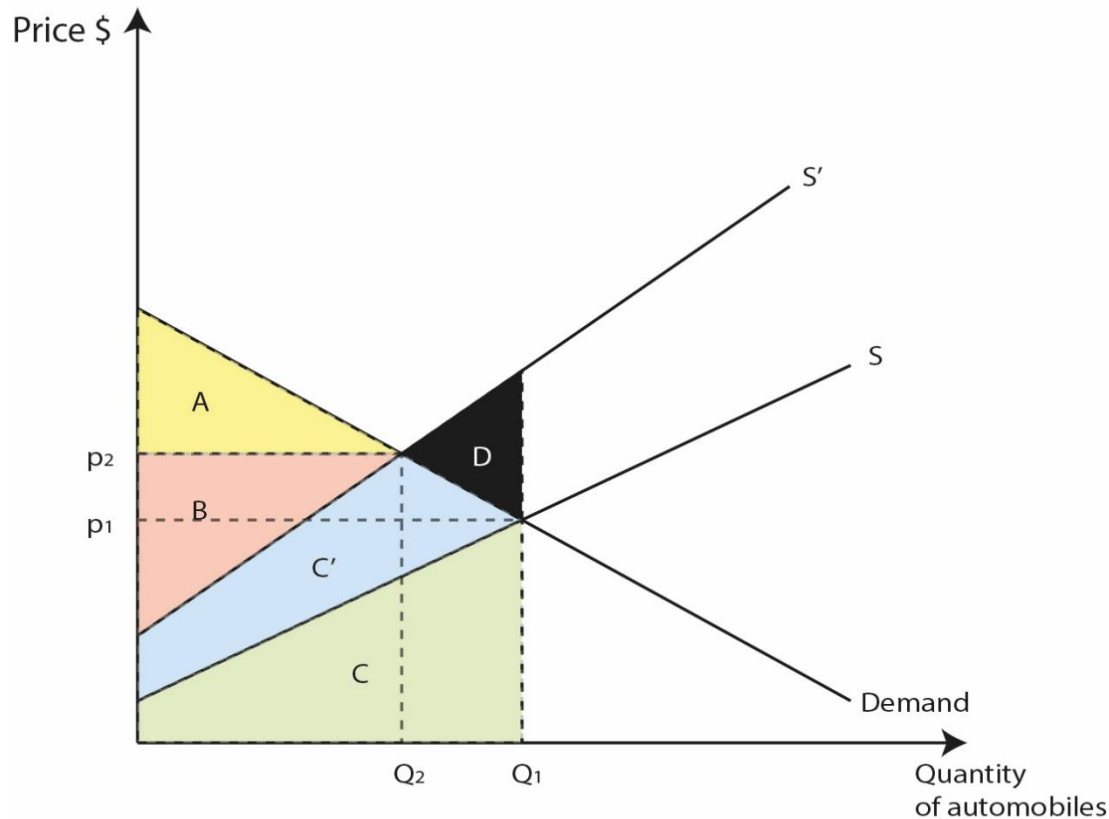
14 Now mark the net welfare loss due to the tax in diagram 1. To calculate the net welfare loss, start by calculating the TEW when the tax is imposed, and subtract that amount from the TEW when no tax is present.

Net welfare loss: \$ \_\_\_\_\_ / week

*Be able to explain: Even though there is a net welfare loss, why might it still be beneficial to society for the government to implement this tax?*

## Exercise 2. Internalizing externalities in car manufacturing

The diagram below represents a simple automobile market where all cars are sold at the same price point, **and** where the government is attempting to internalize a number of external costs associated with the manufacturing of automobiles, including air pollution, water pollution, and noise pollution (carmaking is loud!). To internalize these externalities, the government has introduced the **S'** curve, which *does* take the above external costs into account, as a correction to the **S** curve, which *does not*.



Based on your readings and my lecture, please answer the following questions about the above diagram:

1. While curve **S** is known as the *private* supply curve, curve **S'** is known as the  
\_\_\_\_\_
2. By how much will the price of cars rise as a result of taking the external costs into account? (You can write your answer as  $Q_1$ ,  $Q_2$ ,  $p_1$ ,  $p_2$ , **A**, **B**, **C**, **C'**, **D**, or a combination of these, such as  $A - B$ .)  
\_\_\_\_\_

3. Once the external costs have been taken into account, how many cars will be produced? (You can express your answer as  $Q_1$ ,  $Q_2$ ,  $p_1$ ,  $p_2$ , A, B, C, C', D, or a combination of these.)

---

4. Before internalization of the external costs, more cars were sold at a lower price point. During those bad old days, what was the total cost to society due to these external costs? (Again, you can express your answer as  $Q_1$ ,  $Q_2$ ,  $p_1$ ,  $p_2$ , A, B, C, C', D, or a combination of these.)

---

5. Once the external costs have been fully internalized, what is the total economic welfare generated by these market transactions? (Again, you can express your answer as  $Q_1$ ,  $Q_2$ ,  $p_1$ ,  $p_2$ , A, B, C, C', D, or a combination of these.)

---

6. Which area represents the net social loss during the bad old days—or alternately, the net gain to society from internalizing these external costs? (Again, you can express your answer as  $Q_1$ ,  $Q_2$ ,  $p_1$ ,  $p_2$ , A, B, C, C', D, or a combination of these.)

---

7. Of the four kinds of externalities I went over in my lecture, as which kind do the external costs in this example qualify? (It's enough to provide the two-letter acronym, but you can also spell it out. For a hint, see the next question)

---

8. Name two additional external costs affecting the automobile industry, but on the *consumption* side this time.

---

---

### Exercise 3. Dry cleaning, perc pollution, and cancer

#### Introduction

Source: [http://www.epa.gov/oppt/existingchemicals/pubs/perchloroethylene\\_fact\\_sheet.html](http://www.epa.gov/oppt/existingchemicals/pubs/perchloroethylene_fact_sheet.html)

*Tetrachloroethylene, also known as perchloroethylene, or “perc,” is the predominant chemical solvent used in dry cleaning. It is a clear, colorless liquid that has a sharp, sweet odor and evaporates quickly. Perc is an effective cleaning solvent, and is used by most professional dry cleaners because it removes stains and dirt from all common types of fabrics. However, perc is also a toxic chemical, with both human health and environmental concerns. While the EPA has determined that perc is a “likely human carcinogen,” EPA does not believe that wearing clothes cleaned with perc pose a risk of concern. Instead, perc enters the ground in liquid form through spills, leaky pipes, leaky tanks, machine leaks, and from improperly handled waste. From there, perc can seep into and contaminate surface water, groundwater, and potentially drinking water. A small amount of perc can contaminate a large amount of water and people can be exposed by drinking or using the water.*

#### Context

A dry-cleaning establishment named Danish Dynamite has recently opened in the coastal village of Copenhagen in Queensland, Australia. Copenhagen, QLD is located on the Coral Sea, immediately opposite the Great Barrier Reef.

To drum up customers, Danish Dynamite is charging a flat per-piece fee during its first year of operation. In other words, every piece of clothing brought in for drycleaning, whether a tie or a wedding dress, gets charged the same price.

Suppose the market for dry cleaning in Copenhagen, QLD can be represented by the following demand and private supply schedules (where the latter does not take the effect of perc pollution from Danish Dynamite into account):

$P(x)$	$Q^d(x)$	$Q_{\text{private}}(x)$	$Q_{\text{social}}(x)$
\$30	0	240	
\$28	20	220	
\$26	40	200	
\$24	60	180	
\$22	80	160	
\$20	100	140	
\$18	120	120	
\$16	140	100	
\$14	160	80	
\$12	180	60	
\$10	200	40	
\$8	220	20	
\$6	240	0	

### Problems

Suppose that the external cost of perc pollution to humans and corals caused by Danish Dynamite's perc-laced dry-cleaning is \$8 per clothing item. Given that,

1. Fill in the numbers for  $Q^s_{\text{social}}(x)$  in the table above.
2. On the next page, graph the demand curve and both supply curves.



3. Indicate the area on the graph that corresponds to the welfare loss associated with the external losses due to perc pollution.
4. Suppose the state of Queensland were to impose a pollution tax of \$4 per clothing item on all dry cleaners that use perc. What effect would that have on welfare loss due to perc pollution in Copenhagen, QLD?

