

Homework 5

Solutions

Part I: Multiple Choices (2 Points Each)

1. Which of the following statements is correct?
 - (a) The demand for natural gas is more elastic over a short period of time than over a long period of time.
 - (b) The demand for smoke alarms is more elastic than the demand for Persian rugs.
 - (c) **The demand for bourbon whiskey is more elastic than the demand for alcoholic beverages in general.**
 - (d) All of the above are correct.
2. When the price of a bracelet was \$25 each, the jewelry shop sold 20 per month. When it raised the price to \$35 each, it sold 14 per month. Assuming the demand curve didn't change during this time, the arc price elasticity of demand for bracelets is
 - (a) 1.66.
 - (b) **1.06.**
 - (c) 0.94.
 - (d) 0.60.
3. Pierre says that he will spend exactly 10 dollars a day on coffee, regardless of the price of coffee. Pierre's demand for coffee is
 - (a) perfectly elastic.
 - (b) **unit elastic.**
 - (c) perfectly inelastic.
 - (d) None of the above answers is correct.

4. Last month, sellers of good Y took in \$100 in total revenue on sales of 50 units of good Y. This month sellers of good Y raised their price and took in \$120 in total revenue on sales of 40 units of good Y. At the same time, the price of good X stayed the same, but sales of good X increased from 20 units to 40 units. Suppose changes in the sales of X are driven by demand shifts as a result of changes in the price of Y, we can conclude that goods X and Y are
- (a) substitutes, and have a cross-price elasticity of 0.60.
 - (b) complements, and have a cross-price elasticity of 0.60.
 - (c) **substitutes, and have a cross-price elasticity of 1.67.**
 - (d) complements, and have a cross-price elasticity of 1.67.
5. The federal government is concerned about obesity in the United States. Congress is considering two plans. One will ban the production and sale of “junk food.” The other will increase nutrition-education programs and include substantial advertising campaigns to encourage healthy eating habits. The junk-food ban program
- (a) and the education program will reduce the quantity of junk food sold and raise the price.
 - (b) and the education program will reduce the quantity of junk food sold and lower the price.
 - (c) **will reduce the quantity of junk food sold and raise the price. The education program will reduce the quantity of junk food sold and lower the price.**
 - (d) will reduce the quantity of junk food sold and lower the price. The education program will reduce the quantity of junk food sold and raise the price.

Part II: Problems

Problem 1 (4 Points)

Suppose the market for a good can be represented by the following equations of supply and demand:

$$\text{Supply: } P = 0.05Q_S$$

$$\text{Demand } P = 20 - 0.15Q_D$$

, where Q_S and Q_D denote respectively quantity supplied and quantity demanded.

1. What are the equilibrium price quantity in this market? (2 Points)
 $(W^*, Q^*) = (5, 100)$
2. What are the price elasticity of demand and the price elasticity of supply at this equilibrium? (2 Points)

$$\epsilon_{d,p} = \frac{dQ_D}{dW} \frac{W^*}{Q^*} = \frac{1}{.15} \frac{5}{100} = .33$$

$$\epsilon_{s,p} = \frac{dQ_S}{dW} \frac{W^*}{Q^*} = \frac{1}{.05} \frac{5}{100} = 1$$

Note: the result that $\epsilon_{s,p} = 1$ should also be readily apparent from the fact that the supply curve is linear and has zero intercept.

Problem 2 (6 Points)

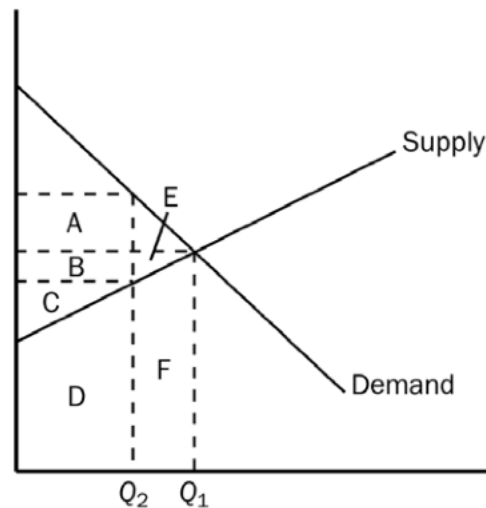
Fred spends his monthly paycheck going out to dinners and going to concerts. His income varies from month to month as does the price of dinners out and the price of concerts. The table below shows the data on number of times he has eaten out each month as well as his income in the month as well as the prices he faced during each month.

Month	Income	Dinner Price	Concert Price	Quantity of Dinners out
Apr	200	10	20	10
May	400	10	20	20
Jun	200	20	20	5
Jul	150	15	30	5

1. To calculate Fred's price elasticity of demand for dinners out, we should use the data for the months of April and June because the (income/**dinner price**/concert price) differs between these months but everything else is the same. Fred's arc price elasticity of demand for dinners out is 1. (2 Points)
2. To calculate Fred's income elasticity of demand for dinners out, we should use the data for the months of April and May because the (**income**/dinner price/concert price) differs between these months but everything else is the same. Fred's arc income elasticity of demand for dinners out is 1. (2 Points)
3. Dinners out are a (**normal**/inferior) good. (2 Points)

Problem 3 (6 Points)

The following graph illustrates the effect of taxing the market of a certain good. The equilibrium quantity is Q_1 before tax and Q_2 after tax.



1. Identify the following areas both before and after the imposition of the tax¹: (2 Points)

(a) total spending by consumers

Before tax: $B+C+D+E+F$; After tax: $A+B+C+D$

(b) total revenue for producers

Before tax: $B+C+D+E+F$; After tax: $C+D$

(c) government tax revenue.

Before tax: 0; After tax: $A+B$

2. Does the price received by producers rise or fall? Can you tell whether total receipts for producers rise or fall? Explain. (2 Points)

Fall. Fall.

3. Does the price paid by consumers rise or fall? Can you tell whether total spending by consumers rises or falls? Explain. (2 Points)

Rise. Whether consumer total spending rises or falls depends on the elasticity of demand.

¹For example, government tax revenue after tax is $A+B$.

Problem 4 (12 Points)

In the **Seven Kingdoms of Westeros**, people buy and sell **Valyrian steel**² and **wildfire**. The markets for Valyrian steel and wildfire are described by the following supply and demand equations:

$$\text{Valyrian steel Demand: } Q_D^V = 400 - 2p^V + p^W$$

$$\text{Valyrian steel Supply: } Q_S^V = 40 + p^V$$

$$\text{Wildfire Demand: } Q_D^W = 200 - 5p^W + 2p^V$$

$$\text{Wildfire Supply: } Q_S^W = 20 + 5p^W$$

, where p^V is the price of Valyrian steel, p^W is the price of wildfire, Q_D^V and Q_S^V are respectively the quantity demanded and supplied of Valyrian steel, and Q_D^W and Q_S^W are respectively the quantity demanded and supplied of wildfire.

1. Solve for the equilibrium price and quantity of Valyrian steel and wildfire. (2 Points)

$$\text{Valyrian Steel: } p^V = 135, Q^V = 175$$

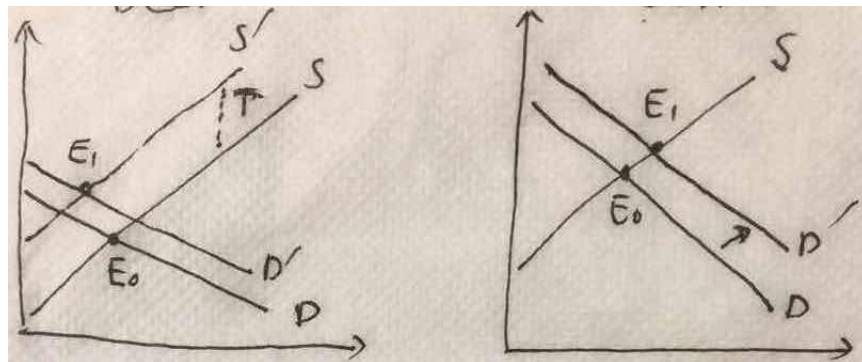
$$\text{Wildfire: } p^W = 45, Q^W = 245$$

2. The **King of Westeros** wants to support wildfire producers. To do so, he imposes a price floor of 60 on wildfire. Under this policy, what would be the market prices of Valyrian steel and wildfire? How much wildfire will people buy? (2 Points)

$$p^V = 140, p^W = 60, Q^W = 180$$

²On sale here: <http://www.valyriansteel.com/shop/>

3. Suppose that instead of a price floor, the King decides to impose a per-unit tax $T = 70$ on the sellers of Valyrian steel. Draw supply and demand diagrams to show the impact of this tax on these two markets. (2 Points)



A Napkin Diagram
Left: Valyrian Steel; Right: Wildfire

4. Solve for the prices that consumers pay for Valyrian steel and wildfire after tax, the prices received by producers of Valyrian steel and wildfire after tax, and the equilibrium quantities of Valyrian steel and wildfire after tax. (2 Points)

After tax on Valyrian steel, the price that consumers pay for Valyrian steel (p_D^V) is no longer the same as the price received by Valyrian steel producers (p_S^V). We have:

$$\begin{aligned} Q_D^V &= 400 - 2p_D^V + p^W \\ Q_S^V &= 40 + p_S^V \\ Q_D^W &= 200 - 5p^W + 2p_D^V \\ Q_S^W &= 2 + 5p^W \\ p_S^V &= p_D^V - T \end{aligned}$$

\Rightarrow

Valyrian Steel: $p_D^V = 160, p_S^V = 90, Q^V = 130$

Wildfire: $p_S^W = 50, Q^W = 270$

5. Calculate tax incidence. Who pays how much for this tax? Who benefits how much from this tax? (2 Points)

Valyrian steel producer pays: $135 - 90 = 45$

Valyrian steel consumer pays: $160 - 135 = 25$

Wildfire consumer pays: $50 - 45 = 5$

Wildfire producer gains: $50 - 45 = 5$