

**PRINCIPLES OF MICROECONOMICS (ECON 1101 SECTION 056)**  
**ASSIGNMENT #5**  
**Answers**

1. (20 points) Read the following article.
- Mulady, Kathy. "City OKs 20-Cent Fee on Plastic, Paper Bags." (2008, Jul. 29) *Seattle Post-Intelligencer*. p. A1
- (a) Describe the externalities at issue in the article.  
The costs of bag disposal are spread across society and across generations and not all paid by the consumer.
- (b) Is the user fee a Pigovian tax? How will it address the externality?  
Yes, the user fee is a Pigovian tax, because it attempts to internalize the cost of detrimental externality. The tax attempts to bring the marginal private benefits down to the marginal social benefits and reduce the quantity of bags consumed.
- (c) What are alternative solutions to the problem? Which do you think would be best?  
San Francisco may ban plastic grocery bags entirely. Most jurisdictions are taking no action.
2. (25 points) Cable television is a service that exhibits excludability but not depletable. Thus, marginal costs are zero. Suppose that demand for cable is given by  $P=80-Q$ , and that there are no externalities in the consumption or production of cable programming.
- (a) Suppose the industry has only one firm, which acts as a unregulated, profit-maximizing monopolist. Calculate the monopoly price, quantity, and consumer surplus.

$$\begin{aligned} MC &= MR \\ 0 &= 80 - 2Q \\ 2Q &= 80 \\ Q &= 40 \\ P &= 80 - 40 = 40 \end{aligned}$$

$$\begin{aligned} CS &= 40(80 - 40)/2 \\ CS &= 800 \end{aligned}$$

- (b) Suppose a price ceiling of 20 is imposed on the monopolist. Calculate the monopoly price, quantity, and consumer surplus.

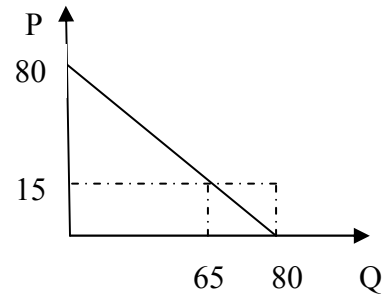
$$\begin{aligned} P &= 20 \\ 20 &= 80 - Q \\ Q &= 60 \end{aligned}$$

$$\begin{aligned} CS &= 60(80 - 20)/2 \\ CS &= 1800 \end{aligned}$$

- (c) Suppose the government provided the whole market with cable service and charged a mandatory fee of 15. Calculate the consumer surplus.

$$CS = 65(80-15)/2 - 15(80-65)/2$$

$$CS = 2000$$



3. (30 points) Ethanol production receives a federal subsidy of 51¢/gal. Suppose the national daily demand for ethanol is given by  $P = 295¢/\text{gal} - (.000007¢/\text{gal}^2)Q$  and without a subsidy the supply of ethanol would be given by  $P = 104¢/\text{gal} + (.000010¢/\text{gal}^2)Q$ .

- (a) Calculate the equilibrium price and quantity without the subsidy.

$$295¢/\text{gal} - (.000007¢/\text{gal}^2)Q = 104¢/\text{gal} + (.000010¢/\text{gal}^2)Q$$

$$191¢/\text{gal} - (.000007¢/\text{gal}^2)Q = (.000010¢/\text{gal}^2)Q$$

$$191¢/\text{gal} = (.000017¢/\text{gal}^2)Q$$

$$Q = 11,235,294 \text{ gal}$$

$$P = 295¢/\text{gal} - (.000007¢/\text{gal}^2)(11,235,294 \text{ gal})$$

$$P = 295¢/\text{gal} - 79¢/\text{gal}$$

$$P = 216¢/\text{gal}$$

- (b) Calculate the equilibrium price and quantity with the subsidy.

$$295¢/\text{gal} - (.000007¢/\text{gal}^2)Q = 104¢/\text{gal} + (.000010¢/\text{gal}^2)Q - 51¢/\text{gal}$$

$$295¢/\text{gal} - (.000007¢/\text{gal}^2)Q = 53¢/\text{gal} + (.000010¢/\text{gal}^2)Q$$

$$242¢/\text{gal} - (.000007¢/\text{gal}^2)Q = (.000010¢/\text{gal}^2)Q$$

$$242¢/\text{gal} = (.000017¢/\text{gal}^2)Q$$

$$Q = 14,235,294 \text{ gal}$$

$$P = 295¢/\text{gal} - (.000007¢/\text{gal}^2)(14,235,294 \text{ gal})$$

$$P = 295¢/\text{gal} - 100¢/\text{gal}$$

$$P = 195¢/\text{gal}$$

- (d) Calculate the government expenditure on the subsidy.

$$\text{Subsidy expenditure} = (51¢/\text{gal})(14,235,294 \text{ gal}) = 726,000,000¢ = \$7,260,000$$

(d) Calculate the deadweight loss of the subsidy assuming no externalities.

Without subsidy

$$CS = (295\text{¢/gal} - 216\text{¢/gal})(11,235,294 \text{ gal})/2$$

$$CS = 443,794,113\text{¢}$$

$$PS = (216\text{¢/gal} - 104\text{¢/gal})(11,235,294 \text{ gal})/2$$

$$PS = 629,176,464\text{¢}$$

$$CS+PS \approx 1,073,000,000\text{¢} = \$10,730,000$$

With subsidy

$$CS = (295\text{¢/gal} - 195\text{¢/gal})(14,235,294 \text{ gal})/2$$

$$CS = 711,764,700\text{¢}$$

$$PS = (195\text{¢/gal} - 53\text{¢/gal})(14,235,294 \text{ gal})/2$$

$$PS = 1,010,705,874\text{¢}$$

$$CS+PS-\text{Subsidy Expenditure} \approx 996,000,000\text{¢} = \$9,960,000$$

$$\text{Deadweight Loss} = \$770,000$$

4. (25 points) Suppose the demand for power sanders is given by  $P = 46 - 0.5Q$  and the supply curve is given by  $P = 34 + Q$ .

(a) Calculate the competitive equilibrium price and quantity.

$$46 - 0.5Q = 34 + Q$$

$$12 - 0.5Q = Q$$

$$12 = 1.5Q$$

$$Q = 8$$

$$P = 34 + 8 = 42$$

(b) Calculate the after-tax price, quantity, consumer surplus, and producer surplus if a per unit tax of 3 is imposed on the purchaser.

$$46 - 0.5Q - 3 = 34 + Q$$

$$43 - 0.5Q = 34 + Q$$

$$9 - 0.5Q = Q$$

$$9 = 1.5Q$$

$$Q = 6$$

$$P_{\text{after tax}} = 46 - 0.5(6) \text{ or } P_{\text{before tax}} = 43 - 0.5(6)$$

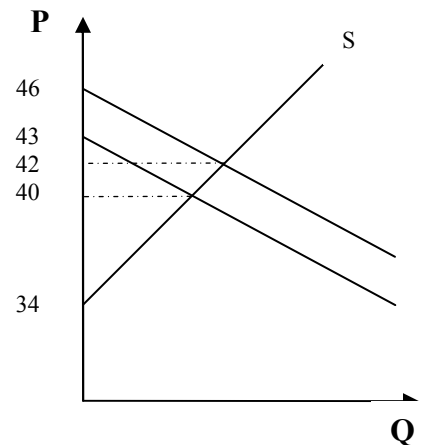
$$P_{\text{after tax}} = 43$$

$$P_{\text{before tax}} = 40$$

$$P_{\text{after tax}} = 40 + 3 = 43$$

$$CS = (43 - 40)(6)/2 = 9$$

$$PS = (40 - 34)(6)/2 = 18$$



(c) Calculate the after-tax price, quantity, consumer surplus, and producer surplus if a per unit tax of 3 is imposed on the seller.

$$46 - 0.5Q = 34 + Q + 3$$

$$46 - 0.5Q = 37 + Q$$

$$9 - 0.5Q = Q$$

$$9 = 1.5Q$$

$$Q = 6$$

$$P_{\text{after tax}} = 46 - 0.5(6)$$

$$P_{\text{after tax}} = 43$$

$$CS = (46 - 43)(6)/2 = 9$$

$$PS = (43 - 37)(6)/2 = 18$$

