

Tutorial 3 - Problems and Answers

March 2014

Problem 1

Suppose that the demand for apples is perfectly elastic and the government levies a tax on the producers of apples. Assume that the supply of apples is neither perfectly elastic nor perfectly inelastic.

- a) How will the price paid by consumers change? Is this change bigger or smaller than the price change that would result if the demand for apples were not perfectly elastic?
- b) How will the quantity of apples consumed change due to the tax? Is this change in quantity larger or smaller than the change that would result if the demand for apples were not perfectly elastic?
- c) Explain the significance of your answers in both part a) and part b) in terms of how the tax affects the welfare of consumers in the apple market.

Problem 2

In the market for apples, the demand curve is $Q = 50 - 3P$ and the supply curve is $Q = 2P$. The Government decides to raise revenue by taxing consumers 2 for every apple purchased.

- a) Graph the supply and demand curves, and indicate how the curves shift after implementation of the tax. Calculate the pre-tax and after-tax equilibrium quantities and prices.
- b) Calculate the change in consumer and producer surplus from the tax.
- c) Calculate the burden of the tax borne by each party.
- d) Calculate elasticity of demand and supply at the equilibrium and use the elasticity formula to check your calculations at point b).
- e) Calculate the amount of revenues raised by the Government and the loss of efficiency for the society (DWL)
- f) Intuitively, why is there dead-weight loss from a tax? That is, what exactly does deadweight loss represent?

Problem 3

Say whether the propositions are True or False and justify your answer.

- a) If the government imposes a binding price floor in the market, then the consumer surplus in that market will increase
- b) Connie can clean windows in large office buildings at a cost of \$1 per window. The market price for window-cleaning services is \$3 per window. If Connie cleans 100 windows, her producer surplus is \$100.
- c) A tax on insulin is likely to cause a very large deadweight loss to society.

Problem 4

Suppose that the market for green tea can be described by the following demand and supply curves (prices are per kg):

$$Q_d = 260 - 5P$$

$$Q_s = 8P$$

- a) Find the market equilibrium in the absence of taxes. Draw the demand and supply curves, labelling all intercepts and the market equilibrium
- b) Draw the curves as in the last item, showing clearly the areas representing the consumer surplus (CS) and the producer surplus (PS). Calculate their values and the value of the total surplus (TS).
- c) Suppose now that the government decides to tax green tea by \$13 per kg. Calculate the tax equilibrium.
- d) Calculate and show on the graph the values of CS , PS , $TAXR$, DWL .

Problem 1 - Solution

- a) The price paid by consumers will not change at all. If the demand for apples is perfectly elastic, it means that consumers have perfect substitutes for apples and will buy another product (and be no worse off) if the price goes up. Consequently, apple producers bear the entire burden of the tax. In contrast, if the demand for apples were not perfectly elastic, the price paid by consumers would rise and consequently the consumers would bear some of the tax burden.
- b) The quantity of apples will fall. If the demand for apples were neither perfectly elastic nor perfectly inelastic (and if supply were neither perfectly elastic or perfectly inelastic), then the quantity would fall but by less than it falls when the demand for apples is perfectly elastic.

- c) Only price changes caused by the tax affects the welfare of the consumers in the market. Since in this case the price paid by consumers does not change, consumers are made no better or worse off because of the tax, even though they consume fewer apples. The reason for this is that the perfectly elastic demand curve for apples implies that consumers are indifferent between consuming apples at that price and consuming other goods at that price. Consequently, although people shift consumption to another good, they are no better or worse off for it.

Problem 2 - Solution

- a) To prepare the graph, find the intercepts for the two curves.

Demand:

$$\text{x-intercept: } P = 0 \Rightarrow Q_D = 50$$

$$\text{y-intercept: } Q = 0 \Rightarrow P = \frac{50}{3} = 16.7$$

Supply:

$$\text{x-intercept: } P = 0 \Rightarrow Q = 0 \text{ The supply curve cross axes in the origin.}$$

To draw the supply curve, find another point belonging to the curve. Assign an arbitrary value to the price, and calculate the quantity supplied. E.g.: when $P = 10 \Rightarrow Q_S = 20$.

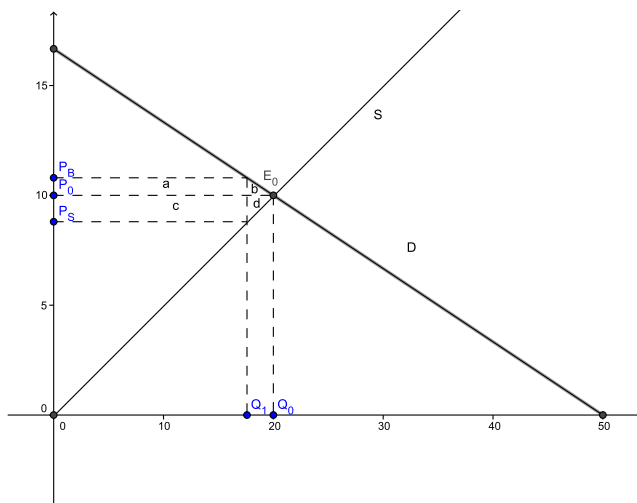


Figure 1: Problem 2

Before-tax equilibrium

$$Q_S = Q_D$$

$$2P = 50 - 3P \Rightarrow 5P = 50$$

$$P^* = 10\$$$

Substituting the equilibrium price in the supply or in the demand curve:

$$Q^* = 20$$

After-tax equilibrium

$$P_B = P_S + 2$$

$$D : Q_D = 50 - 3P_B = 50 - 3(P_S + 2) = 44 - 3P_S$$

$$S : Q_S = 2P_S$$

To find the equilibrium:

$$Q_S = Q_D$$

$$2P_S = 44 - 3P_S$$

$$5P_S = 44 \Rightarrow P_S = 8.80\$$$

$$P_B = P_S + 2 = 10.80\$$$

$$Q_1 = 2 \times 8.80 = 17.6$$

b)

$$\Delta CS = -a - b = -\frac{(Q_0 + Q_1)(P_B - P_0)}{2} = -\frac{(17.6 + 20)(10.8 - 10)}{2} = -15.04$$

$$\Delta PS = -c - d = -\frac{(Q_0 + Q_1)(P_0 - P_S)}{2} = -\frac{(20 + 17.6)(10 - 8.80)}{2} = -22.56$$

c) The burden of the tax for consumers is: $P_B - P_0 = 0.80$.

The burden of the tax for sellers is: $P_0 - P_S = 1.20$.

Consumers are paying $\frac{P_B - P_0}{T} = 40\%$ of the tax, while producers are paying $\frac{P_0 - P_S}{T} = 60\%$ of the tax.

d)

$$E_D = \frac{\Delta Q^D}{\Delta P} \frac{P_0}{Q_0} = slope \times \frac{P_0}{Q_0} = -3 \frac{10}{20} = -\frac{3}{2}$$

$$E_S = \frac{Q_S}{P_S} \frac{P_0}{Q_0} = slope \times \frac{P_0}{Q_0} = 2 \times \frac{10}{20} = 1$$

We can use the elasticities of the demand and supply curves to calculate tax incidence.

Tax incidence on consumers is given by:

$$\frac{E_S}{E_S - E_D} = \frac{1}{1 - (\frac{3}{2})} = \frac{1}{\frac{5}{2}} = \frac{2}{5} = 40\%$$

e)

$$\text{Tax Revenues} = T \times Q_1 = 2 \times 17.6 = 35.2$$

$$DWL = \frac{T \times (Q_0 - Q_1)}{2} = 2.4$$

- f) In this example, dead-weight loss represents inefficiency from efficient trades that should have occurred, but were prevented due to the tax. Inefficiency is measured by the difference between social marginal benefit and social marginal cost curves at the new market outcome - so in this case, since the marginal benefit is greater than the marginal cost at the new outcome, efficient trades are prevented from occurring.

Problem 3 - solution

- a) False. It will decrease, since the price will be higher than the one that prevails in the absence of the price floor.
- b) False. Her producer surplus is \$2 per window. Thus, her total producer surplus is of \$200.
- c) False. The demand for insulin is highly inelastic. The deadweight loss is, thus, comparatively small.

problem 4 - Solution

- a) In equilibrium $Q_S = Q_D$:

$$8P = 260 - 5P \Rightarrow 13P = 260$$

$$P_0 = 20\$$$

$$Q_0 = 8 \times P_0 = 160 \text{ kg}$$

Graph: see Figure 2

- b) See Figure 2

$$CS = \text{areaa} = \frac{160 \times (52 - 20)}{2} = 2560$$

$$PS = \text{areab} = \frac{20 \times 160}{2} = 1600$$

$$TS = a + b = 4160$$

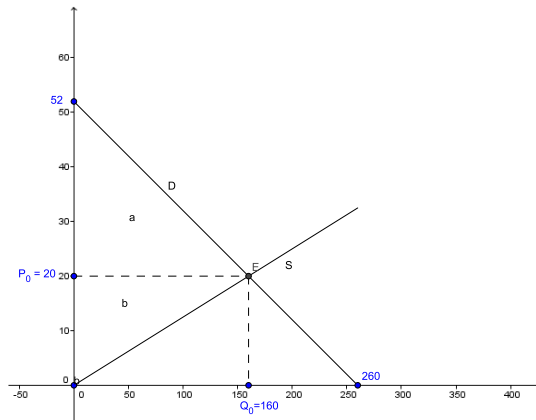


Figure 2: Problem 2

c)

$$P_B = P_S + 13$$

$$Q_D = 260 - 5P_B = 260 - 5 \times (P_S + 13)$$

$$Q_D = 260 - 5P_S - 65 = 195 - 5P_S$$

$$Q_D = Q_S$$

$$195 - 5P_S = 8P_S$$

$$P_S = 15$$

$$P_B = 15 + 13 = 28$$

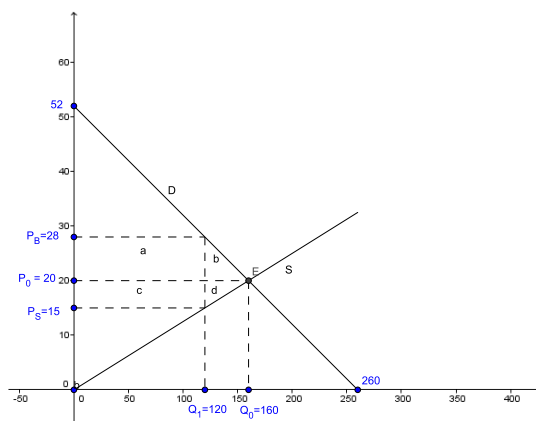


Figure 3: Problem 2

To find the quantity of equilibrium, substitute the relevant price in the demand or in the supply curve.

E.g., substituting in the supply curve:

$$Q_1 = 8 \times P_S = 8 \times 15 = 120$$

d)

$$\Delta CS = -a - b = -\frac{(160 + 120)(28 - 20)}{2} = -1120$$

$$\Delta PS = -c - d = -\frac{(160 + 120)(20 - 15)}{2} = 700$$

$$\text{Tax Revenue} = T \times Q_1 = 13 \times 120 = 1560$$

$$DWL = \frac{13 \times (160 - 120)}{2} = 260$$