

## Assignment 3

### Answer Key

**Question 1.** (4 marks) Compare the impact of rent control when the supply of housing is fixed and when supply curve is upward sloping.

*The purpose of this exercise was to help you understand the idea behind government intervention into competitive markets and see under what circumstances it will cause DWL. We have discussed that competitive equilibrium is efficient in the sense that in competitive equilibrium gains from trade are maximized. Recall that both consumer and producer surplus depend on price at which the good is sold: the higher is the price the larger is producer surplus, the lower is the price the higher is consumer surplus. Government can use price controls and quotas to redistribute the gains from trade (surpluses) between the sides of the market by affecting the market price. Price floors and quotas are policies that are aimed at keeping market price high (above equilibrium) and these benefit producers. Rent control is an example of a price ceiling, which is a policy aimed at keeping the market price below the equilibrium level, obviously the objective is to benefit consumers. In the case with fixed supply the quantity of housing that is actually rented out does not change, which means that the gains from trade are the same and there is no welfare loss generated by the policy. In the case with upward sloping supply the situation will be different. Since landlords must charge lower rent they will choose to supply less housing, the quantity of housing that is actually rented will decrease and so will gains from trade.*

**Question 2.** (3 marks) Consider 2 cases (i) supply curve is perfectly elastic and demand curve is downward sloping. (ii) demand curve is perfectly inelastic and supply curve is upward sloping. Compare the impact of a 1 dollar per unit tax levied on producers.

*Case (i): horizontal supply shifts up by the amount of tax. Equilibrium price increases by the amount of tax  $P_t = P^* + 1$ . Consumers pay the entire tax because supply is more elastic than demand. Quantity traded decreases, since quantity falls there is a DWL.*

**STORY:** *Recall where the horizontal supply curve come from in a competitive market - it corresponds to the minimum point of ATC curve, all firms have the same average costs and firms make zero profits. This means that firms cannot absorb any portion of the tax: at the initial equilibrium price profits are zero and if firms receive price any lower than  $P^*$  none of the firms will be able to operate. That is why entire tax must be paid by the consumers.*

*Case(ii): demand is vertical. Upward sloping supply shifts up by the amount of tax, equilibrium quantity is the same, market price increases by the amount of tax. Consumers pay entire tax burden because demand is inelastic compared to supply. There is no dead weight loss because DWL results from decrease in quantity traded and in this case quantity does not change after the tax is imposed.*

**STORY:** *Vertical demand curve means that consumers are willing to purchase the same quantity regardless of how much they will have to pay. This makes it easy for producers to shift the tax to consumers: even if price goes up by 1 dollar, consumers will still purchase the same quantity as before tax. You can also think about this situation as follows. Quantity demanded is fixed at  $Q^*$ . Producers are willing to supply this quantity if they receive price  $P^*$ . This means that after tax price received by producers cannot be below  $P^*$ . If producers carry any of the tax burden they will not supply the quantity demanded by consumers  $Q^*$  and the market will not be in equilibrium. This means that in after tax equilibrium producers receive the same price as*

before tax and consumers bear the entire tax burden.

**Problem 1.** (10 marks)

Consider a competitive market with demand given by  $P = 450 - .5Q$  and supply given by  $P = Q$ .

- a) Find competitive equilibrium price and quantity  $P^*$  and  $Q^*$ . What are the consumer and producer surplus?

$$P^* = 300, Q^* = 300, CS = 22,500, PS = 45,000$$

- b) Suppose government introduces as per unit tax of  $t = 30$  on producers. Find the quantity traded in the market after tax  $Q_t$ . Find the price paid by consumers  $P_t$  and price received by producers after tax  $P_S$ .

$$\text{Consumers pay } P_t = 310 \text{ (market price after tax), } Q_t = 280, \text{ producers get } P_S = 280$$

- c) Calculate consumer and producer surplus, tax paid by consumers, tax paid by producers, and the total tax revenue to the government, find the dead weight loss associated with the tax.

$$\begin{aligned} CS &= 19,600, PS = 39,200, \\ \text{tax paid by consumers} &(310 - 300)280 = 2,800, \\ \text{tax paid by producers} &(300 - 280)280 = 5,600, \\ \text{government revenue } GR &= 8,400, \\ DWL &= .5(300 - 280) \cdot 30 = 300. \end{aligned}$$

- d) Calculate price elasticity of demand and supply in the competitive market equilibrium using point elasticity formula. Now calculate what percentage of tax revenue is paid by the consumers and what percentage is paid by the producers. What can you say about the relationship between the elasticity of supply and demand and the shares of tax paid by consumers and producers?

$$\text{Point elasticity of demand in competitive equilibrium} = \frac{1}{\text{slope}} \cdot \frac{P^*}{Q^*} = \frac{1}{-.5} \cdot \frac{300}{300} = -2.$$

$$\text{Point elasticity of supply in competitive equilibrium} = \frac{1}{\text{slope}} \cdot \frac{P^*}{Q^*} = \frac{1}{1} \cdot \frac{300}{300} = 1.$$

*Demand is elastic compared to supply, consumers bear 33% of the tax burden producers bear 67%.*

*We observe the standard result: whoever has relatively inelastic curve bears more of the tax burden. In this case it is producers.*

- e) Show your results on a diagram. In particular indicate competitive equilibrium, after tax quantity and prices, after tax consumer and producer surplus, government revenue and the dead weight loss.