HUL 211: Introduction to Economics
Practice Problems

Indian Institute of Technology Delhi

February 10, 2025

Practice Problems

1. You have been asked to analyze the market for steel. From public sources, you are able to find that last year's price for steel was 20 per ton. At this price, 100 million tons were sold on the world market. From trade association data you are able to obtain estimates for the own price elasticities of demand and supply on the world markets as 0.25 for demand and 0.5 for supply (Elasticity values are at given equilibrium price and quantity). Assume that steel has linear demand and supply curves throughout.

    1. Solve for the equations of demand and supply in this market and sketch the demand and supply curves.

    2. Suppose that you discover that the current price of steel is 15 per ton and the current level of worldwide sales of steel is 150 million tons. The most recent elasticity estimates from the trade association this year are 0.125 for demand and 0.25 for supply. Describe the change in the supply and demand curves over the past year using your diagram from part (a). What sort of event(s) might explain the change?

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1. Consider the market for apple juice. In this market, the supply curve is given by $Q_S = 10P_J - 5P_A$ and the demand curve is given by $Q_D = 100 - 15P_J + 10P_T$, where J denotes apple juice, A denotes apples, and T denotes tea.
    1. Assume that P_A is fixed at 1 and $P_T = 5$. Calculate the equilibrium price and quantity in the apple juice market.
    2. Suppose that a poor harvest season raises the price of apples to $P_A = 2$. Find the new equilibrium price and quantity of apple juice. Draw a graph to illustrate your answer.
    3. Suppose $P_A = 1$ but the price of tea drops to $P_T = 3$. Find the new equilibrium price and quantity of apple juice.
    4. Suppose $P_A = 1$, $P_T = 5$, and there is a price ceiling on apple juice of $P^* = 5$. What is J the excess demand for apple juice as a result? Draw a graph to illustrate your answer.

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1. Suppose the market for corn is competitive. No imports and exports are possible. The demand curve is $Q^d = 10 - P^d$, where Q^d is the quantity demanded (in millions of units) when the price consumers pay is P^d . The supply curve is

$$Q^s = \begin{cases} -4 + P^s & if\ P^s \geq 4 \\ 0 & if\ P^s < 4 \end{cases},$$

where Q^s is the quantity supplied (in millions of units) when the price producers receive is P^s .

    1. What are the equilibrium price and quantity?
    2. At the equilibrium in part a, what is consumer surplus? Producer surplus? Deadweight loss? Show all of these graphically.
    3. Suppose the government imposes a tax of 2 per unit to raise government revenues. What will the new equilibrium quantity be? What price will buyers pay? What price will sellers receive?

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2. Suppose the government has a change of heart about the importance of kumquat revenues to the happiness of the Boornian farmers. The tax is removed, and a subsidy of 1 per unit is granted to kumquat producers. What will the equilibrium quantity be? What price will the buyer pay? What price (including the subsidy) will kumquat farmers receive?

3. At the equilibrium in part e, what is consumer surplus? Producer surplus? What will be the total cost to the government? Deadweight loss? Show all of these graphically.

4. Verify that for your answers to parts b, d, and f the following sum is always the same: consumer surplus + producer surplus + impact on the government budget + deadweight loss. Why is the sum equal in all three cases?

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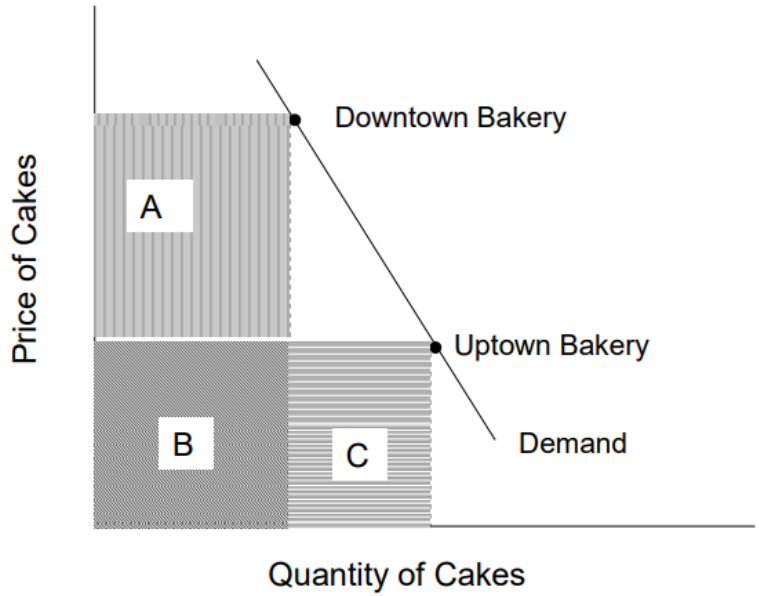

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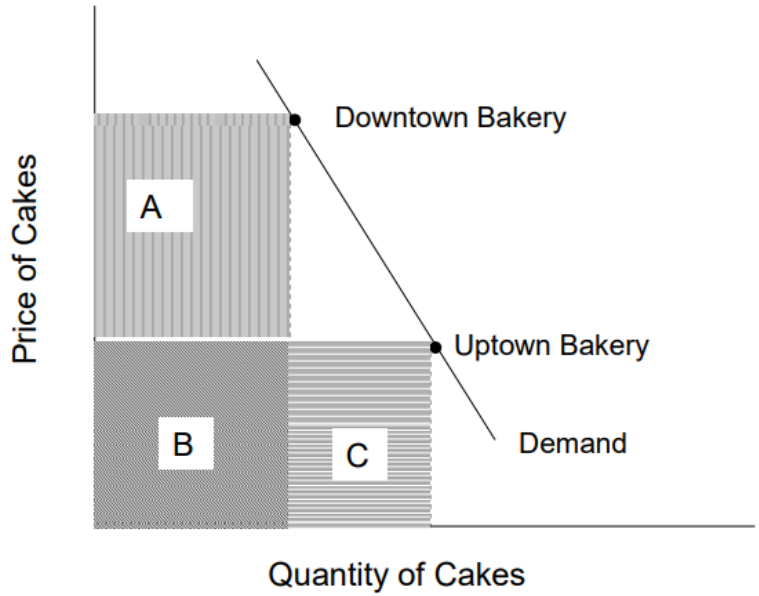

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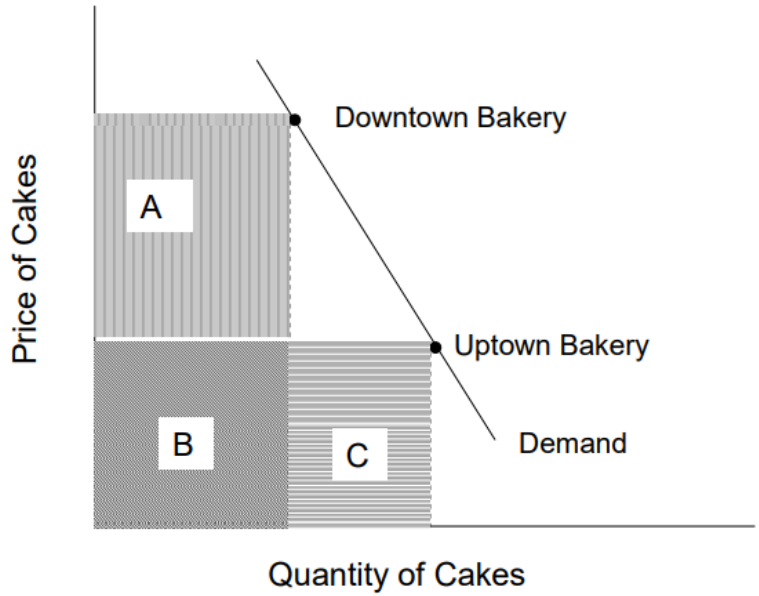

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True or False

- Perfectly elastic demand refers to a situation in which any price change for the good in question, no matter how small, will produce an "infinite" change in quantity demanded.
- When the seller increases the price charged for a good with an elastic demand, the seller's revenues will go up.
- Elasticity is the same as the slope of the demand curve.

Solutions: 1

1. Assume $X_d = a - bP$ and $X_s = c + dP$. We know from the equation for own-price elasticity of demand that

$$E_{Q_X P_X} = \frac{dX_d}{dP_X}\frac{P_X}{X_d} = -b\frac{P_X}{X_d} = -b\frac{20}{100} = -0.25$$

   Solving for b, then, we have $b = 1.25$. Substituting back into the equation for demand, $X_d = a - 1.25P$ or $100 = a - 1.25(20)$. Solving for a we have $a = 125$. Hence, the equation for last year's demand is $X_d = 125 - 1.25P$. Similarly solving for d and c, we get $c = 50$ and $d = 2.5$.

2. Same exercise for b. $b = 1.25$ and $a = 168.75$. Also, $d = 2.5$ and $c = 112.5$. The demand and supply have kept the same slope as last year, but the intercepts have changed for both curves: demand and supply have shifted out.

Solutions: 2

1. We have the system of equations $Q = 10P_J - 5 \cdot 1$ and $Q = 100 - 15P_J + 10 \cdot 5$. Solving for P_J and Q we get that $P_J = 6.2$ and $Q = 57$.

2. We now have to solve the system: $Q = 10P_J - 10$ and $Q = 150 - 15P_J$. Solving for P_J and Q we get that $P_J = 6.4$ and $Q = 54$. In a supply and demand graph, the supply curve shifts to the left, resulting in the higher equilibrium price and lower equilibrium quantity.

3. $q = 10P_J - 5, Q = 130 - 15P_J$; $P_J = 5.4, Q = 49$.

4. Note that the price ceiling will be binding, since the equilibrium price from (a) is $P_J = 6.2$. Plugging the price ceiling level into the supply and demand equations we get that $Q_S = 45$ and $Q_D = 75$. Hence, there will be excess demand for apple juice of $Q_E = 30$.

Solutions: 3

1. $P^* = 7, Q^* = 3$

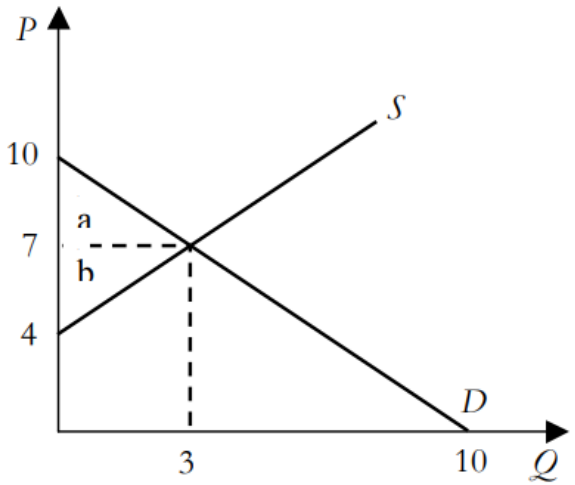

Figure: 3(b)

2. If the government imposes a tax of 2 per unit, $P^d = P^s + 2$. Setting $Q^d = Q^s$ and substituting for P^d , we obtain $10 - (P^s + 2) = -4 + P^s$, $P^s = 6, P^d = 8, Q^d = 2$.

Solutions: 3

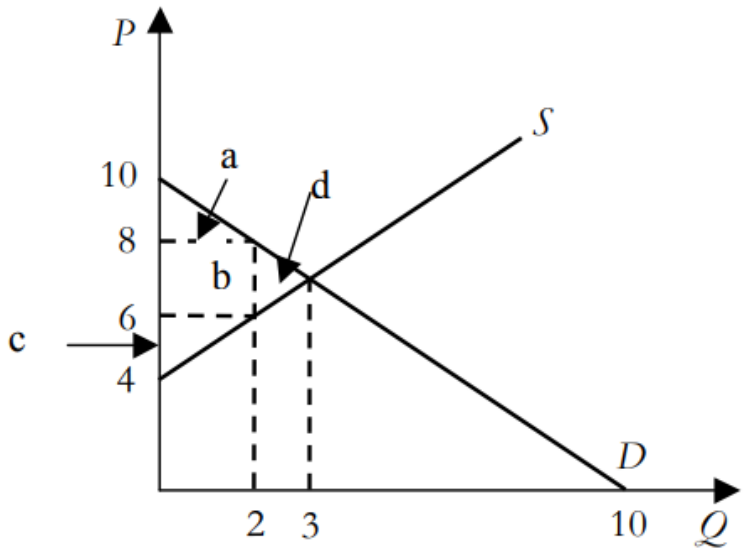

Figure: 3(d)

- $CS = a$, $PS = c$, $GR = b$, $DWL = d$

- If the government repeals the tax and implements a subsidy of 1 per unit, $P^s = P^d + 1$. Setting $Q^d = Q^s$ and substituting for P^s , we obtain $10 - P^d = -4 + (P^d + 1)$ $P^d = 6.5, P^s = 7.5, Q^d = 3.5$

Solutions: 3

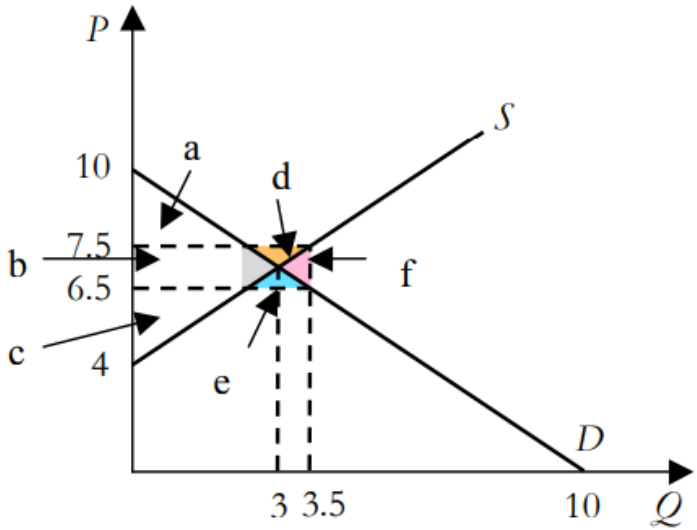

Figure: 3(f)

- $CS = a + b + e$, $PS = c + b + d$, $Cost_g = b + d + e + f$, $DWL = f$.

Solutions: 4 5

- Downtown: $A + B$, Uptown: $B + C$.
- Inelastic demand. How? Increase in prices is not pull down demand as Quantity demanded is not that responsive to the price changes.
- 5(a) True. By definition.
- 5(b) False. With elastic demand, quantity demanded will be more responsive to price changes and thus revenue will fall. Rater, under inelastic demand the seller's revenues will go up. See $Q - 4$
- 5(c) False. At every point on the inverse demand curve, elasticity is different, even though slope is constant throughout. By definition, elasticity of demand is inversely related to the slope of the inverse demand function weighted by the ratio $\frac{P}{Q}$