S5 Economics Practice Paper (Set 2): Price Elasticity of Demand, Consumer and Producer Surplus, Per-unit Tax Incidence and Deadweight Loss, Price Ceiling and Quota, Cost and Profit Maximisation, Factor Demand

S5 Economics | 100 marks | 75 minutes

Question 1: Price Elasticity of Demand and Total Revenue

A snack shop sells fish balls. When the price falls from $10 to $8, daily sales rise from 100 to 130 skewers.

Calculate the price elasticity of demand over this range using the arc (midpoint) method, and take the absolute value. *(6 marks)*

Answer: Elasticity = [(130 - 100) / 115] / [(8 - 10) / 9] = 0.2609 / (-0.2222) = --1.1739, so the absolute value is 1.17.

State whether demand over this range is elastic or inelastic, and explain. *(5 marks)*

Answer: The absolute value 1.17 exceeds 1, so demand is elastic: the percentage change in quantity demanded is larger than the percentage change in price.

Calculate total revenue before and after the price cut, and use elasticity to explain the direction of the change. *(4 marks)*

Answer: Revenue before = $10 x 100 = $1000; after = $8 x 130 = $1040. With elastic demand a price cut raises revenue because the quantity gain outweighs the price loss, so revenue rises by $40.

If the price rises from $10 to $12 and sales fall from 100 to 80 skewers, find the arc elasticity over this range and explain why elasticity can differ between price ranges for the same good. *(3 marks)*

Answer: Elasticity = [(80 - 100) / 90] / [(12 - 10) / 11] = -0.2222 / 0.1818 = --1.2222, absolute value 1.22. Elasticity differs across ranges because the availability of substitutes, the share of income spent and the level of satisfaction already reached all change.

Question 2: Equilibrium, a Per-unit Tax and Tax Incidence

In a market the demand function is Qd = 200 - 5P and the supply function is Qs = 20 + 3P, where P is in dollars and Q is in thousands of units. The government then imposes a per-unit tax of $4 collected from sellers.

Find the equilibrium price and quantity before the tax. *(5 marks)*

Answer: 200 - 5P = 20 + 3P, so 8P = 180, P = $22.5 and Q = 20 + 3 x 22.5 = 87.5 thousand units.

Find the post-tax equilibrium price, quantity and the price sellers actually keep. *(5 marks)*

Answer: New supply Qs = 20 + 3(P - 4) = 8 + 3P; 200 - 5P = 8 + 3P gives P = $24.0, Q = 80.0 thousand units and sellers keep $20.0.

Calculate how much of the tax is borne by buyers and by sellers, and the government tax revenue. *(5 marks)*

Answer: Buyers bear 24 - 22.5 = $1.5 and sellers bear 4 - 1.5 = $2.5. Revenue = $4 x 80.0 thousand = $320 thousand.

Using the elasticities at equilibrium (demand -1.286, supply 0.771), explain why sellers bear the larger share. *(3 marks)*

Answer: The absolute demand elasticity 1.286 exceeds the supply elasticity 0.771, and the less elastic side bears more of the tax; sellers adjust output less readily, so they bear $2.5 against the buyers' $1.5.

Question 3: Consumer Surplus, Producer Surplus and Deadweight Loss

Use the pre-tax demand and supply functions from Question 2 (Qd = 200 - 5P, Qs = 20 + 3P).

Find the consumer surplus before the tax, in thousand dollars. *(5 marks)*

Answer: Demand gives P = $40 at Q = 0. Consumer surplus = 0.5 x (40 - 22.5) x 87.5 = $766 thousand.

Find the producer surplus before the tax, in thousand dollars. *(4 marks)*

Answer: Supply gives P = $0 at Q = 20. Producer surplus = 0.5 x 22.5 x (87.5 - 20) = $759 thousand.

Find the consumer and producer surplus after the tax, in thousand dollars. *(4 marks)*

Answer: Consumer surplus = 0.5 x (40 - 24.0) x 80.0 = $640 thousand; producer surplus = 0.5 x 20.0 x (80.0 - 20) = $600 thousand.

Calculate the deadweight loss and state the two parts it consists of. *(4 marks)*

Answer: Deadweight loss = 0.5 x $4 x (87.5 - 80.0) = $15 thousand: the lost consumer surplus plus the lost producer surplus on the 7.5 thousand units no longer traded.

Question 4: Comparing a Price Ceiling with a Quota

Still using Qd = 200 - 5P and Qs = 20 + 3P. The government considers two interventions: (A) a price ceiling of $18; (B) a sales quota of 60 thousand units.

Under the $18 ceiling, find quantity demanded, quantity supplied and the shortage. *(5 marks)*

Answer: Qd = 200 - 5 x 18 = 110 thousand; Qs = 20 + 3 x 18 = 74 thousand; shortage = 110 - 74 = 36 thousand.

Under the 60 thousand unit quota, find the market price. *(4 marks)*

Answer: Supply is fixed at 60 thousand units, so demand sets the price: 200 - 5P = 60 gives P = $28.

Under the ceiling buyers pay only $18 while some would pay more. Describe the non-price competition that arises and state whether the value buyers would have paid but did not is counted as consumer surplus. *(3 marks)*

Answer: Queuing, first-come-first-served, gifts or ration coupons and similar non-price competition appear, wasting resources and time. The value buyers would have paid is not counted as consumer surplus, because only 74 thousand units trade and 36 thousand are unavailable.

Calculate consumer surplus under each intervention and judge which is better for consumers. *(4 marks)*

Answer: Consumer surplus under the ceiling = 0.5 x (40 - 18) x 74 = $814 thousand; under the quota = 0.5 x (40 - 28) x 60 = $360 thousand. By consumer surplus the ceiling is higher ($814 thousand against $360 thousand), but it brings a shortage of 36 thousand units.

Question 5: Cost, Profit Maximisation and Shutdown

A perfectly competitive firm has total cost TC = 500 + 20Q + 0.5Q^2 in dollars, and the market price is $60.

Find the marginal cost function and the profit-maximising output. *(5 marks)*

Answer: MC = 20 + Q; setting MC = P gives 20 + Q = 60, so Q = 40 units.

Calculate the profit at that output. *(4 marks)*

Answer: TR = 60 x 40 = $2400; TC = 500 + 800 + 800 = $2100; profit = $300.

If the price falls to $30, find the profit-maximising output and profit, and decide whether the firm should shut down at once. *(4 marks)*

Answer: MC = 30 at Q = 10; TC = 500 + 200 + 50 = $750; profit = $300 - $750 = -$450. Minimum average variable cost is $20, below the $30 price, so the firm should keep producing in the short run: the loss is smaller than the $500 fixed cost lost by shutting down.

Explain how economies of scale and external economies lower long-run average cost, giving one example of each. *(3 marks)*

Answer: Internal economies of scale come from the firm's own larger output: finer division of labour, specialised machinery and bulk buying cut unit cost. External economies come from industry-wide expansion: shared skilled labour, supplier networks and infrastructure shift each firm's LAC down.

Question 6: Factor Demand and Marginal Revenue Product

A firm uses only labour as a variable factor. The marginal product of the 1st to 5th worker per day is 10, 9, 7, 5 and 3 units. The product price is $50 and the daily wage is $400.

Calculate the marginal revenue product (MRP) of each worker and find the profit-maximising employment. *(6 marks)*

Answer: MRP = MPP x $50, giving $500, $450, $350, $250 and $150. Hire while MRP is at least the $400 wage: worker 2 gives $450 but worker 3 gives only $350, so 2 workers are hired.

If the product price rises to $60, find the new employment and explain. *(4 marks)*

Answer: MRP becomes $600, $540, $420, $300 and $180; worker 3 gives $420, at least $400, so 3 workers are hired. A higher product price shifts the MRP curve right and raises factor demand.

If the wage rises to $480 while the product price stays at $50, how does employment change? *(3 marks)*

Answer: MRP is $500, $450, $350 ... and only the first worker's $500 reaches $480, so employment falls from 2 to 1; a higher wage moves the firm along its MRP curve.

Explain why factor demand is called a derived demand. *(2 marks)*

Answer: A firm hires a factor not for its own sake but to produce goods for sale; factor demand rises only when product demand, product price or factor productivity rises.