ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2014
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FINAL EXAMINATION ANSWER KEY

Version A

I. Multiple choice

(1)b. (2)d. (3)e. (4)e. (5)b. (6)c. (7)b. (8)b. (9)c. (10)c.
(11)b. (12)c. (13)d. (14)e. (15)a. (16)e. (17)c. (18)c. (19)a. (20)a.

I. Short answer

(1) a. inelastic. b. decrease. c. 4 %. d. increase. e. 1 %.
(2) a. \$3. b. 10 units. c. \$12. d. 3 units. e. -4 units. f. -3 units.

III. Problems

(1) a. $180 = 10\, x_1^{1/2}\, x_2^{1/2}$.

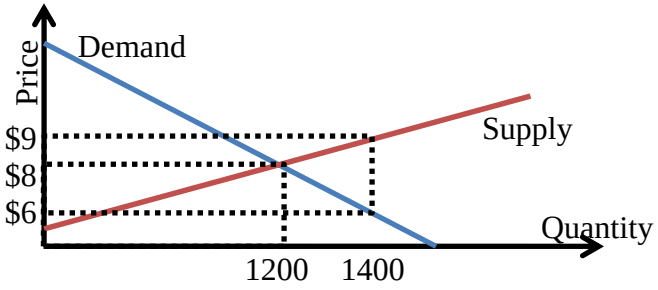
b. $MRSP = MP_2/MP_1 = \dfrac{10\, x_1^{1/2} \left(\frac{1}{2}\right) x_2^{-1/2}}{10 \left(\frac{1}{2}\right) x_1^{-1/2}\, x_2^{1/2}} = x_1/x_2$.

c. Set MRSP = \$10/\$40 and solve jointly with $180 = 10\, x_1^{1/2}\, x_2^{1/2}$, to get $x_1^*=9$ and $x_2^*=36$.

d. TC(180) = 9×\$40 + 36×\$10 = \$720.

(2) a. Set $P_D = P_S$ and solve to get $Q^*=1200$ and $P^*=P_D=P_S=\$8$.

b. Set $P_D + \$3 = P_S$ and solve to get $Q_{SUB} = 1400$. Incidentally, $P_D = \$6$, $P_S = \$9$.



c. Consumer surplus increases by \$2600, the area of the lower trapezoid.

d. Producer surplus increases by \$1300, the area of the upper trapezoid.

e. The country as a whole loses because the government must pay \$3×1400 = \$4200 for the subsidy program. The deadweight loss is \$300.

(3) a. MC(Q) = dTC/dQ = 1 + (Q/10).

b. AC(Q) = TC/Q = 1 + Q/20.

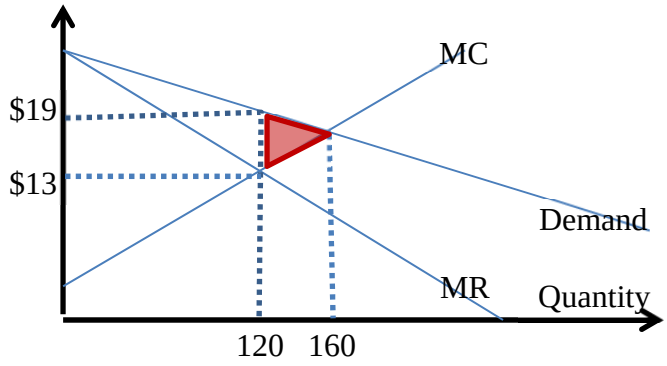
c. Rev(Q) = P×Q = 25Q – (Q^2/20), so MR = dRev/dQ = 25 – (Q/10).

d. Set MC(Q) = MR(Q) and solve to find Q* = 120.

e. Substitute into demand curve: P* = 25 – (120/20) = \$19.

f. Profit = Rev(Q) – TC(Q) = \$1440.

g. The efficient level of output is where the marginal cost curve intersects the demand curve, that is, where MC=P. Set 1 + (Q/10) = 25 – (Q/20) and solve to find Q = 160. Deadweight loss is the area of the triangle bounded by the demand curve, the marginal cost curve, and a vertical line at the monopolist's quantity, 120. So DWL = \$120, the area of the red triangle below.



(4) a. Set $P_D = P_S$ and solve to get $Q^{**}=100$ and $P^{**}=P_D=P_S=\$7$.
b. $MSB = P_D + MEB = 26 – (3Q/20)$.
c. Set $MSB = P_S$ and solve to get $Q^* = 120$.
d. Pigou subsidy rate = MEB when Q = 120, that is, \$3 per vaccine.

(5) a. Set ATS(Q) = 0 and solve to get $Q^{**} = 200$ cars.
b. $TTS(Q) = ATS(Q) \times Q = 20\,Q – Q^2/10$.
c. Maximize TTS by setting its derivative equal to zero. Now $dTTS/dQ = 20 – (2Q/10)$. Set this equal to zero and solve to get $Q^* = 100$ cars.
d. TTS(200) = 4000 minutes. ATS(100) = 10 minutes per car.
e. The fee that makes the average driver indifferent is the fee that equals $ATS(100) \times \$0.50 = 10 \times \$0.50 = \$5$.

(6) a. $P_D = EL + \$40 = 340 – 0.2\,Q$.
b. $MC = EL = 300 – 0.2\,Q$.
c. Everyone would get insurance, because P_D (willingness-to-pay) is greater than MC for every value of Q.
d. $AC = 300 – 0.1\,Q$. Note that this is effectively the long-run supply curve (P_S) for insurance, since with free entry and exit, firms must break even.
e. Set $AC = P_D$ and solve to get $Q^{**} = 400$. In the long run, price must equal average cost, so $P^{**} = AC(400) = \$260$.

IV. Essay

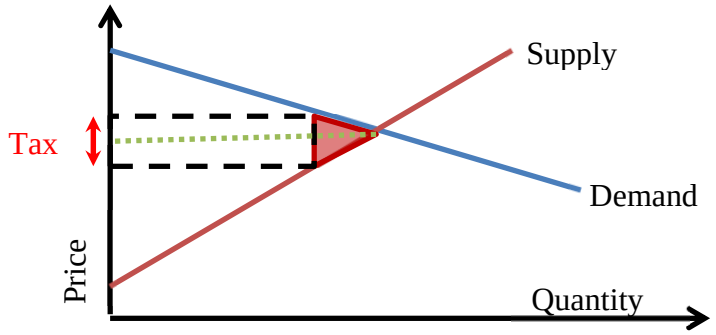
One should *disagree* with this statement. Economic efficiency is *not* maximized when production is maximized. Instead, economic efficiency is maximized when the marginal benefit to consumers of the last unit produced equals the marginal cost of producing that unit.

In an unregulated competitive market, assuming no externalities, marginal benefit is represented by the demand curve and marginal cost is represented by the supply curve. Equilibrium therefore occurs where the two are equal—at the economically efficient level of production.

When a tax is imposed on a competitive market, demanders pay more in total than suppliers receive—the difference is paid to the government. A tax therefore creates a wedge

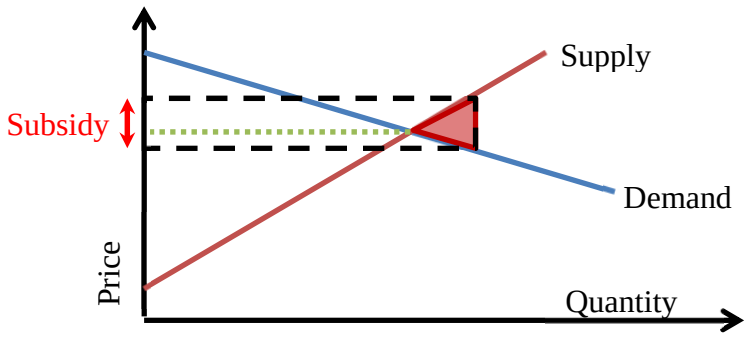
between marginal benefit and marginal cost, causing *too little* to be produced. A tax therefore reduces economic efficiency. There are at least two ways to show this.

1. With a tax, some demanders who are willing to pay the marginal cost of production choose not to buy the product, because the tax raises the price that demanders must pay to a level above the marginal cost of production. So taxes do indeed discourage production and reduce economic efficiency. The loss of efficiency from too little production is measured by deadweight loss, shown as the area of the red triangle in the graph below.
2. A tax creates losses for consumers and producers that are greater than the tax revenue collected by the government. In the graph below, consumer surplus decreases by the area of the upper trapezoid, producer surplus decreases by the area of the lower trapezoid, and the government collects tax revenue equal to the area of the dashed rectangle. Clearly, the revenue collected by the government is less than the loss of consumer and producer surplus. The difference is the loss of economic efficiency, called deadweight loss, measured by the area of the red triangle.



However, a subsidy does *not* increase economic efficiency. When a subsidy is imposed on a competitive market, demanders pay less than suppliers receive in total—the difference is paid by the government. A subsidy therefore creates a negative wedge between marginal benefit and marginal cost, causing *too much* to be produced. A subsidy therefore also reduces economic efficiency. There are at least two ways to show this.

1. With a subsidy, some demanders who are *not* willing to pay the marginal cost of production choose to buy the product anyway, because the subsidy lowers the price that demanders pay to a level below the cost of production. So subsidies encourage production, but they nevertheless *reduce* economic efficiency, because the benefit of the last few units produced is *less* than their cost. The loss of efficiency from too much production is measured by deadweight loss, shown as the area of the triangle in the graph below.
2. A subsidy creates gains for consumers and producers that are less than the direct cost of the subsidy program to the government. In the graph below, consumer surplus increases by the area of the lower trapezoid, producer surplus decreases by the area of the upper trapezoid, and the subsidy program costs the government an amount equal to the area of the dashed rectangle. Clearly, the cost of the program is greater than the loss of consumer and producer surplus. The difference is the loss of economic efficiency, called deadweight loss, measured by the area of the red triangle.



Version B

I. Multiple choice

(1)d. (2)d. (3)b. (4)b. (5)d. (6)a. (7)c. (8)c. (9)b. (10)a.
(11)d. (12)c. (13)a. (14)c. (15)b. (16)d. (17)d. (18)b. (19)c. (20)b.

I. Short answer

(1) a. elastic. b. decrease. c. 7 %. d. decrease. e. 2 %.
(2) a. \$3. b. 9 units. c. \$6. d. 5 units. e. -3 units. f. -1 unit.

III. Problems

(1) a. $120 = 2\, x_1\, x_2$, or $60 = x_1\, x_2$.

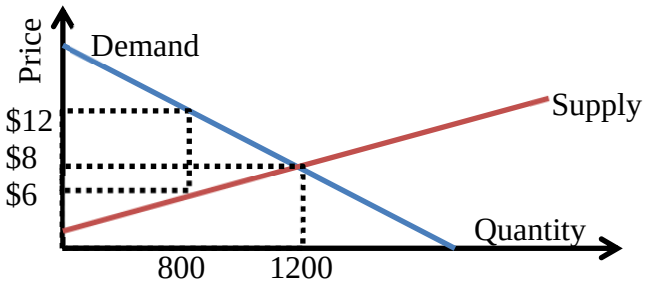
b. $MRSP = MP_2/MP_1 = \frac{2\,x_1}{2\,x_2} = x_1/x_2$.

c. Set MRSP = \$20/\$70 and solve jointly with $60 = x_1\, x_2$, to get $x_1^*=4$ and $x_2^*=15$.

d. TC(120) = 4×\$75 + 15×\$20 = \$600.

(2) a. Set $P_D = P_S$ and solve to get $Q^*=1200$ and $P^*=P_D=P_S=\$8$.

b. Set $P_D = P_S + \$6$ and solve to get $Q_{TAX} = 800$. Incidentally, $P_D = \$12$, $P_S = \$6$.



c. Consumer surplus decreases by \$4000, the area of the higher trapezoid.

d. Producer surplus decreases by \$2000, the area of the lower trapezoid.

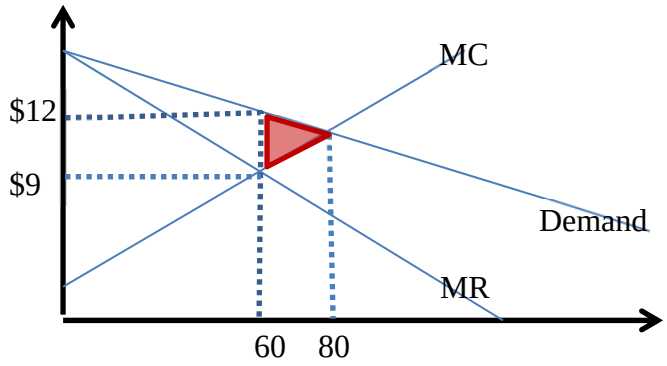
e. The country as a whole loses even though the government collects \$6×800 = \$4800 in tax revenue. The deadweight loss is \$1200.

(3) a. MC(Q) = dTC/dQ = 3 + (Q/10).

b. AC(Q) = TC/Q = 3 + (Q/20).

c. Rev(Q) = P×Q = 15Q – (Q^2/20), so MR = dRev/dQ = 15 – (Q/10).

d. Set MC(Q) = MR(Q) and solve to find Q* = 60.
e. Substitute into demand curve: P* = 15 – (60/20) = $12.
f. Profit = Rev(Q) – TC(Q) = $360.
g. The efficient level of output is where the marginal cost curve intersects the demand curve, that is, where MC=P. Set 3 + (Q/10) = 15 – (Q/20) and solve to find Q = 80. Deadweight loss is the area of the triangle bounded by the demand curve, the marginal cost curve, and a vertical line at the monopolist's quantity, 60. So DWL = $30, the area of the red triangle below.



(4) a. Set $P_D = P_S$ and solve to get $Q^{**}=100$ and $P^{**}=P_D=P_S=\$7$.
b. $MSC = P_S + MEC = 3 + (Q/10)$.
c. Set $MSC = P_D$ and solve to get $Q^* = 70$.
d. Pigou subsidy rate = MEC when Q = 70, that is, $4.50 per vaccine.

(5) a. Set ATS(Q) = 0 and solve to get $Q^{**} = 400$ cars.
b. $TTS(Q) = ATS(Q) \times Q = 40\,Q - Q^2/10$.
c. Maximize TTS by setting its derivative equal to zero. Now $dTTS/dQ = 40 - (2Q/10)$. Set this equal to zero and solve to get $Q^* = 200$ cars.
d. TTS(200) = 4000 minutes. ATS(200) = 20 minutes per car.
e. The fee that makes the average driver indifferent is the fee that equals $ATS(200) \times \$0.50 = 20 \times \$0.50 = \$10$.

(6) a. $P_D = EL + \$70 = 470 - 0.2\,Q$.
b. $MC = EL = 400 - 0.2\,Q$.
c. Everyone would get insurance, because P_D (willingness-to-pay) is greater than MC for every value of Q.
d. $AC = 400 - 0.1\,Q$. Note that this is effectively the long-run supply curve (P_S) for insurance, since with free entry and exit, firms must break even.
e. Set $AC = P_D$ and solve to get $Q^{**} = 700$. In the long run, price must equal average cost, so $P^{**} = AC(700) = \$330$.

IV. Essay
Same as Version A.

[end of answer key]