ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2022
William M. Boal

FINAL EXAMINATION ANSWER KEY

Version A

I. Multiple choice

(1)b. (2)a. (3)b. (4)c. (5)d. (6)d. (7)f. (8)c. (9)b. (10)d.
(11)b. (12)a. (13)a (14)c. (15)a. (16)c. (17)c. (18)d. (19)b. (20)a.
(21)a. (22)d. (23)b.

II. Multiple answer

Which of the following types of market failure cause *too little* of the good or service to be produced?

a. Monopoly YES
b. External cost NO
c. External benefit YES
d. Adverse selection YES

III. Short answer

(1) a. elastic. b. decrease. c. 6 %.
d. decrease. e. 1 %.

(2) a. $\varepsilon^{comp} = -0.29$. b. decrease. c. 3 %.
d. decrease e. 2.9 % (applying ε^{comp}).

(3) a. 3 units. b. 4 units. c. \$100.
d. 2 units. c. \$140.

(4) a. \$5. b. 10 thousand. c. \$3 per watermelon.
d. \$6 per watermelon. e. increase. f. \$9 thousand.
g. increase. h. \$18 thousand. i. \$30 thousand.
j. \$3 thousand.

(5) a. 3 units of clothing. b. 1/3 units of food. c. slope = -3.
d. P_{food} = \$18, because slope of each consumer's budget line = $-P_{food}/P_{clothing} = -3$.

(6) a. $P_A = MC / (1 + [1/\varepsilon_A]) = \$16$.
b. $P_C = MC / (1 + [1/\varepsilon_C]) = \$10$.

(7) a. Zero concerts, because MC > MB for all positive values of Q.
b. MSB = 1000 (20-2Q) = 20,000 - 2000 Q.
c. 8 concerts (found by setting MSB = MC and solving for Q).

(8) a. Pareto optimal: yes, no, yes, yes.
b. Dominant-strategy equilibria: no, yes, no, no.
c. Nash equilibria in pure strategies: no, yes, no, no.

IV. Problems

(1) [Budgets and choice]

a. Equation for budget line (income=spending): $100 = 5\,q_1 + 8\,q_2$.

b. $MRSC = MU_2/MU_1 = (q_1-4) / q_2$.

c. Solve the tangency condition ($MRSC = p_2/p_1 = 8/5$) jointly with equation for budget line (see part a) to get $q_1^* = 12$, $q_2^* = 5$.

(2) [Cost curves; Long-run market equilibrium]

a. $AC = TC/q = 0.01\,q^2 - q + 40$.

Set $0 = dAC/dq = 0.02\,q - 1$ and solve to get $q_{ES} = 50$.

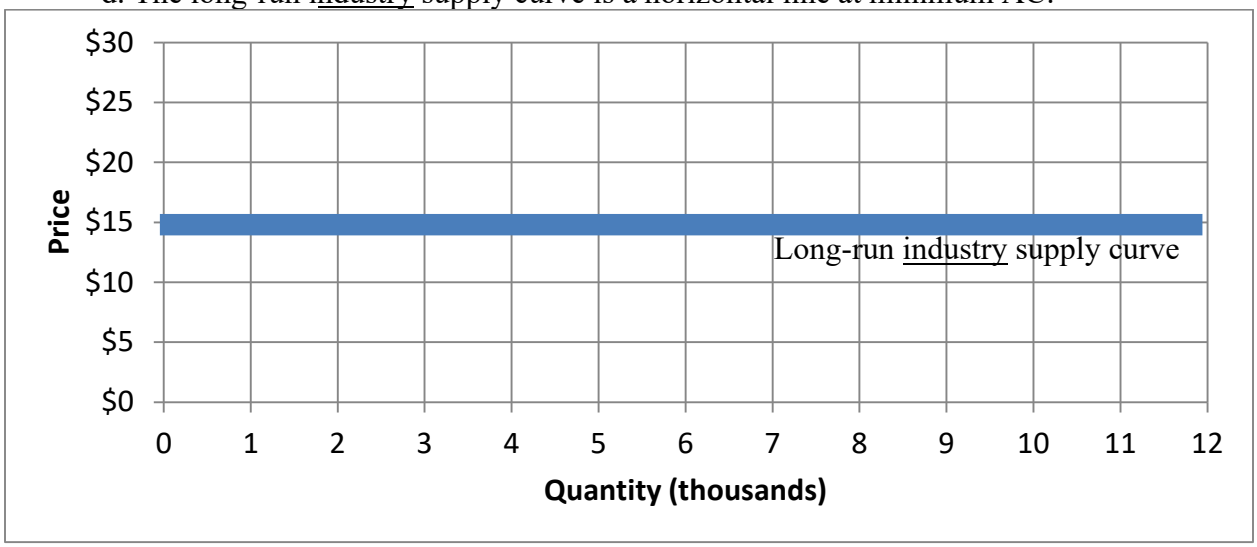
b. Breakeven price = minimum AC = $AC(q_{ES}) = \$15$.

c. A firm's supply curve shows how much the firm will produce for any given price. If P>minimum average cost, the profit-maximizing firm will choose an output level where P=MC(q), and if P<minimum average cost, it will produce nothing. So the firm's supply curve is given by the following equations.

If $P \geq \$15$, $P = MC(q) = dTC/dq = 0.03\,q^2 - 2\,q + 40$.

If $P \leq \$15$, $q=0$ (firm shuts down).

d. The long-run industry supply curve is a horizontal line at minimum AC:



(3) [Monopoly, profit maximization]

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

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

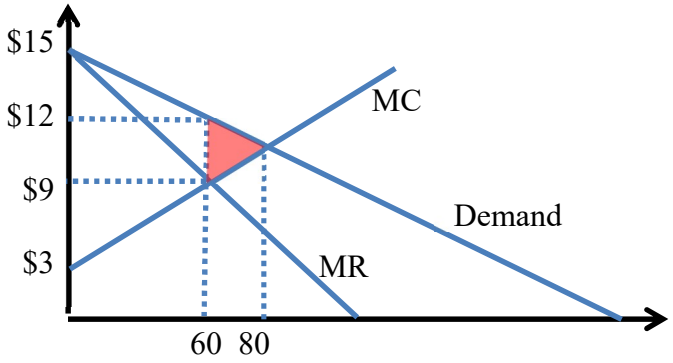
c. First find total revenue $= P \times Q = 15Q - (Q^2/20)$. So $MR = dTR/dQ =$ **$15 - (Q/10)$.**

d. Set MC = MR and solve to get $Q_M =$ **60**.

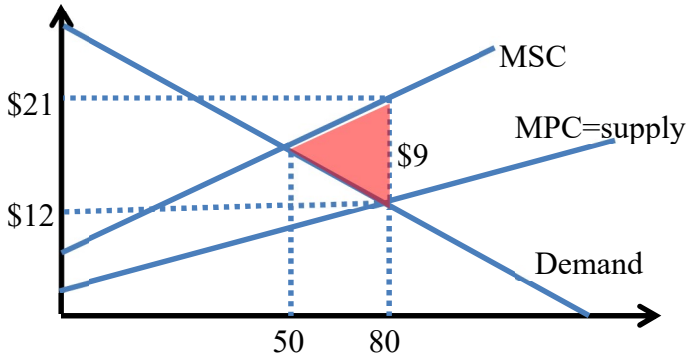
e. Substitute into demand function: $P_M = 15 - (60/20) =$ **$12**.

f. Profit = TR – TC = $(60 \times 10) - (60 + 60^2/20) =$ **$360**.

g. The efficient level of output lies where marginal cost intersects demand ("marginal cost pricing"). Find this quantity by setting $13 - (Q/20) = 1 + (Q/10)$, which yields Q=80. Then find $MC(60) = 1 + (60/20) = \$4$. Then evaluate DWL as the area of a triangle: **$30** (see red triangle below).



(4) [External cost and Pigou tax]
a. Set $P_D = P_S$ and solve to get Q** = 80, P = $12.
b. MSC = P_S + MEC = 5 + (2Q/10).
c. Set MSC = P_D and solve to get Q* = 50.
d. DWL = (1/2) × (80-50) × 9 = $135 (see red triangle below).
e. Pigou tax rate = MEC(50) = $6.

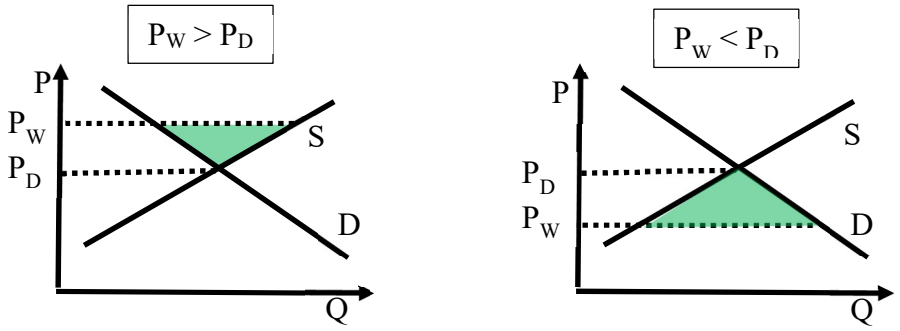


(5) [Uncertainty, risk aversion, demand for insurance.] U(I) = 30 – (200/I)
a. E(I) = (0.5 × 40) + (0.5 × 10) = $25 .
b. E(U) = 0.5 × (10 – 80/40) + 0.5 × (10 – 80/10) = 5 utils.
c. Set U(I) = 10 – 80/I = 5 and solve to get I* = $16 .
d. Willing to pay $40 - $16 = $24.
e. Fair insurance premium = 0.5 × $30 = $15 .

(6) [Hidden characteristics and adverse selection]
a. P_D = 20 + EL = 220 – 0.1 Q.
b. MC = EL = 200 – 0.1 Q.
c. If the market were efficient, everyone (Q=1000) would get insurance because everyone is willing to pay more than the marginal cost of insurance: P_D > MC for all values of Q.
d. AC = 200 – 0.05 Q.
e. Set P_D = AC and solve to get Q** = 400. P** = AC(400) = $180.

V. Critical thinking

(1) One should *reject* this proposal regarding international trade, because there is *always* a gain in social welfare whether the world price is greater than or less than the domestic price. When the world price is greater than the domestic price, the country will export the good, and the resulting increase in producer surplus will be greater than the decrease in consumer surplus. When the world price is less than the domestic price, the country will import the good, and the resulting increase in consumer surplus will be greater than the decrease in producer surplus. So international trade *should be permitted regardless*. The following graphs justify this answer by showing the net gain in social welfare in each case as a green triangle.



(2) An example of such a production function with both diminishing returns to each input separately, but increasing returns to scale, is $\mathbf{q = f(x_1, f_2) = x_1^{2/3} x_2^{2/3}}$.

- There are *diminishing returns to* x_1 because the marginal product of x_1, $(2/3)\, x_1^{-1/3} x_2^{2/3}$, is decreasing in x_1.
- There are *diminishing returns to* x_2 because the marginal product of x_2, $(2/3)\, x_1^{2/3} x_2^{-1/3}$, is decreasing in x_2.
- There are also *increasing returns to scale* because if we multiply x_1 and x_2 by any factor $a>1$, then the result is

  $f(a\, x_1, a\, x_2) = (a\, x_1)^{2/3} (a\, x_2)^{2/3} = a^{2/3} a^{2/3} x_1^{2/3} x_2^{2/3} = a^{4/3} x_1^{2/3} x_2^{2/3} = a^{4/3}\, q > a\, q.$

  The last inequality holds because $a^{4/3} > a$, provided $a>1$. Conclude that multiplying all inputs by any factor $a>1$ causes output to rise by an even greater factor, so the production function has increasing returns to scale.

Version B

I. Multiple choice

(1)d. (2)e. (3)a. (4)c. (5)b. (6)b. (7)d (8)b. (9)d. (10)a.
(11)d. (12)b. (13)b (14)b. (15)b. (16)c. (17)b. (18)d. (19)b. (20)a.
(21)c. (22)b. (23)d.

II. Multiple answer

Which of the following types of market failure cause *too much* of the good or service to be produced?

a. Monopoly NO
b. External cost YES
c. External benefit NO
d. Adverse selection NO

III. Short answer

(1) a. inelastic. b. decrease. c. 7 %.
d. increase. e. 3 %.

(2) a. $\varepsilon^{comp} = -0.18$. b. decrease. c. 8 %.
d. decrease e. 7.2 % (applying ε^{comp}).

(3) a. 3 units. b. 4 units. c. \$100.
d. 8 units. c. \$120.

(4) a. \$5. b. 5 thousand. c. \$9 per watermelon.
d. \$3 per watermelon. e. decrease. f. \$14 thousand.
g. decrease. h. \$28 thousand. i. \$30 thousand.
j. \$12 thousand.

(5) a. 2 units of clothing. b. 1/2 units of food. c. slope = -2.
d. P_{food} = \$12, because slope of each consumer's budget line = $-P_{food}/P_{clothing} = -2$.

(6) a. $P_A = MC / (1 + [1/\varepsilon_A]) = \$9$.
b. $P_C = MC / (1 + [1/\varepsilon_C]) = \$8$.

(7) a. Zero concerts, because MC > MB for all positive values of Q.
b. MSB = 1000 (10-2Q) = 10,000 - 2000 Q.
c. 3 concerts (found by setting MSB = MC and solving for Q).

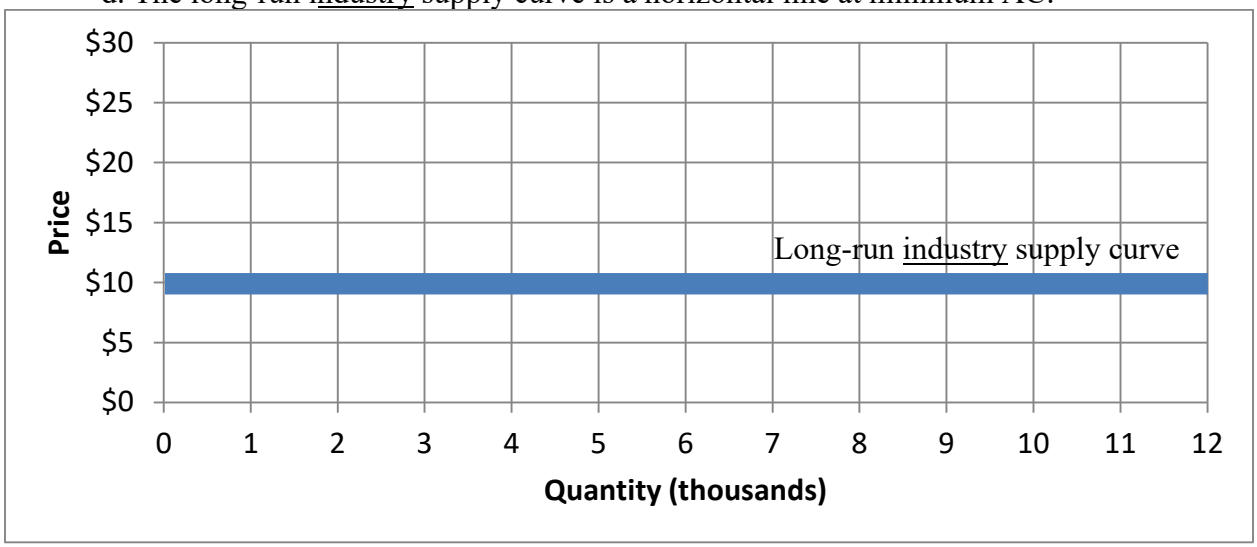
(8) a. Pareto optimal: no, no, yes, yes.
b. Dominant-strategy equilibria: no, no, no, no.
c. Nash equilibria in pure strategies: no, no, yes, yes.

IV. Problems

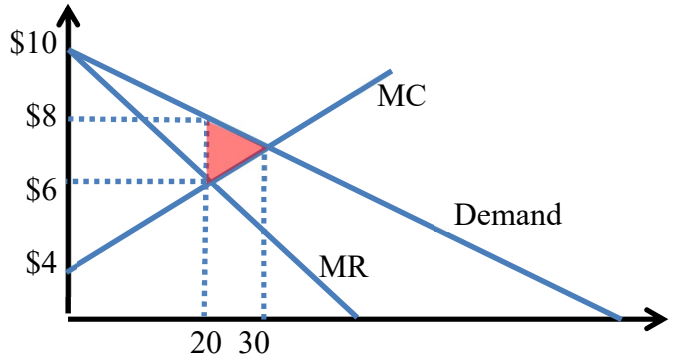
(1) [Budgets and choice]
a. Equation for budget line (income=spending): $100 = 5\ q_1 + 7\ q_2$.
b. $MRSC = MU_2/MU_1 = \frac{q_1+8}{q_2}$.
c. Solve the tangency condition ($MRSC = p_2/p_1 = 7/5$) jointly with equation for budget line (see part a) to get $q_1^* = 6$, $q_2^* = 10$.

(2) [Cost curves; Long-run market equilibrium]
a. $AC = TC/q = 0.01\ q^2 - 0.8\ q + 26$.
Set $0 = dAC/dq = 0.02\ q - 0.8$ and solve to get $q_{ES} = 40$.
b. Breakeven price = minimum AC = $AC(q_{ES}) = \$10$.

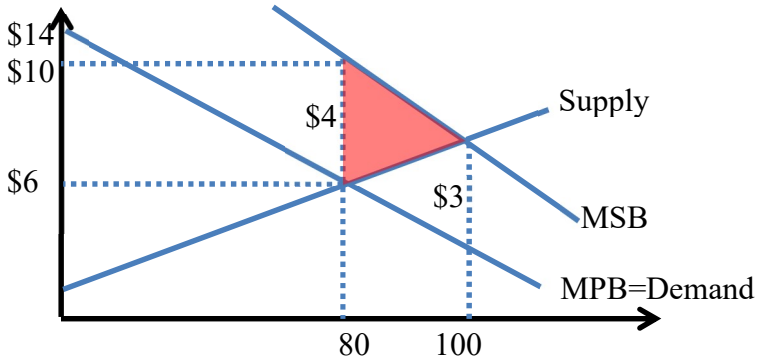
c. A firm's supply curve shows how much the firm will produce for any given price. If P>minimum average cost, the profit-maximizing firm will choose an output level where P=MC(q), and if P<minimum average cost, it will produce nothing. So the firm's supply curve is given by the following equations.
If $P \geq \$10$, $P = MC(q) = dTC/dq = 0.03\,q^2 - 1.6\,q + 26$.
If $P \leq \$10$, $q=0$ (firm shuts down).
d. The long-run industry supply curve is a horizontal line at minimum AC:



(3) [Monopoly, profit maximization]
a. MC = dTC/dQ = **4 + (Q/10).**
b. AC = TC/Q = **4 + (Q/20).**
c. First find total revenue = P×Q = $10Q - (Q^2/10)$. So MR = dTR/dQ = **10 – (2Q/10).**
d. Set MC = MR and solve to get Q_M = **20**.
e. Substitute into demand function: $P_M = 15 - (60/20)$ = **$8**.
f. Profit = TR – TC = $(20\times8) - (4\times20 + 20^2/20)$ = **$60**.
g. The efficient level of output lies where marginal cost intersects demand ("marginal cost pricing"). Find this quantity by setting $10 - (Q/10) = 4 + (Q/10)$, which yields Q=30. Then find MC(220) = 4 + (20/10) = $6. Then evaluate DWL as the area of a triangle: **$10** (see red triangle below).



(4) [External benefit and Pigou subsidy]
a. Set $P_D = P_S$ and solve to get Q** = 80, P = \$6.
b. MSB = P_D + MEB = 22 – (3Q/20).
c. Set MSB = P_S and solve to get Q* = 100.
d. DWL = (1/2) × (100-80) × 4 = \$40 (see red triangle below).
e. Pigou subsidy rate = MEB(100) = \$3.



(5) [Uncertainty, risk aversion, demand for insurance.] U(I) = 15 – (400/I)
a. E(I) = (0.50 × 200) + (0.50 × 50) = \$125 .
b. E(U) = 0.50 × (15 – 400/200) + 0.50 × (15 – 400/50) = 10 utils.
c. Set U(I) = 15 – 400/I = 10 and solve to get I* = \$80 .
d. Willing to pay \$200 - \$80 = \$124.
e. Fair insurance premium = 0.50 × \$150 = \$75 .

(6) [Hidden characteristics and adverse selection]
a. P_D = 60 + EL = 560 – 0.2 Q.
b. MC = EL = 500 – 0.2 Q.
c. If the market were efficient, everyone (Q=1000) would get insurance because everyone is willing to pay more than the marginal cost of insurance: P_D > MC for all values of Q.
d. AC = 500 – 0.1 Q.
e. Set P_D = AC and solve to get Q* = 600. P** = AC(600) = \$440.

V. Critical thinking
Same as version A.

[end of answer key]