Lecture8-9

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Lecture8-9

Lecture 8-9: Price Discrimination

Mauricio Romero

Lecture 8-9: Price Discrimination

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- In real life, firms often have different prices for different consumers/units
- We will explore some of these now
- In a competitive market such exotic pricing schemes could never arise since $\boxed{p = \text{marginal cost}}$

Lecture 8-9: Price Discrimination

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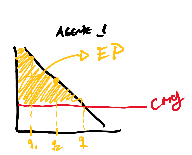
- Suppose the firm can observe all characteristics of the consumer (DISPONIBILIDAD A PAGAR)
- What should the firm do?



- Suppose the firm can observe all characteristics of the consumer
- What should the firm do?
- Demand curve illustrates the willingness to pay for the q-th unit of the product

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- What should the firm do?
- Demand curve illustrates the willingness to pay for the q-th unit of the product

- Firm can extract all of the surplus of the consumer. How?

- Firm will price at $p(q)$ for the q-th unit and continue to produce until $p(q) = MC(q)$

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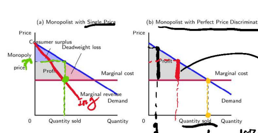
- Firm gets all of the consumer surplus as his profits:

$$\Pi = \int_0^{q^*} (p(q) - c'(q))dq = \int_0^{q^*} p(q)dq - c(q^*),$$

where q^* is the quantity at which $p(q^*) = c'(q^*)$.



PBS=0 ¿EFICIENTE? "PARETO"

PRECIO? No es UNICO

q

$q^{1er\ GRADO} = q^*_{Eq.\ Comp}$

- Firm can do this is because it knows the exact demand curve of each consumer
- Such activity is prohibited in many countries

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- Amazon tries to estimate everyone's demand curve

RAPPI → DATOS

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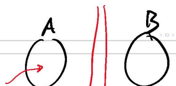
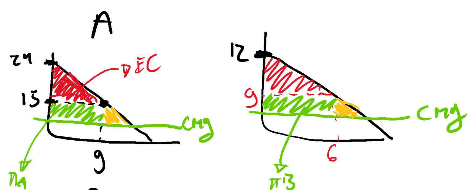


MONOPOLISTA: $\pi(P) = \boxed{q(P)}P - C(q(P))$

- Market is segmented (no re-selling across markets)
- Firm knows the characteristics of each market (demand curve)
- Consider the following example: Two kinds of consumers:

$$\boxed{q_A(p_A) = 24 - p_A}$$
$$q_B(p_B) = 24 - 2p_B.$$

- constant marginal cost of production of $\boxed{6}$



If the firm were allowed to set different prices in the different markets, then he would choose:

$$\pi_A: \max_{p_A} \underbrace{(24 - p_A)}_{q_A}\underbrace{(p_A - 6)}_{(P-C)} \Longrightarrow p_A^* = 15, \quad q_A = 9,\ \pi_A = 9(9) = 81,\ EC_A = \frac{\overbrace{(24-15)}^{a} \cdot \overbrace{9}^{b}}{2} = 81/2$$
$$\pi_B: \max_{p_B} \underbrace{(24 - 2p_B)}_{q_B}(p_B - 6) \Longrightarrow p_B^* = 9., \quad q_B = 6,\ \pi_B = 6(3) = 18,\ EC_B = \frac{3 \cdot 6}{2} = 18/2$$

Total consumer surplus (CS) and profits of the firm in each market:

$$\pi_A^* = 81, \pi_B^* = 18, CS_A = 40.5, CS_B = 9.$$

$\boxed{\text{UNICO PRECIO}}$

$q_A = 24 - P$

$q_B = 24 - 2P$

$\Downarrow$

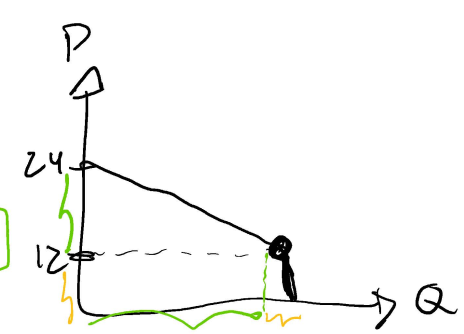
$q_A = \max(0, 24 - P)$

$q_B = \max(0, 24 - 2P)$

$\hookrightarrow q_A = 0$ si $P \geq 24$

$q_B = 0$ si $P \geq 12$

$$Q_T = \begin{cases} 48 - 3P & P \leq 12 \\ 24 - P & 12 \leq P \leq 24 \\ 0 & P \geq 24 \end{cases}$$



Firm chose to set the same price in each market. Then he would maximize the following:

$$\max\left\{\max_{p \geq 12}(24 - p)(p - 6), \max_{p < 12}(24 - p)(p - 6) + (24 - 2p)(p - 6)\right\}$$
$$= \max\{81, 75\} = 81$$

$$\max_{P}\ Q(P)P - C(Q(P))$$

- Price of $p^* = 15$ in both markets, which leads to only consumers in market A buying
- To summarize, the consumer surplus and profits in each market are:

$$\pi_A^* = 81, \pi_B^* = 0, CS_A = 40.5, CS_B = 0.$$

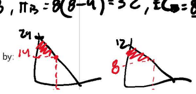
- Prohibiting third degree price discrimination can exclude a whole market altogether
- Highly inefficient compared to the social welfare outcome given third degree price discrimination

- Suppose that the constant marginal cost of production is now $\boxed{4}$ instead of $\boxed{6}$
- With third degree price discrimination, the firm sets the following prices:

$$\pi_A = \max_{p_A}(24 - p_A)(p_A - 4) \Longrightarrow p_A^* = 14, \quad q_A = 10,\ \pi_A = 10(14-4) = 100,\ EC_A = \frac{10(10)}{2} = 50$$
$$\pi_B = \max_{p_B}(24 - 2p_B)(p_B - 4) \Longrightarrow p_B^* = 8., \quad q_B = 8,\ \pi_B = 8(8-4) = 32,\ EC_B = \frac{8(4)}{2} = 16$$

- In this case, the profits and consumer surplus in each market is given by:

$$\pi_A^* = 100, \pi_B^* = 32, CS_A = 50, CS_B = 16, \boxed{TS = 198.}$$



$\pi_B = \max_{p_B}(24 - 2p_B)(p_B - 4) \Longrightarrow p_B^* = 8.$, $q_B = 8$, $\pi_B = 8(8-4) = 32$, $EC_B = \frac{8(4)}{2} = 16$

- In this case, the profits and consumer surplus in each market is given by:

$$\pi_A^* = 100, \pi_B^* = 32, CS_A = 50, CS_B = 16, \boxed{TS = 198.}$$

- If the firm were prohibited from using third degree price discrimination, then:

$$\max\left\{\max_{p\geq 12}(24-p)(p-4), \max_{p<12}(48-3p)(p-4)\right\} = \max\{100, 108\} = 108.$$

- $\boxed{p = 10}$
- profits in both markets and the consumer surplus in both markets:

$$\boxed{\pi_A^* = 84, \pi_B^* = 24} \; CS_A = 98, CS_B = 4, TS = 210.$$

- Consumers in region B are hurt but consumers in region A gain significantly leading to an increase in consumer surplus
- The firm's joint profits are hurt but the total surplus actually increases
- Total surplus decreases

- Third degree price discrimination is considered illegal in many countries and the European union
- It is possible to get around such allegations by claiming that the differential pricing comes from cost reasons

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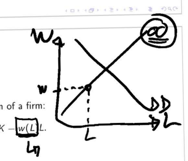
Introduction
First Degree Price Discrimination
Third Degree Price Discrimination
Monopsony
Double Marginalization Problem
Profit Sharing and Double Marginalization

- When someone or some firm is the sole buyer (monopoly is the sole seller)
- Often arises in the context of firms being the sole buyers of labor

- Let us study the profit maximization problem of a firm:

$$\max_{K,L} pf(K,L) - rK - \boxed{w(L)}L.$$



- w is now a function of the amount of labor ~~demanded~~ OFERTA (reflecting the power of the firm in the labor market)

$$\frac{\partial \Pi}{\partial L} = P\frac{\partial f}{\partial L} - w'(L)\cdot L - w(L)\cdot 1 = 0$$

Comp. Perfecta $\quad \Pi: Pf(K,L) - rK - wL \quad \frac{\partial \Pi}{\partial L} = \boxed{P\frac{\partial f}{\partial L} - w = 0} \quad \boxed{\frac{\partial f}{\partial L} = \frac{w}{P}}$

$\max_P \; Q(P)P - C(Q(P))$

SUPONGA $P > 12$

$$\Pi = (24-P)(P-6)$$

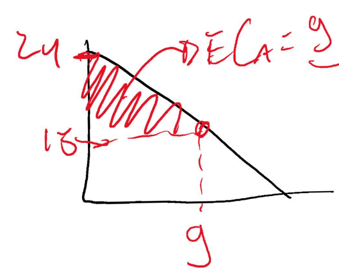
$$\frac{\partial \Pi}{\partial P} = -1(P-6) + (24-P)(1) = 0$$

$$-P + 6 + 24 - P = 0$$

$$30 = 2P$$

$$P^* = 15$$

$$\Pi^* = (24-15)(15-6) = 9\cdot 9 = 81$$



$EC_A = \frac{9\cdot 9}{2} = \frac{81}{2}$

SUPONGA $P < 12$

$$\Pi = (48-3P)(P-6)$$

$$\frac{\partial \Pi}{\partial P} = -3(P-6) + 1(48-3P) = 0$$

$$-3P + 18 + 48 - 3P = 0$$

$$66 = 6P$$

$$P = 11$$

$$\Pi = (48-33)(11-6)$$

$$\Pi = (15)(5) = 75$$

$\boxed{P^{ÚNICO} = 15}$

$\boxed{\Pi = 81}$

P ÚNICO

$$Q_T = \begin{cases} 48-3P & P < 12 \\ 24-P & 12 < P < 24 \\ 0 & P > 24 \end{cases}$$

SUPONGA $P < 12$

$$\Pi = (48-3P)(P-4)$$

$$\frac{\partial \Pi}{\partial P} = \ldots (48-3P) = 0$$

SUPONGA $P > 12$

$$\Pi = (24-P)(P-4)$$

$$\frac{\partial \Pi}{\partial P} = -1(P-4) + 1(24-P) = 0$$

Comp. Perfecta $\quad \pi: pf(K,L) - rK - wL \quad \boxed{\frac{\partial \pi}{\partial L}: p\frac{\partial f}{\partial L} - w = 0} \rightarrow \boxed{\frac{\partial f}{\partial L} = \frac{w}{p}}$

- The first order condition yields:

$$p\frac{\partial f}{\partial L}(K^*, L^*) = w'(L^*)L^* + w(L^*) \Longrightarrow \boxed{pMPL = \boxed{L^* w'} + w.} \quad w^M$$

- In a competitive market $w' = 0$ and so $\boxed{pMPL = w} \rightarrow w^{cp}$
- Wages and labor below the competitive level (an argument for minimum wages and union) $\boxed{w^M < w^{cp}}$

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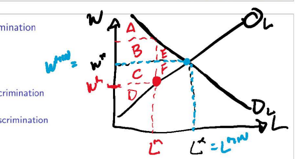
- Third Degree Price Discrimination
- Monopsony
- Double Marginalization Problem
- Profit Sharing and Double Marginalization



Comp. Perfect
EC(Firma): A+B+E
EP(Trabajadores): C+F+D

Monopsonio
EC(Firma): A+B+C
EP(Trab): D
$\boxed{PBS = E+F}$

$\boxed{W\ MIN}$
EC: A+B+E
EP: C+F+D
PBS = 0

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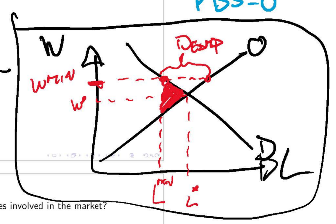

- What happens when there are multiple monopolies involved in the market?

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$$\frac{\partial \pi}{\partial P} = -3(P-4) + 1(48 - 3P) = 0$$

$$-3P + 12 + 48 - 3P = 0$$

$$60 = 6P$$

$$P = 10$$

$$\pi = (18)(6) = 108$$

$$\boxed{P^{UNICO} = 10 \qquad \pi^{UNICO} = 108}$$

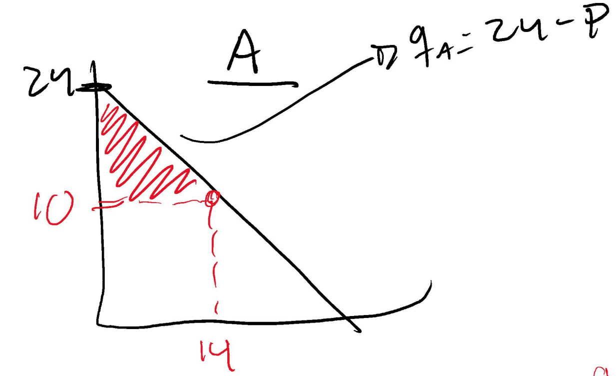
$$\frac{\partial \pi}{\partial P} = -1(P-4) + 1(24 - P) = 0$$

$$-P + 4 + 24 - P = 0$$

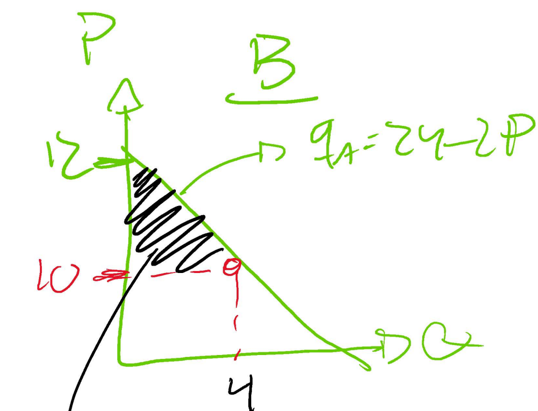
$$28 = 2P$$

$$P = 14$$

$$\pi = 10 \cdot 10 = 100$$



$$EC_A = \frac{14(14)}{2} = 14 \cdot 7 = 98$$



$$EC_B = \frac{4(2)}{2} = 4$$

- What happens when there are multiple monopolies involved in the market?
- Firm A produces factor a at no cost
- Firm b in order to supply q_b units of b must buy q_a units of a
- Firm B produces according to a cost function:

$$C(q_b) = (p_a + c)q_b.$$

- What happens when there are multiple monopolies involved in the market?
- Firm A produces factor a at no cost
- Firm b in order to supply q_b units of b must buy q_a units of a $(1b \rightarrow 1a)$
- Firm B produces according to a cost function:

ocng

$$C(q_b) = (p_a + c)q_b.$$

- Demand equation for good b is linear:

$$q_b(p_b) = 100 - p_b.$$

→ FIRMA B UNICO COMPRADOR DE A

- Firm B's optimization problem becomes:

$$\max_{q_b} \underbrace{(100 - q_b)}_{P_b} q_b - p_a q_b - c q_b.$$

$$\frac{\partial \pi}{\partial q_b} = 100 - 2q_b - P_a - C = 0$$

- Firm B's optimization problem becomes:

$$\max_{q_b} (100 - q_b) q_b - p_a q_b - c q_b.$$

- The first order condition tells us:

$$100 - 2q_b = p_a + c \Longrightarrow \boxed{p_a = 100 - 2q_b - c.}$$

$$\boxed{q_a = q_b}$$

$$\boxed{P_a = 100 - 2q_a - C} \text{ DDa.}$$

- Firm B's optimization problem becomes:

$$\max_{q_b} (100 - q_b) q_b - p_a q_b - c q_b.$$

- The first order condition tells us:

$$100 - 2q_b = p_a + c \Longrightarrow p_a = 100 - 2q_b - c.$$

- Since firm b is the only demander of commodity a, we have:

$$p_a = 100 - 2q_b - c = 100 - 2q_a - c.$$

- If the price is p_a then the q_a that solves the above equation would be the amount demanded of good a

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- If the price is p_a then the q_a that solves the above equation would be the amount demanded of good a
- Thus firm B's maximization problem has given us an inverse demand function for commodity a

- Since firm A is also a monopolist in producing good a, we can solve firm A's maximization problem in the following way:

$$\max_{q_a} q_a \underbrace{(100 - 2q_a - c)}_{P_a}. - ~~c~~\ DC$$

$$\frac{\partial \pi}{\partial q_a} = 100 - 4q_a - c = 0$$

$$\boxed{q_a = \frac{100 - c}{4}}$$

- Since firm A is also a monopolist in producing good a, we can solve firm A's maximization problem in the following way:

$$\max_{q_a} q_a (100 - 2q_a - c).$$

- As a result, we get:

$$100 - 4q_a - c = 0 \Rightarrow q_a^* = \frac{100 - c}{4}, \boxed{p_a^* = 50 - \frac{c}{2}}.$$

- Since firm A is also a monopolist in producing good a, we can solve firm A's maximization problem in the following way:

$$\max_{q_a} q_a (100 - 2q_a - c).$$

- As a result, we get:

$$100 - 4q_a - c = 0 \Rightarrow q_a^* = \frac{100 - c}{4}, p_a^* = 50 - \frac{c}{2}.$$

- Firm a decides to supply the above units of a at a price $50 - c/2$

- Firm B will produce $\boxed{q_b^* = q_a^* = \frac{100-c}{4}}$

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- Then the price is given by:

$$p_b^* = 100 - \frac{100 - c}{4} = 75 + \frac{c}{4}.$$

- Firm B will produce $q_b^* = q_a^* = \frac{100-c}{4}$
- Then the price is given by:

$$p_b^* = 100 - \frac{100 - c}{4} = 75 + \frac{c}{4}.$$

- To summarize, we have:

$$p_a^* = 50 - \frac{c}{2} \quad (1)$$
$$q_a^* = \frac{100 - c}{4} \quad (2)$$
$$p_b^* = 75 + \frac{c}{4} \quad (3)$$
$$q_b^* = \frac{100 - c}{4} \quad (4)$$

$\rightarrow \pi_a^*$

$\rightarrow \pi_b^*$

- **Case 1:** $c = 0$
-

$$\boxed{p_a^* = 50, q_a^* = 25, p_b^* = 75, q_b^* = 25.}$$

- If the firms were to merge so that whatever is produced by one of the firms can be used freely by that firm?
- The monopolists problem becomes:

$$\boxed{\max_q q\underbrace{(100 - q)}_{P_b}.}$$

- The first order condition states that:

$$100 - 2q^* = 0 \Longrightarrow \boxed{q^* = 50, p^* = 50.}$$

- Price of good b comes down from 75 to 50
- Production of good b goes up from 25 to 50
- This increases both the profits of the firm *and* $\boxed{\text{the consumer surplus}}$

$\uparrow$

$$\pi^M = \pi_a + \pi_b$$

$$= \boxed{q_a P_a} + q_b P_b \boxed{- \underbrace{P_a q_b}_{P_a q_a}} - c q_b$$

$$\boxed{\pi^M = q_b P_b - c q_b}$$

$$\boxed{q_b(100 - q_b) - c q_b}$$

- **Case ~~1~~ 2:** $c = 10$
-

$$\boxed{p_a^* = 45, q_a^* = 22.5, p_b^* = 77.5, q_b^* = 22.5.}$$

- If the firms were to merge so that whatever is produced by one of the firms can be used freely by that firm?
- The monopolists problem becomes:

$$\boxed{\max_q q(100 - q) - 10q}$$

- The first order condition states that:

$$100 - 2q = 10 \Longrightarrow \boxed{p^* = 55, q^* = 45.}$$

$\pi^T \uparrow$

- The monopolists problem becomes:

$$\boxed{\max_q q(100-q) - 10q}$$

- The first order condition states that:

$$100 - 2q = 10 \implies \boxed{p^* = 55, q^* = 45.}$$

- ~~This increases both the profits of the firm and the consumer surplus!~~

$\Pi^T \uparrow$

$EC \downarrow$

- What is going on in the above examples?
- because the first firm is a monopolist, it charges a mark up above marginal cost for its intermediate good
- This then distorts the marginal cost of firm B up additionally
- This then leads an even larger mark up on top of this additional marginal cost that affects the price of good b
- Essentially a markup on product a indirectly leads to an even larger markup on the final product b
- This is called the **double marginalization problem**

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- Double marginalization can lead to inefficiently high prices and inefficiently low levels of production
- By merging, both profits of the firm and consumer surplus may simultaneously go up
- Difficult to tell if two firms are merging to solve a double marginalization problem or if they are simply merging to create a monopoly
- What are some potential ways to solve this problem without mergers?
- One possible way might be to engage in profit sharing

- Firms agree to share profits according to the following rule
- Prices charged for good a are zero "ESTUDIOS CINE"
- In exchange, the profits of firm B are shared via a split of α going to firm A and $(1-\alpha)$ going to firm B

NETFLIX

- Firms agree to share profits according to the following rule
- Prices charged for good a are zero
- In exchange, the profits of firm B are shared via a split of α going to firm A and $(1-\alpha)$ going to firm B
- Firm A's decision is trivial. He simply produces $\boxed{q_a = q_b}$
- Firm B chooses to maximize:

$$\max_q (1-\alpha)\left((100-q)q - cq\right) = (1-\alpha)\Big(\overbrace{\max_q (100-q)q - cq}^{\Pi^M}\Big).$$

- Term inside the parentheses is just the monopoly profits if the two firms merged:

$$\Pi_b = (1-\alpha)\max_q \Pi^m(q) \rightarrow \boxed{q^{M\,\text{FUSIÓN}} = q^{CG}}$$

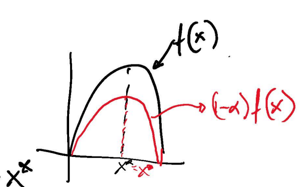
$\Pi_b = P_b q_b - \cancel{P_a} q_b - c q_b$, $P_a \rightarrow 0$

$\Pi_b = (100 - q_b)q_b - c q_b$

$f(x)$

x^*

$(1-\alpha)f(x) \rightarrow x^*$



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- Really, for any α?

- The firms will produce at the monopoly quantities which we were found were strictly greater than if the two firms produced completely separately without any such agreement
- The price will be the monopoly price $p_b^M = p_b^{CG}$, $q_b^M = q_b^{CG}$
- For any $\alpha \in (0, 1)$, we get an increase in consumer surplus and total profits

  $\pi_a^* \le \alpha \pi^M$ $\pi_b^* \le (1-\alpha)\pi^M$
- Really, for any α?
- Such arrangements can break down easily. Profits are hard to verify.

- Profits are usually difficult to verify. However, revenues are much easier to check.

  CDP·q

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- Firms enter into an arrangement where the revenues are shared according to α (firm A) and $(1-\alpha)$ (firm B) split

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- Profits are usually difficult to verify. However, revenues are much easier to check.
- Firms enter into an arrangement where the revenues are shared according to α (firm A) and $(1-\alpha)$ (firm B) split
- Suppose that $\alpha = 1/2$ and $c = 10$. Then firm 2 maximizes:

$$\boxed{\max_q \boxed{\frac{1}{2}} q(100 - q) - 10q.}$$

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$$\max_q \frac{1}{2} q(100-q) - 10q.$$

- The first order condition gives:

$$\boxed{\frac{1}{2}MR(q)} = MC = 10 \Longrightarrow MR(q) = 2MC = 20.$$

$\frac{1}{2}$ Img = Cmg

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- The first order condition gives:

$$\frac{1}{2}MR(q) = MC = 10 \Longrightarrow MR(q) = 2MC = 20.$$

- Firm will produce below monopoly profits since it will produce at a point where $MR = 2MC$ instead of $MR = MC$

- Solving, we get:

$$100 - 2q = 20 \Longrightarrow p^* = 60 > \boxed{p^m = 55}, q^* = 40 < q^m = 45.$$

- Solving, we get:

$$100 - 2q = 20 \Longrightarrow p^* = 60 > p^m = 55, q^* = 40 < q^m = 45.$$

- This does solve the double marginalization problem slightly:

$$p_b^* = 77.5 > p^* = 60, q_b^* = 22.5 < q^* = 40.$$