Firms in the Global Economy

Krugman Chapter 8

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Topics

- The Theory of Imperfect Competition
- Monopolistic Competition and Trade
- Firm Responses to Trade
- Dumping
- Multinationals and Outsourcing
- The Firm's Decision Regarding Foreign Direct Investment (FDI)

The Theory of Imperfect Competition

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Imperfect Competition

	Perfectly Competitive Market	Monopoly	Oligopoly
# of sellers	∞	1	few
Market Price	Taker	Setter	Restrictive Setter
To sell more product,	Just make more product	Lower the price	Lower the price
MR curve	Horizontal	Downward Sloping	Downward Sloping

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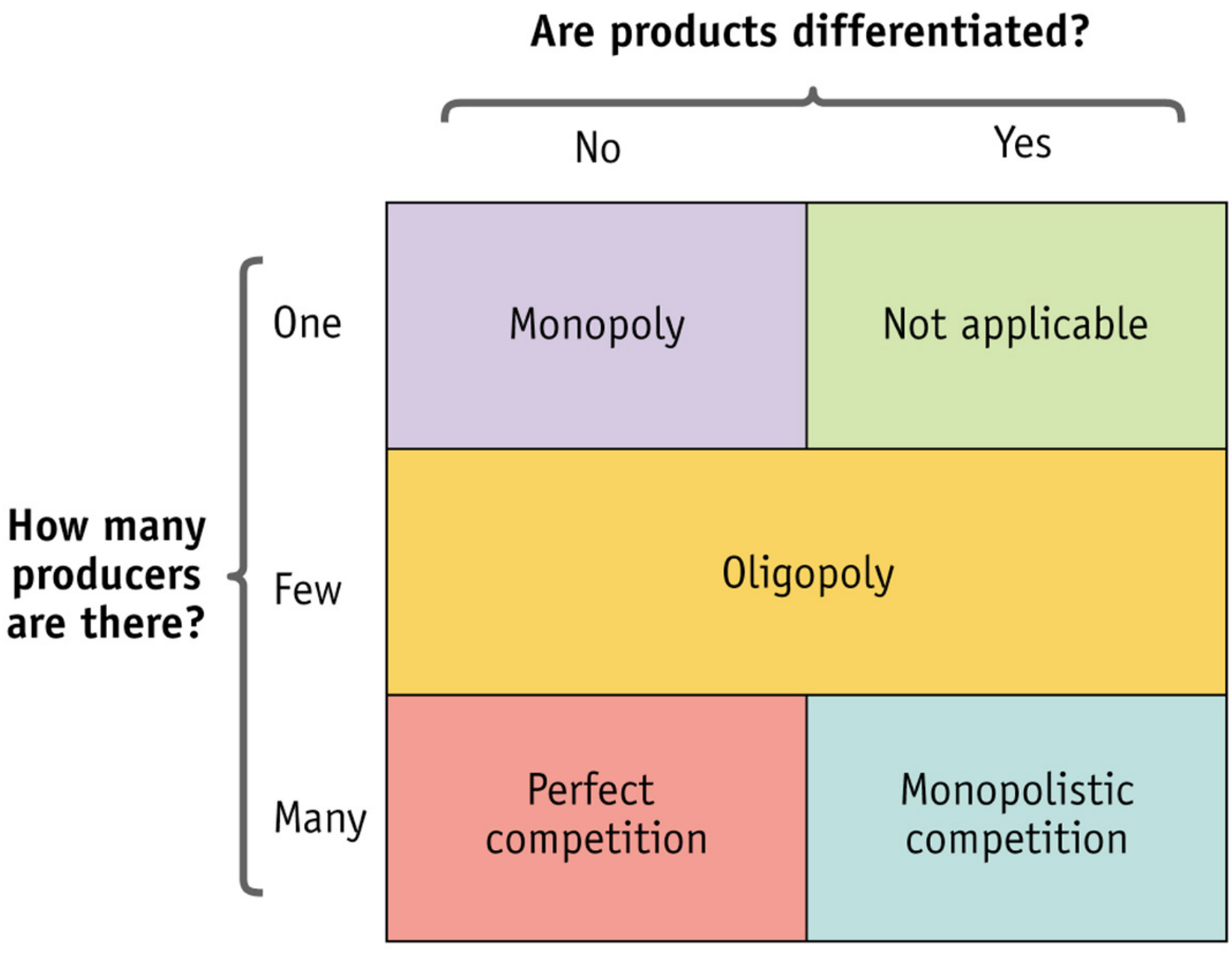
Market Types



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Monopoly: A Brief Review

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Model Setting

- A single monopolistic firm
  - The only firm in this sector
- Demand curve: D
- Downward sloping marginal revenue (MR) curve

Hypothetical Example: An Industry's Demand

Q(EA)	P($)	TR($)	MR($)
0	1000	0	950
1	950	950	850
2	900	1800	750
3	850	2550	650
4	800	3200	550
5	750	3750	450
6	700	4200	350
7	650	4550	250
8	600	4800	150
9	550	4950	50
10	500	5000	-50
11	450	4950	-150
12	400	4800	-250
13	350	4550	-350
14	300	4200	-450
15	250	3750	-550
16	200	3200	-650
17	150	2550	-750
18	100	1800	-850
19	50	950	-950
20	0	0	

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Hypothetical Example: An Industry's Demand

Q(EA)	P($)	TR($)	MR($)
0	1000	0	950
1	950	950	850
2	900	1800	750
3	850	2550	650
4	800	3200	550
5	750	3750	450
6	700	4200	350
7	650	4550	250
8	600	4800	150
9	550	4950	50
10	500	5000	-50
11	450	4950	-150
12	400	4800	-250
13	350	4550	-350
14	300	4200	-450
15	250	3750	-550
16	200	3200	-650
17	150	2550	-750
18	100	1800	-850
19	50	950	-950
20	0	0	

Demand Schedule

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Demand and MR curve

MR curve is a downward curve
below the Demand curve

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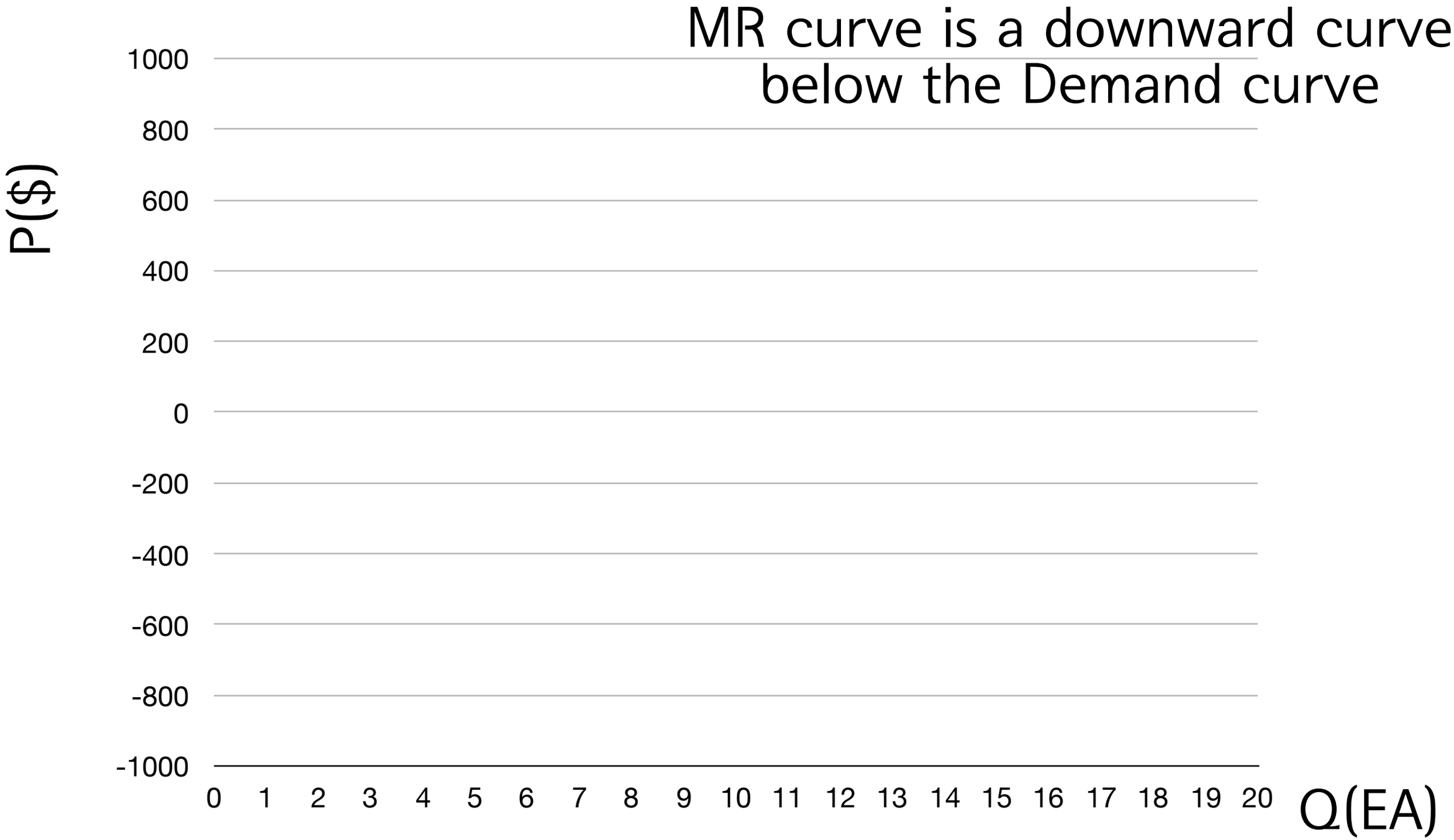
Demand and MR curve



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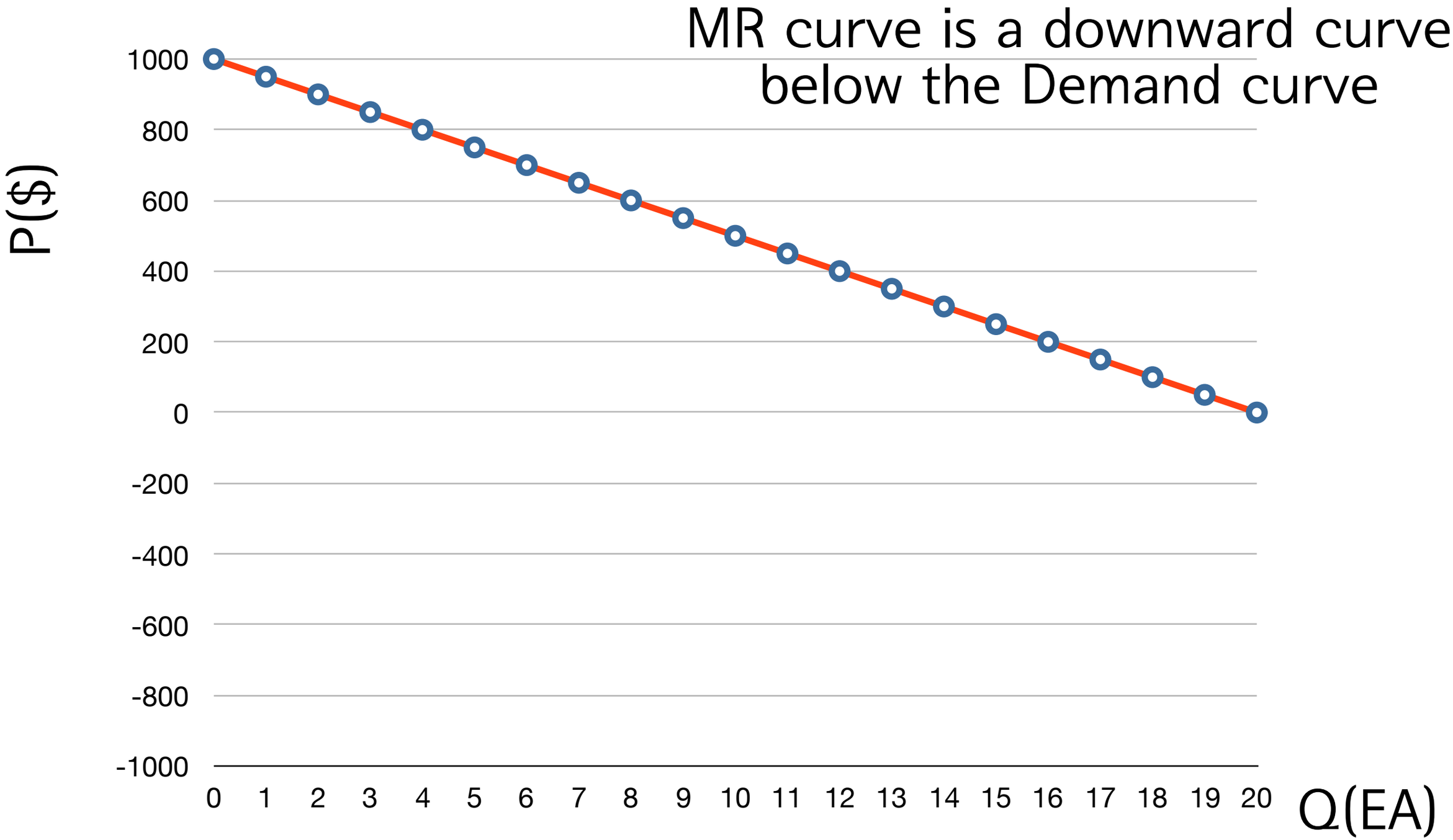

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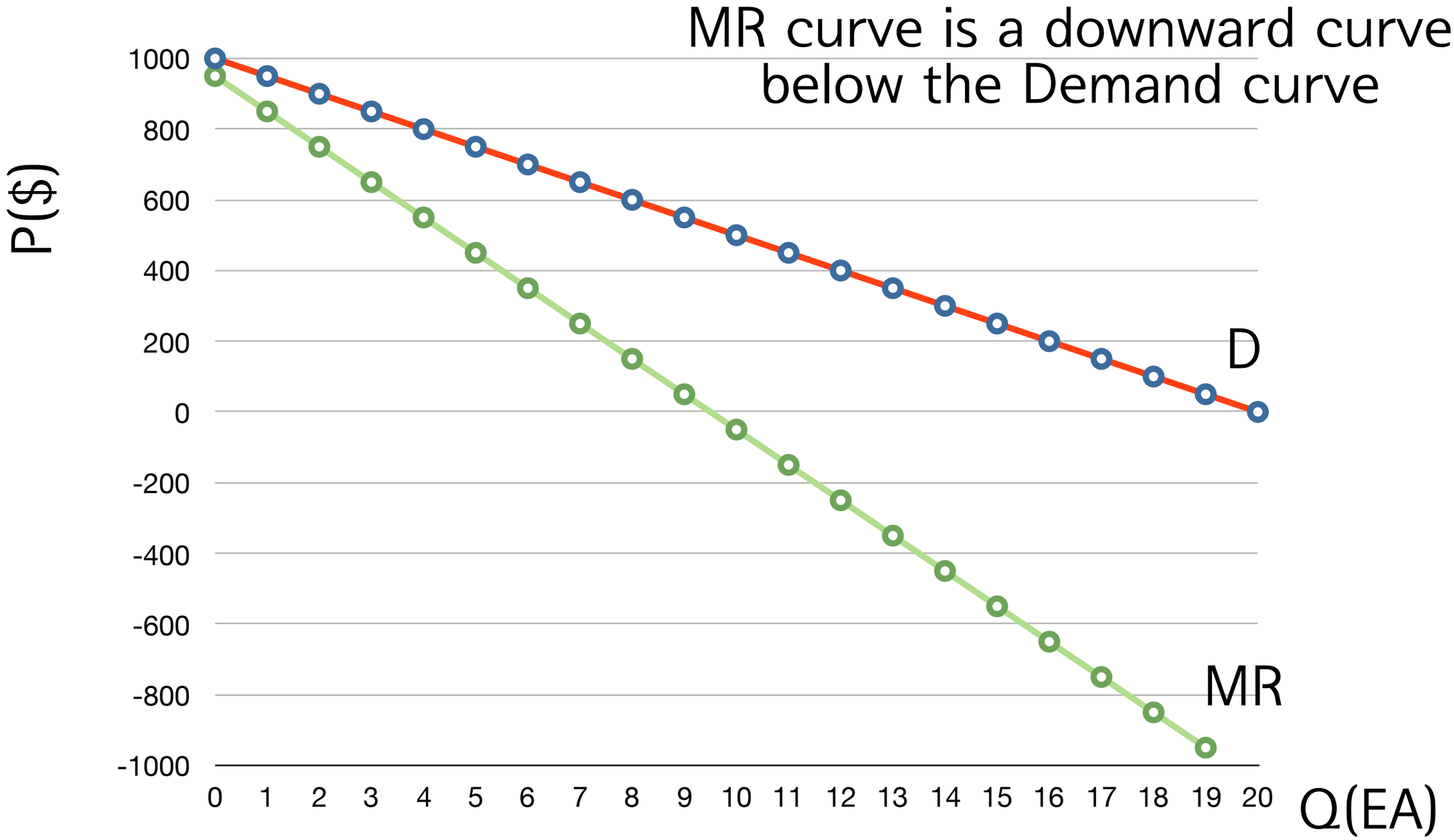

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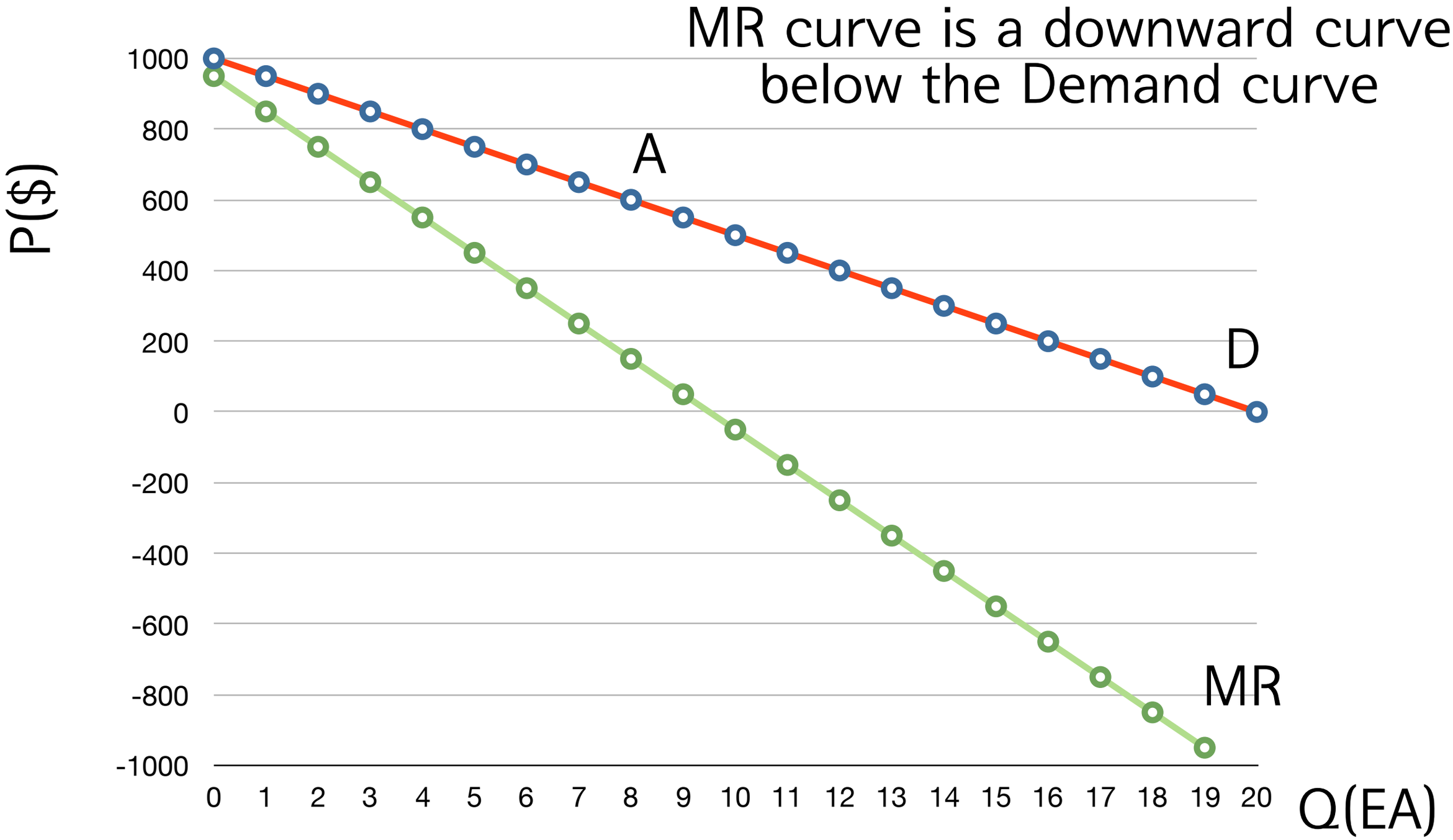

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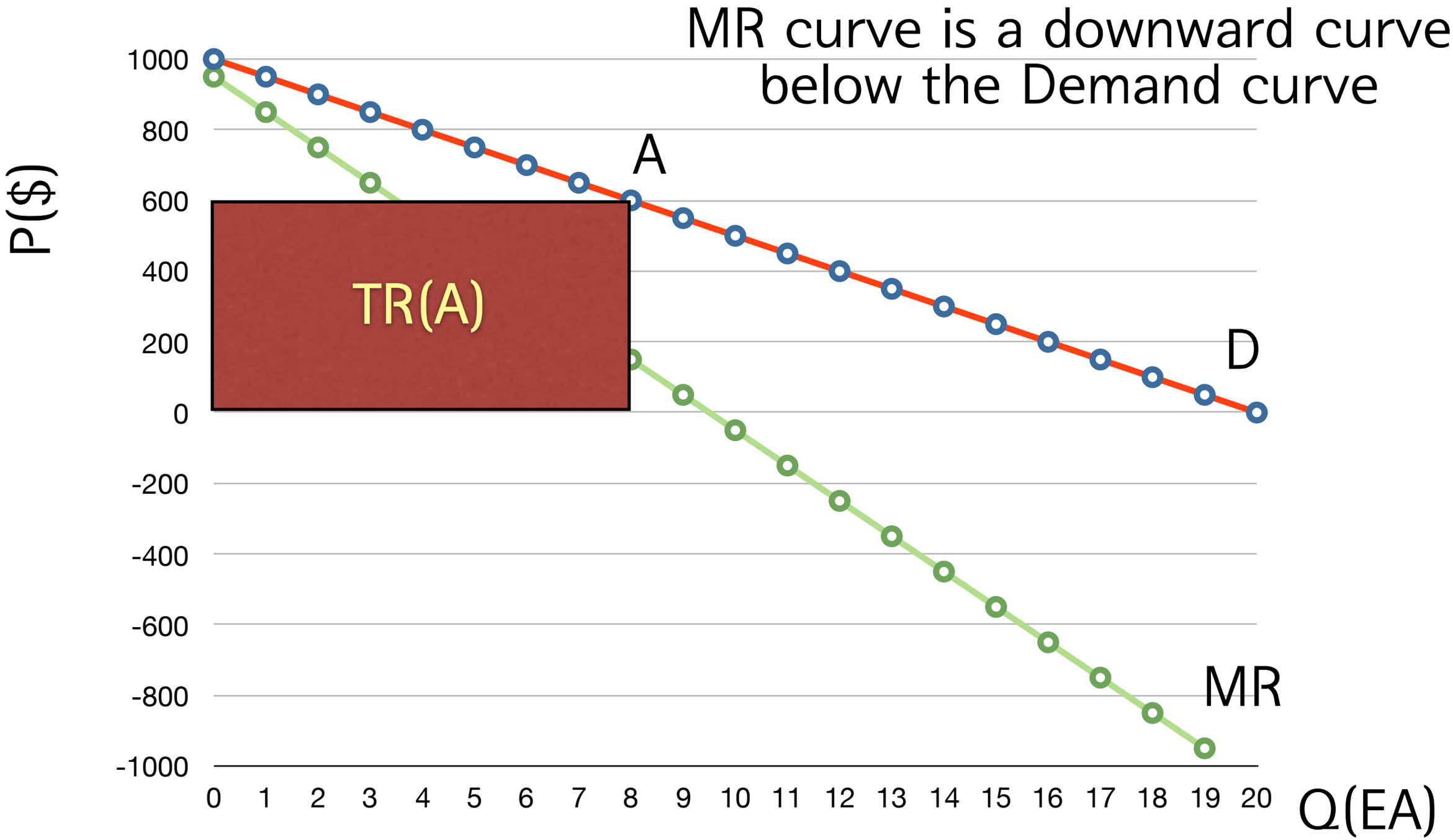

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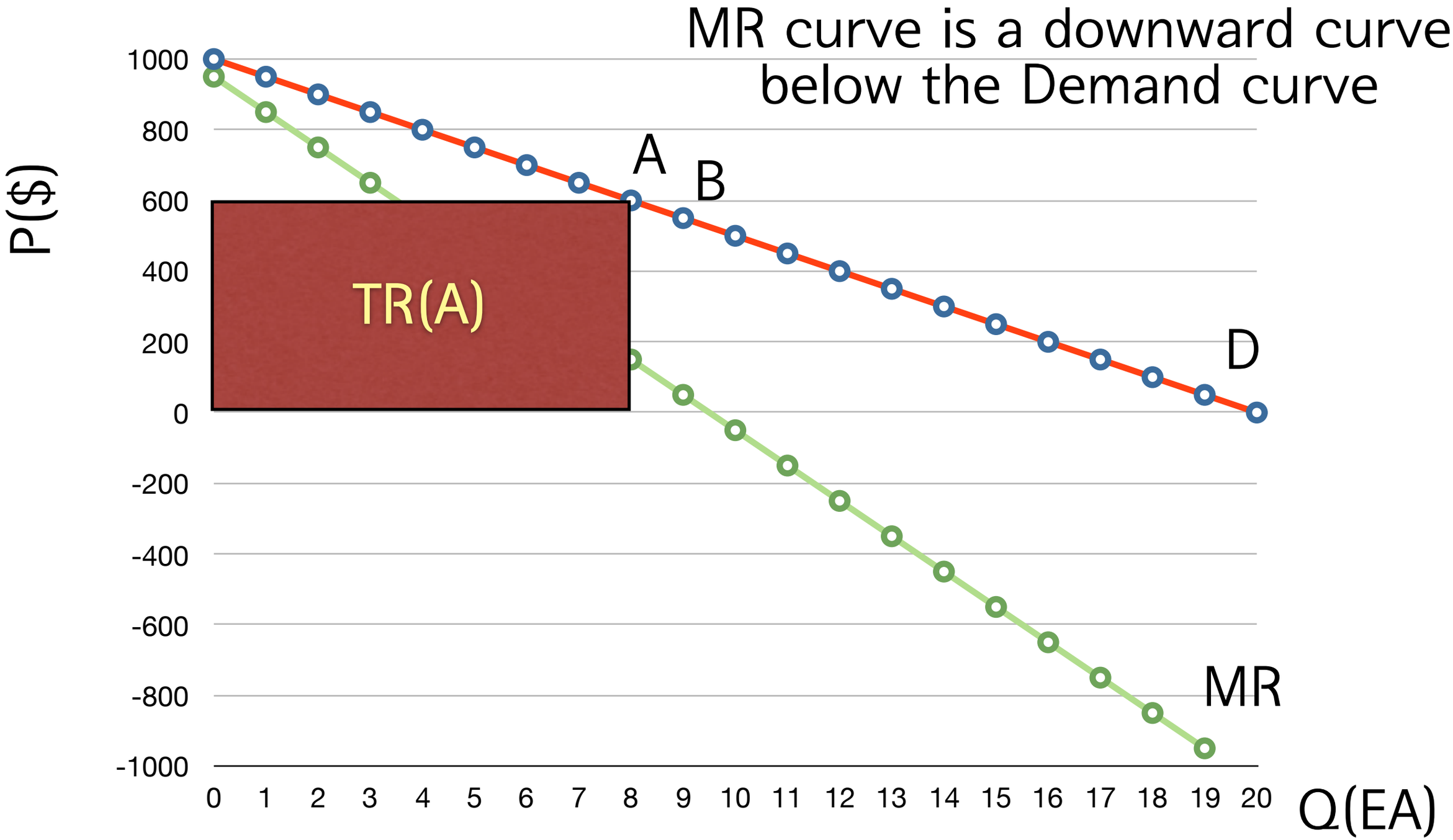
Demand and MR curve

MR curve is a downward curve below the Demand curve



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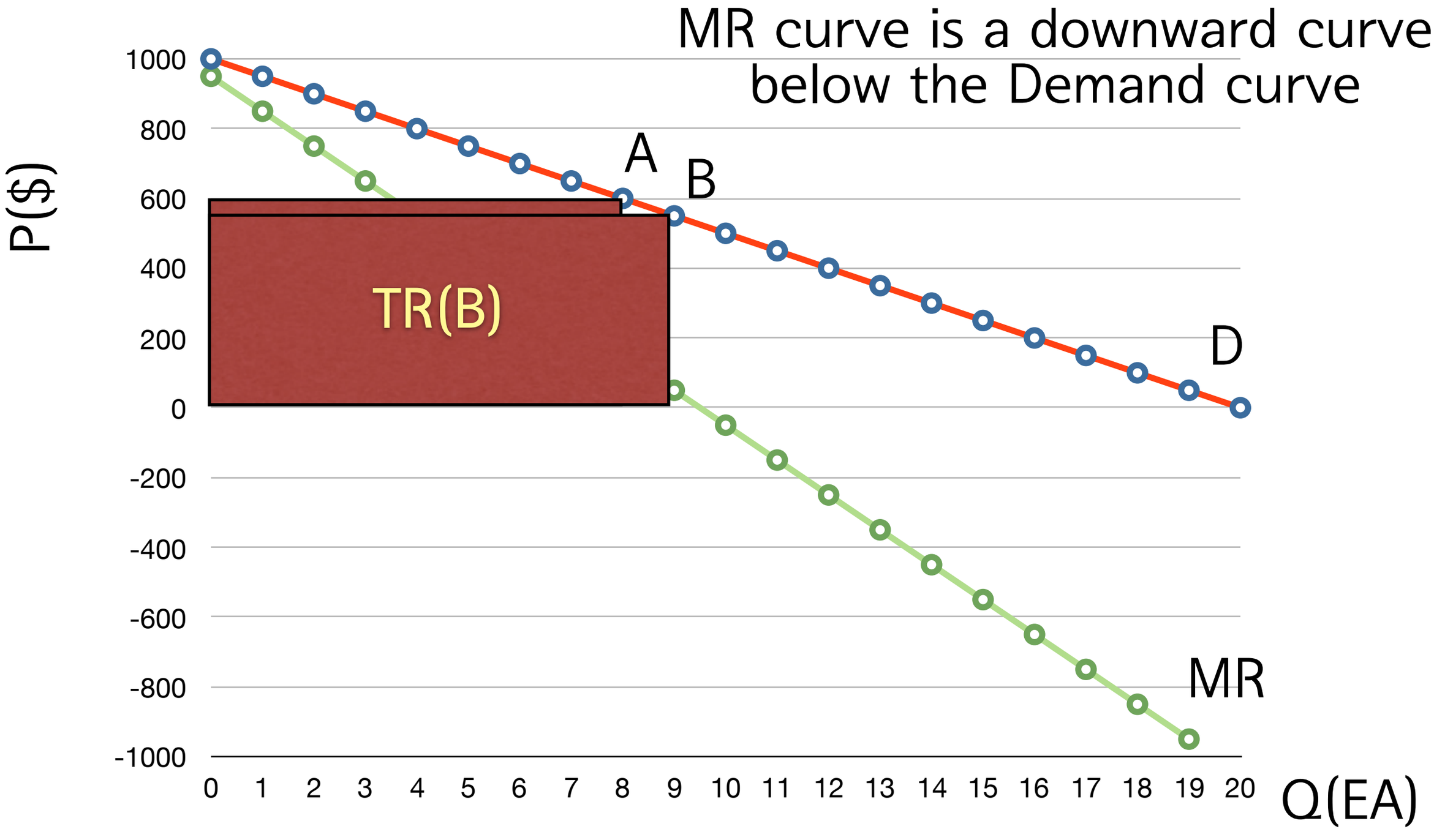

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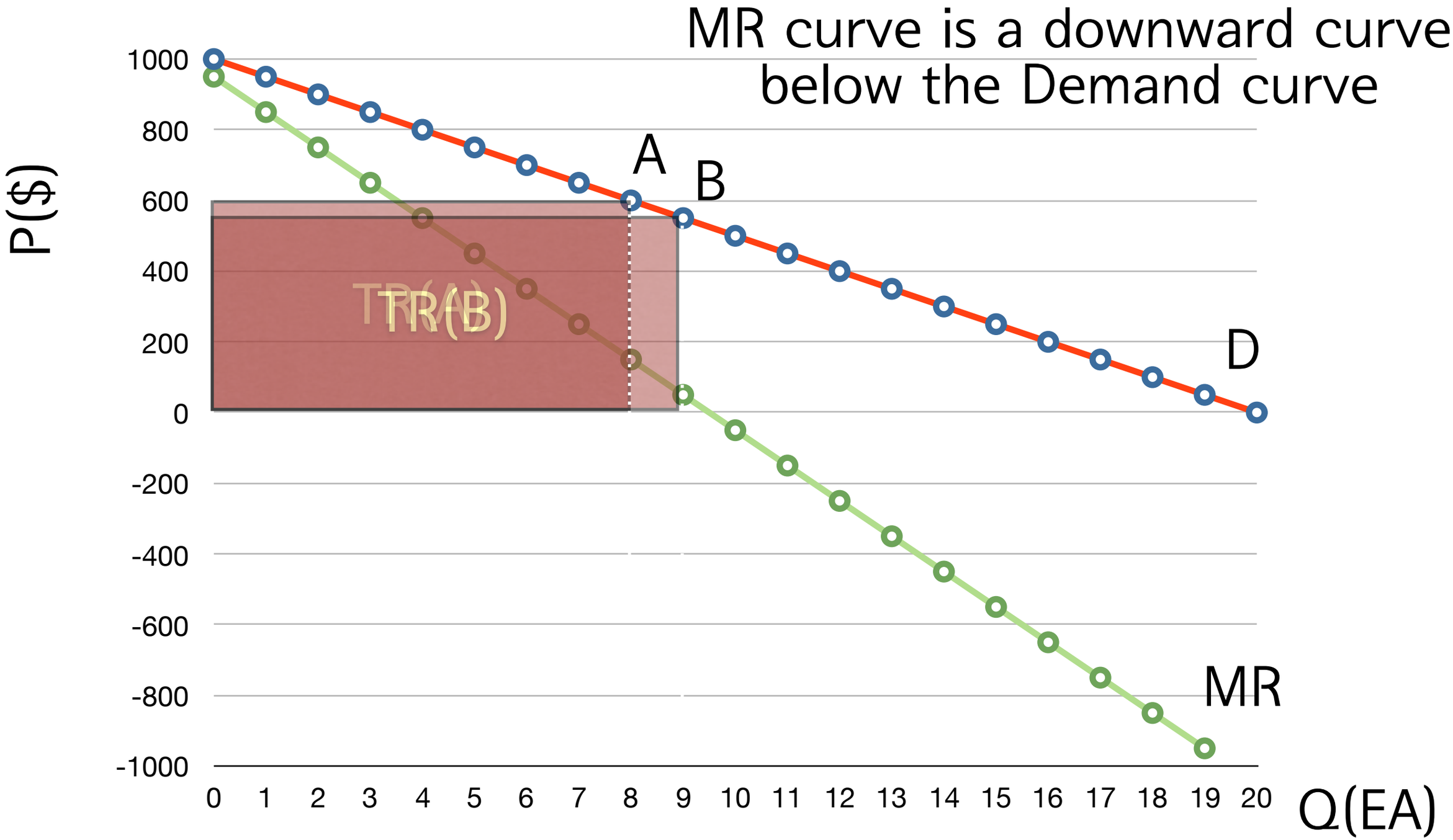

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A Hypothetical Industry

TABLE 7-1 Relationship of Input to Output for a Hypothetical Industry

Output	Total Labor Input	Average Labor Input
5	10	2
10	15	1.5
15	20	1.333333
20	25	1.25
25	30	1.2
30	35	1.166667

Relationship between MR and Price

- For the simplicity, suppose that demand curve is linear:
  - $Q = \bar{A} - \bar{B} \times P \qquad (\Rightarrow P = A/B - Q/B)$
    - $\bar{A}, \bar{B} > 0$
    - Q: quantity of the product
    - P: price of the product

Eq 8-1

- $TR := P \times Q,$
- $MR := \frac{dTR}{dQ} = \frac{d(A/B - Q/B)Q}{dQ} = A/B - 2Q/B = A/B - Q/B - Q/B = P - Q/B$
- $\therefore P - MR = Q/B$

Eq 8-2

Average Cost (AC) and Marginal Cost (MC)

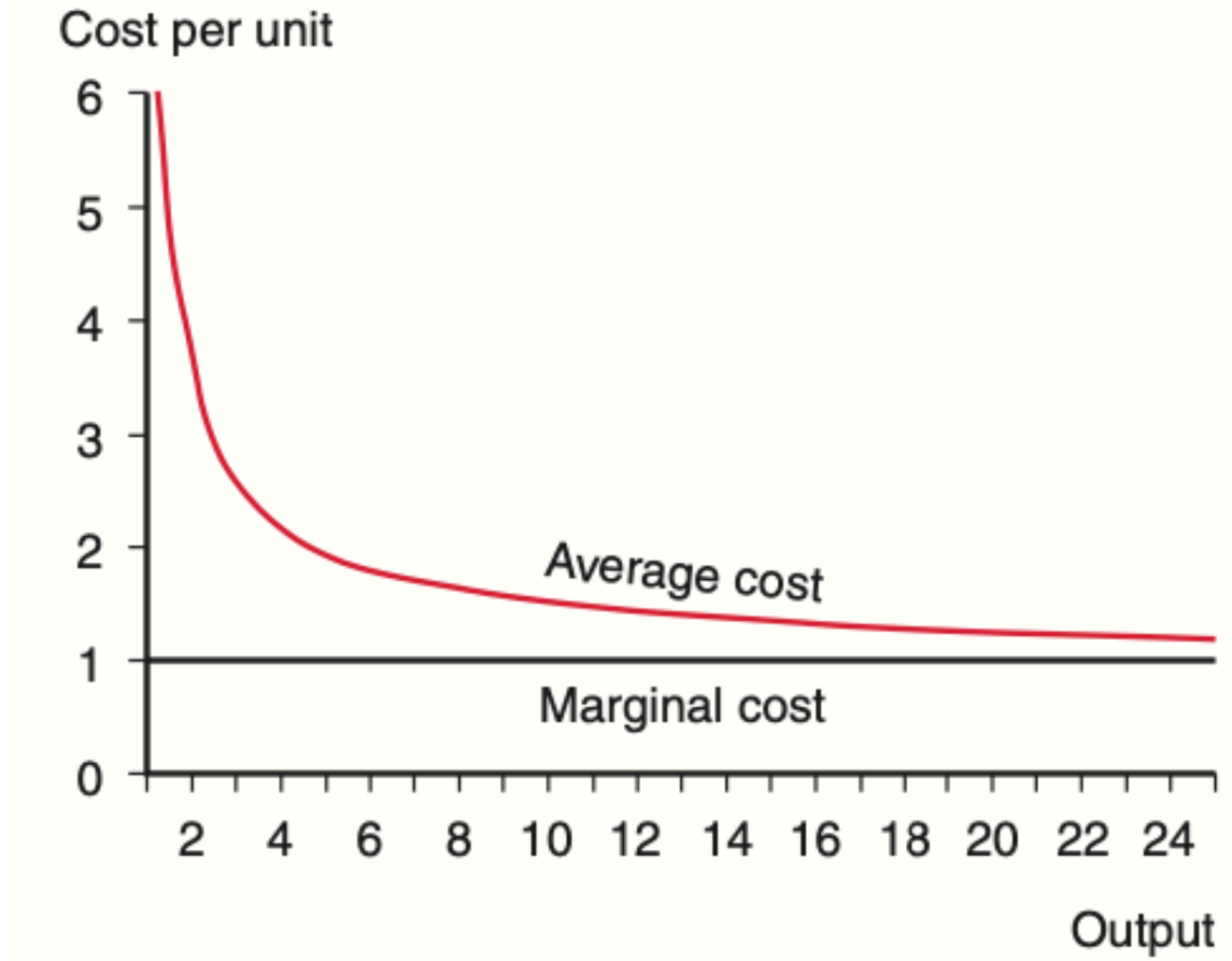
- TC: Total Cost
- $AC := TC/Q$
  - q↑ ⇒ AC ↓
- $MC := \frac{dTC}{dQ}$
  - we assume MC is a constant: horizontal MC curve
    - just for the simplicity

AC and MC

EQ 8-3

- $TC = F + c \times Q$
  - F: Fixed cost
  - c: Marginal cost
- $AC := TC/Q \Rightarrow AC = F/Q + c$
  - Q ↑ ⇒ F/Q ↓
  - AC > c = MC

EQ 8-4



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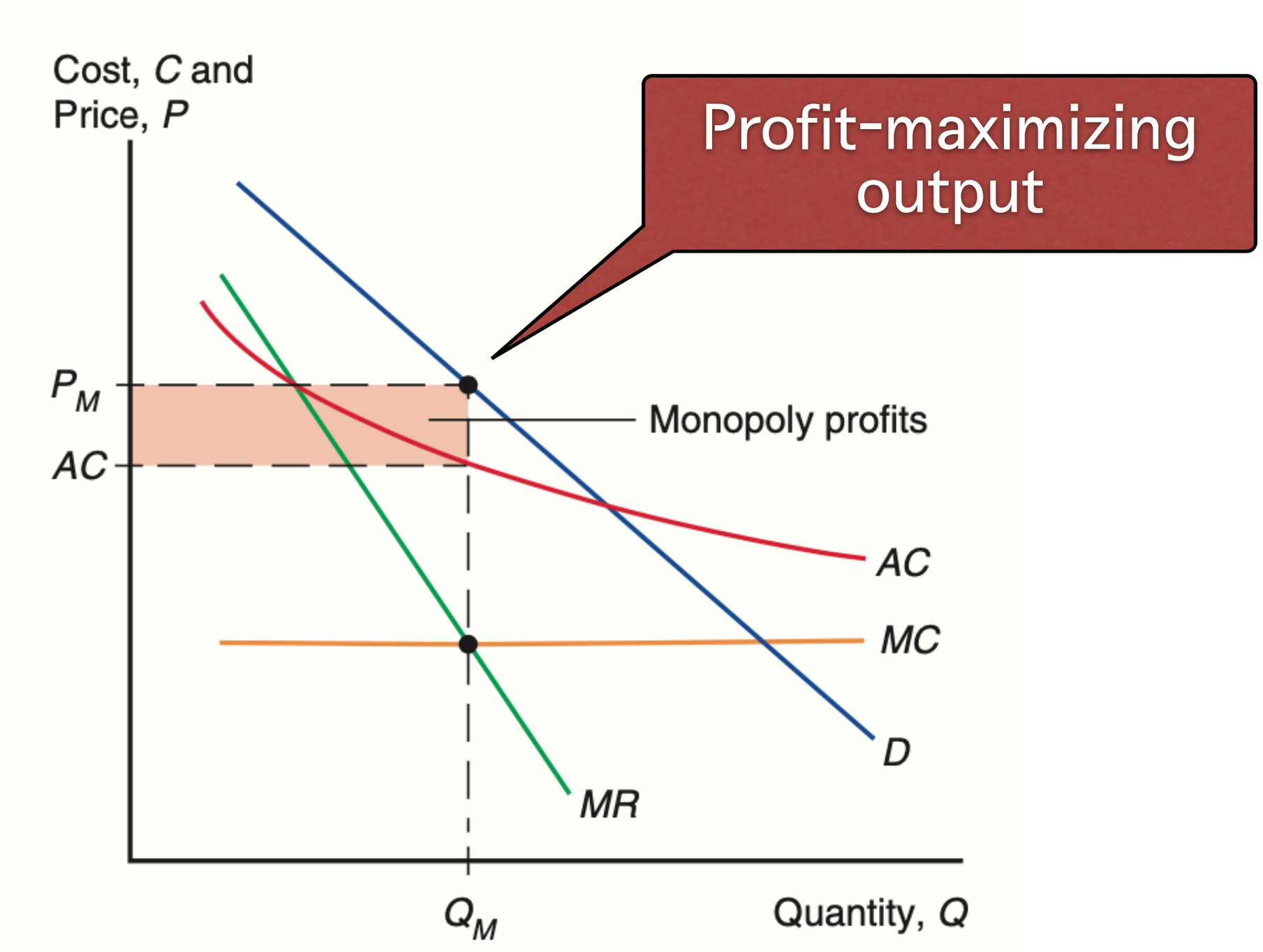
Monopolistic Pricing and Production Decisions



Monopolistic Competition

- Characteristics of monopolistic competition:
  - Many producers
  - Differentiated products
  - Free entry and exit

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Monopolistic Competition: Assumptions (1)

- $Q = S \times [1/n - b(P - \bar{P})]$
  - Q: Firm's production quantity
  - S: Total production quantity in sector
  - n: The number of the firms
  - b>0: constant
  - P: The price charged by the firm
  - $\bar{P}$: The average price charged by its competitors

Meaning

Eq 8-5

- $Q = S \times [1/n - b(P - \bar{P})]$
- Case 1: $P = \bar{P} \Rightarrow$ Q = S/n (equal share)
- Case 2: $P > \bar{P} \Rightarrow$ Q < S/n (lower share)
- Case 3: $P < \bar{P} \Rightarrow$ Q > S/n (higher share)

Monopolistic Competition: Assumptions (2)

- Sector (industry) output S is constant
  - S is unaffected by the average price ($\bar{P}$)
- Firms can gain customers only at each other's expense
- All firms are symmetric
  - They all face the same demand curve (eq 8-5)
  - They have same cost function (eq 8-3)
    - $TC = F + c \times Q$, (eq 8-3)
    - $AC = F/Q + c$. (eq 8-4)

Above assumptions are for the simplicity in analysis

Market Equilibrium: Big Picture

- To determine n (the number of firms), $\bar{P}$ (the average price of firms):
  - STEP1: Derive a relationship between n and AC
  - STEP2: Show the relationship between n and P (not $\bar{P}$)
  - STEP3: Introduce firm entry and exit
    - Positive profit $\Rightarrow$ additional firms enter $\Rightarrow n \uparrow \Rightarrow$ AC $\uparrow$, P $\downarrow$ $\Rightarrow$ profit $\uparrow$ $\Rightarrow$ ...
    - Negative profit $\Rightarrow$ some firms exit $\Rightarrow n \downarrow \Rightarrow$ AC $\downarrow$, P $\uparrow$ $\Rightarrow$ profit $\downarrow$ $\Rightarrow$ ...

STEP1: n and AC

- In equilibrium, $P = \bar{P} \Rightarrow Q = S/n$ (eq 8-5)
- From eq 8-4,
  - $AC = F/Q + c \Rightarrow AC = nF/S + c$ (eq8-6)
- For given F>0, S>0, c>0,
  - The more firms there are in the industry (n ↑), the higher is average cost (AC ↑)

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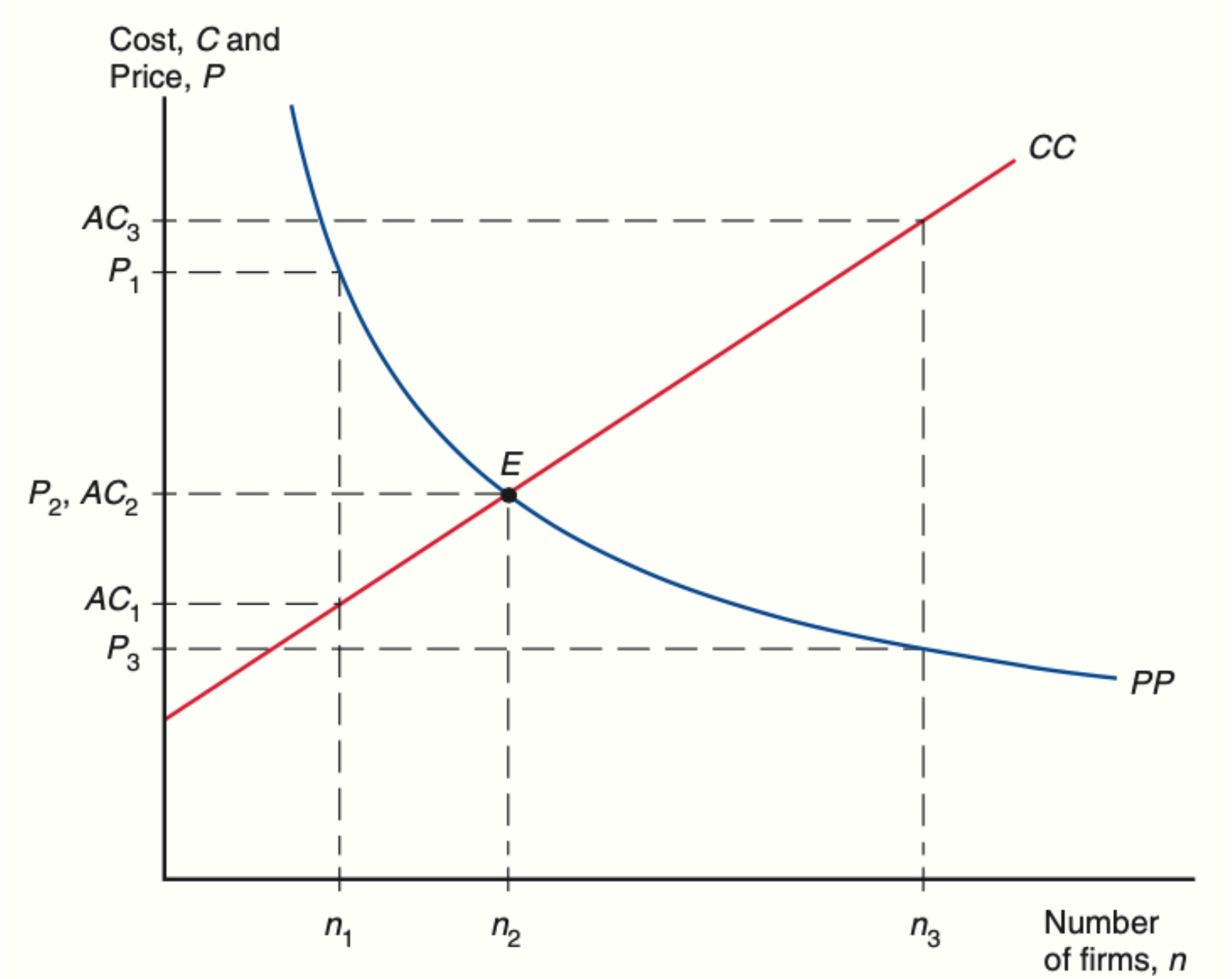
Positive Relationship between n and AC: line CC



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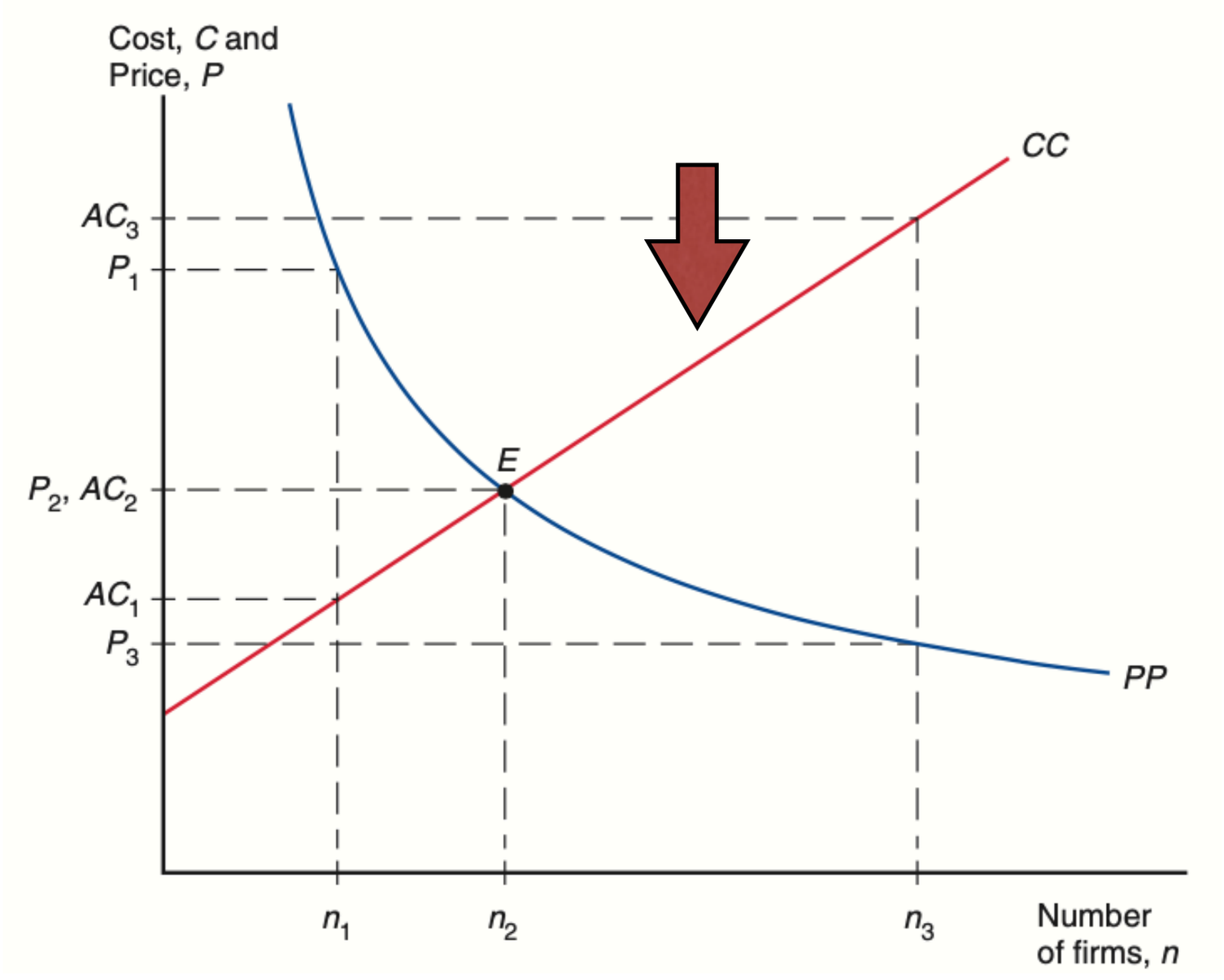

STEP2: n and P

- Eq 8-1: $Q = A - B \times P$ (linear demand curve)
- Eq 8-5: $Q = S \times [1/n - b(P - \bar{P})]$
  - $Q = [(S/n) + Sb\bar{P}] - SbP$ (Eq 8-7)
- Comparing Eq8-1, Eq8-5:
  - $A = S/n + Sb\bar{P}$, $B = Sb \Rightarrow$ Eq 8-2: $MR = P - Q/B \Rightarrow MR = P - Q/(Sb)$ (Eq 8-8)

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STEP2: Continued

- $MR = P - Q/(Sb)$ (Eq 8-8)
- ∵ Profit maximizing firms make MR = MC = c
  - $MR = P - Q/(Sb) = c$
  - $P = c + Q/(Sb)$ (Eq 8-9)
- When $P = \bar{P}$, then $Q = S/n$. therefore,
  - $P = c + \frac{S}{n}\frac{1}{Sb} = c + \frac{1}{nb}$ (eq 8-10)

STEP2: Continued

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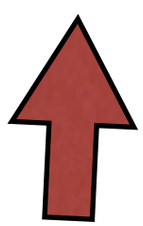

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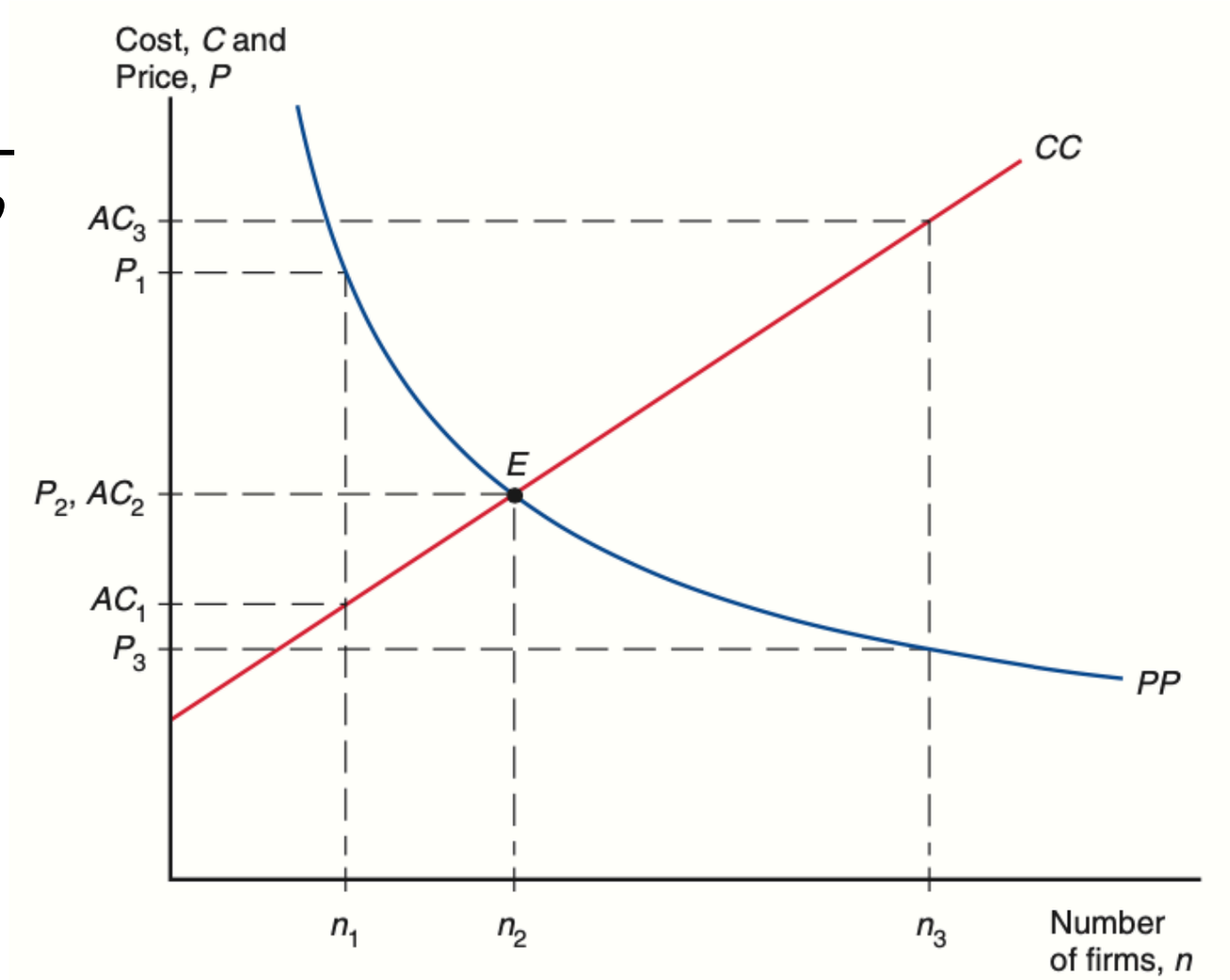
STEP2: Continued (2)

- Eq 8-10: $P = c + \frac{1}{nb}$
- For given c>0, b>0,
  - P is negatively correlated with n
  - $n \uparrow \Rightarrow P \downarrow$
- Curve PP
- Meaning of $P - c$:
  - Markup over MC



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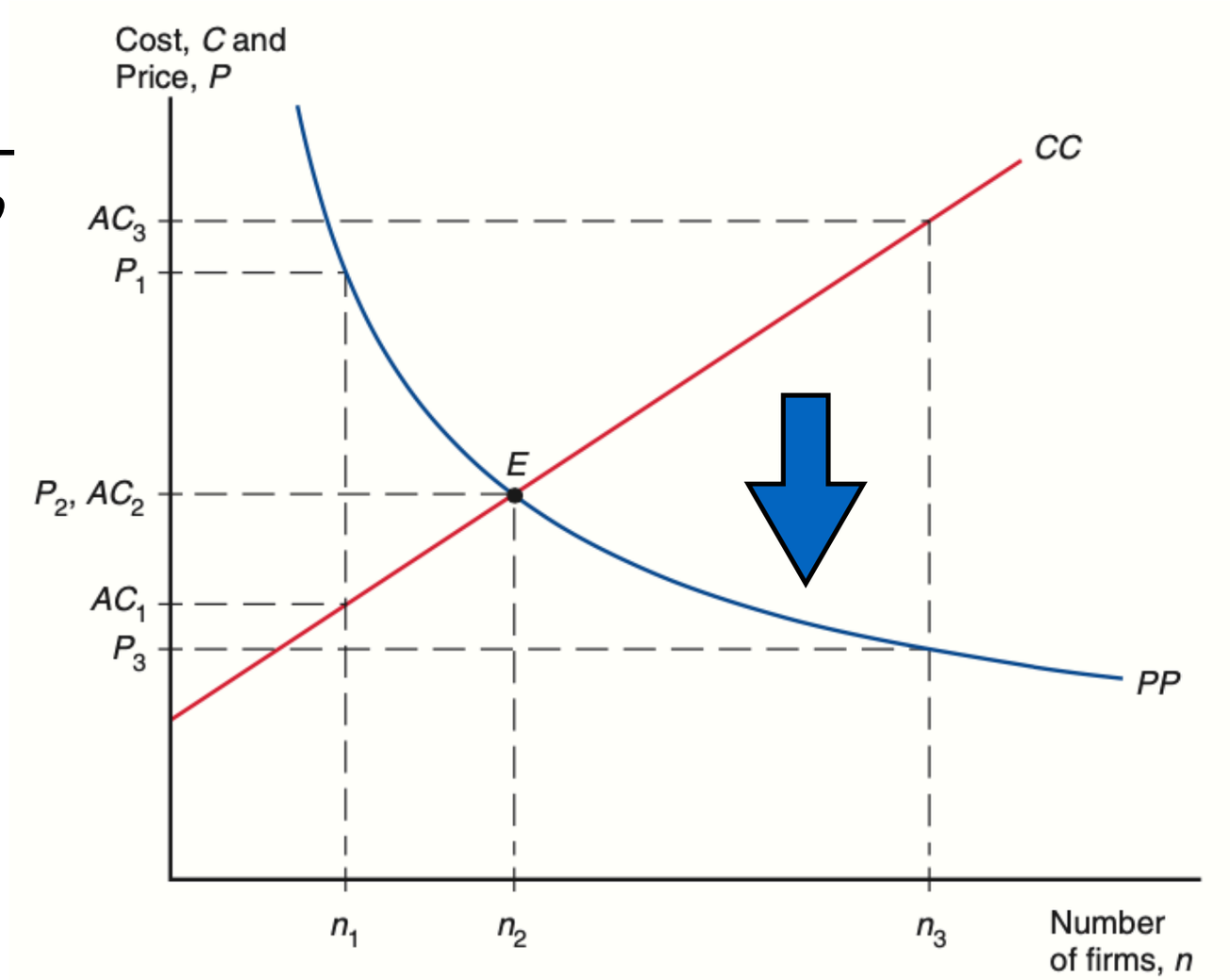
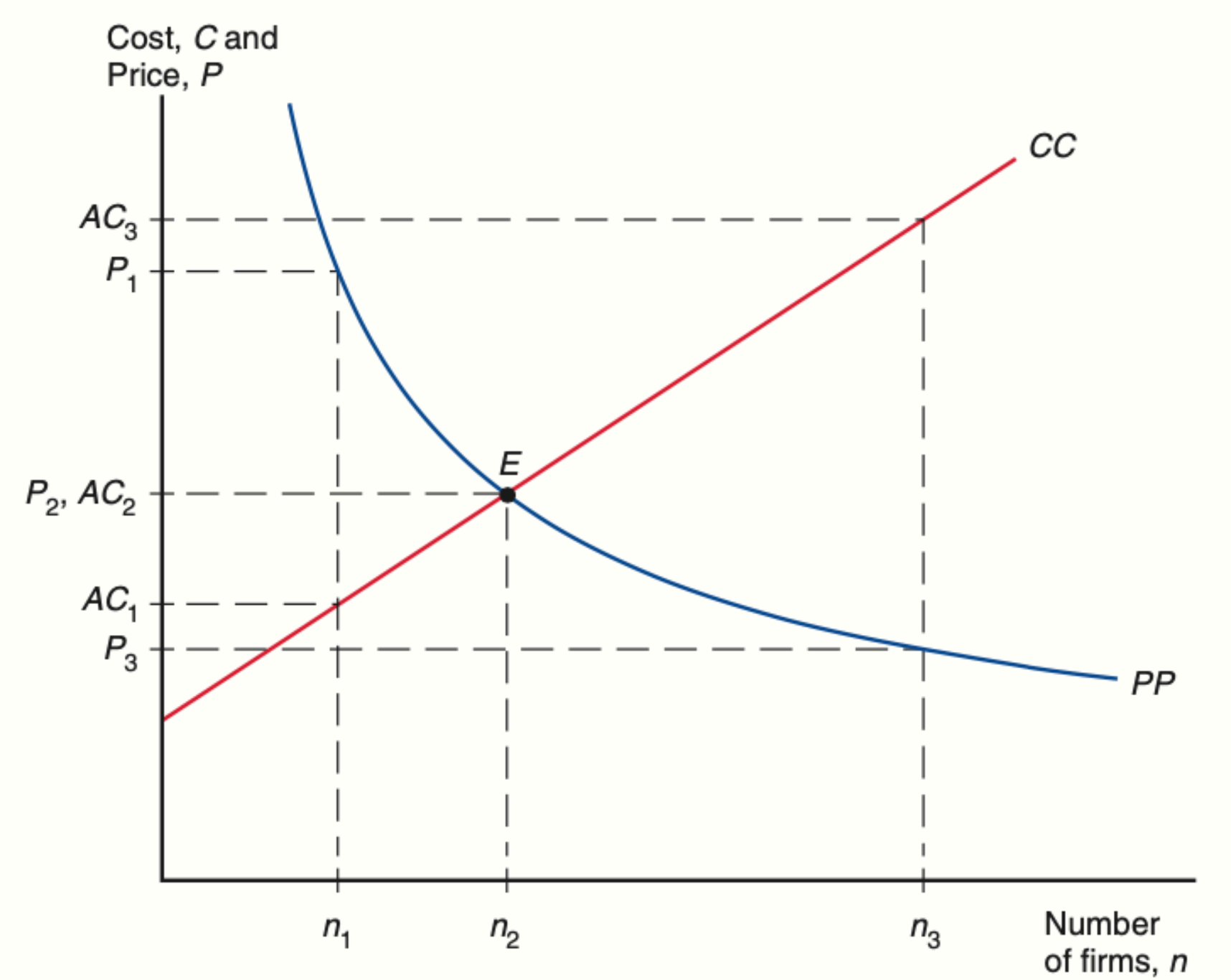


STEP3: Equilibrium



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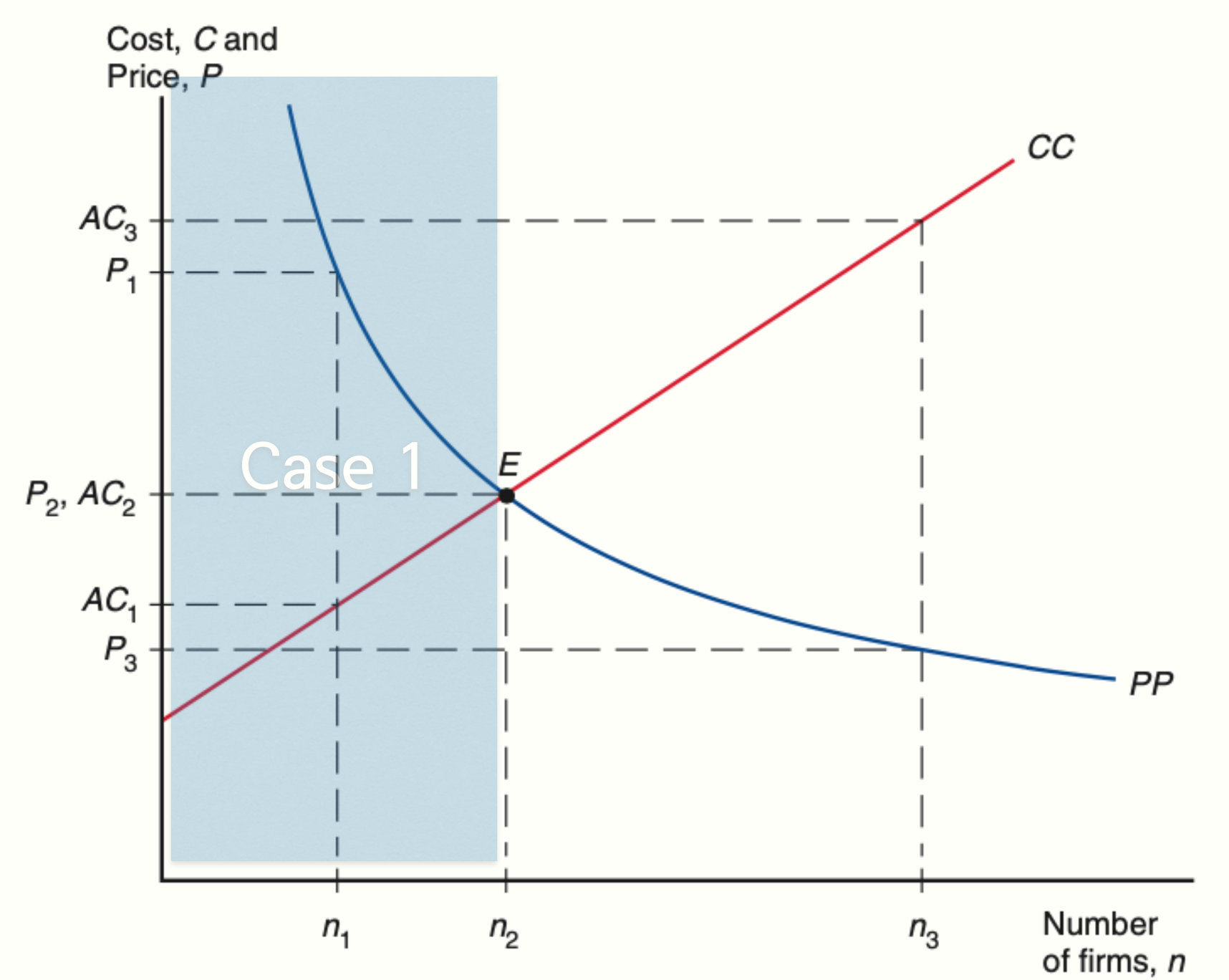

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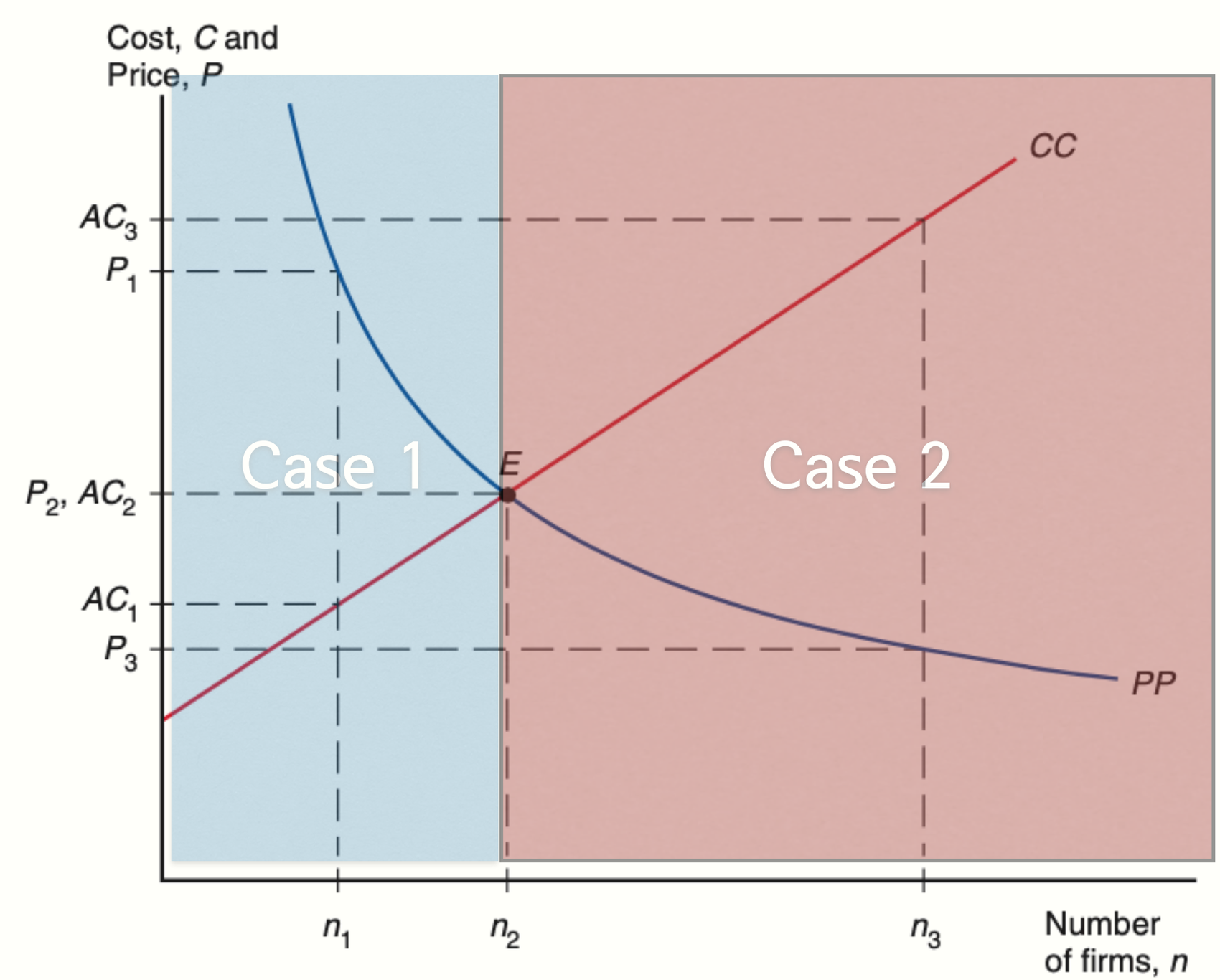

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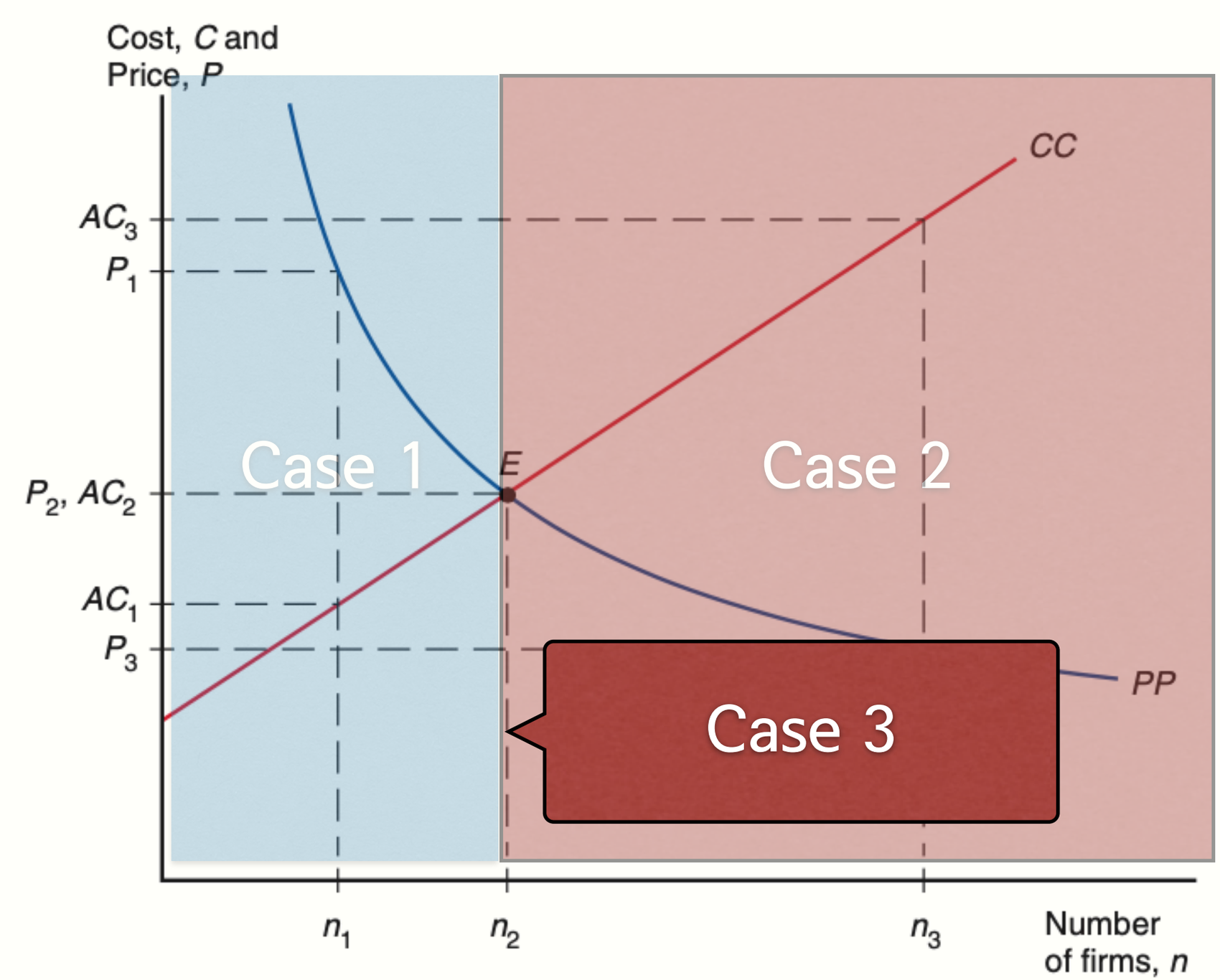
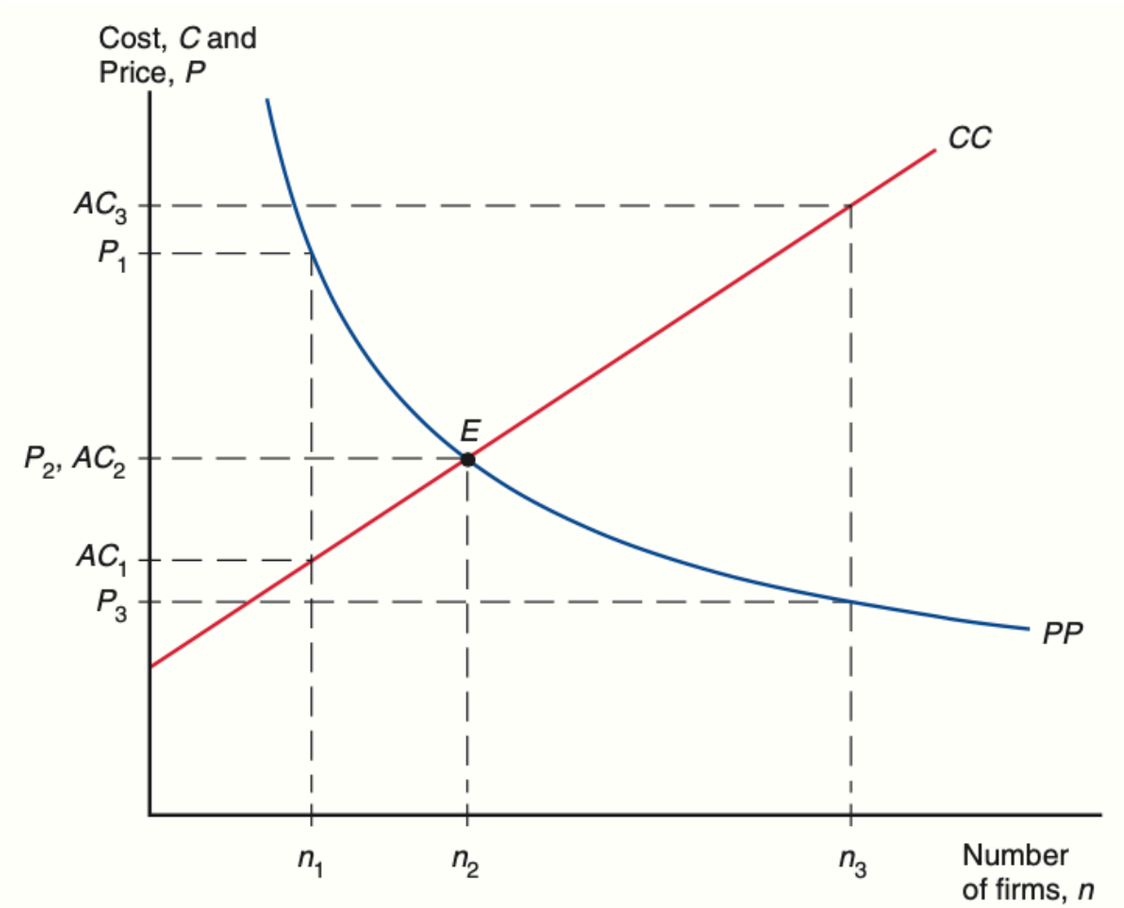


Case 1: $n < n_2$

- $n = n_1$,
  - $P_1 > AC_1$
  - Profit > 0
    - Excessive profit
- $\Rightarrow$ Additional firms enter
- $\Rightarrow n \uparrow$



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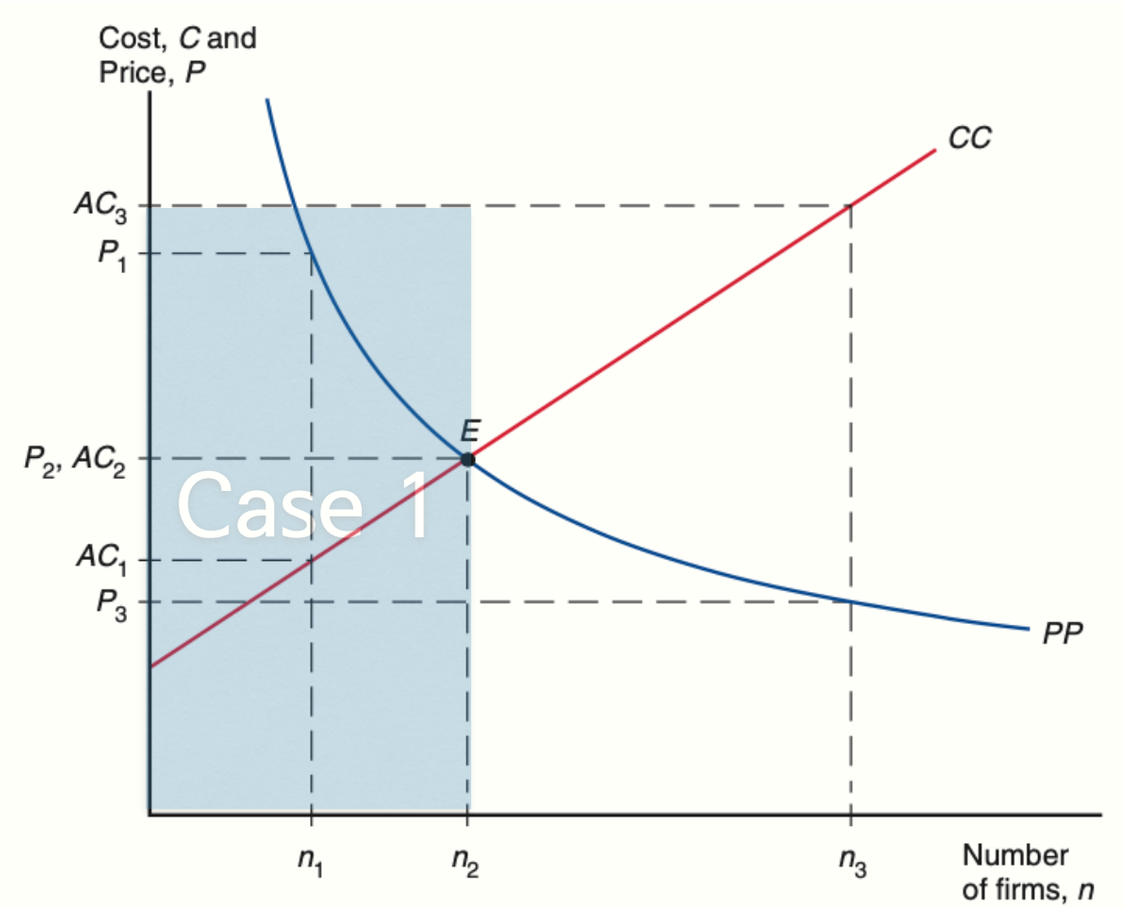

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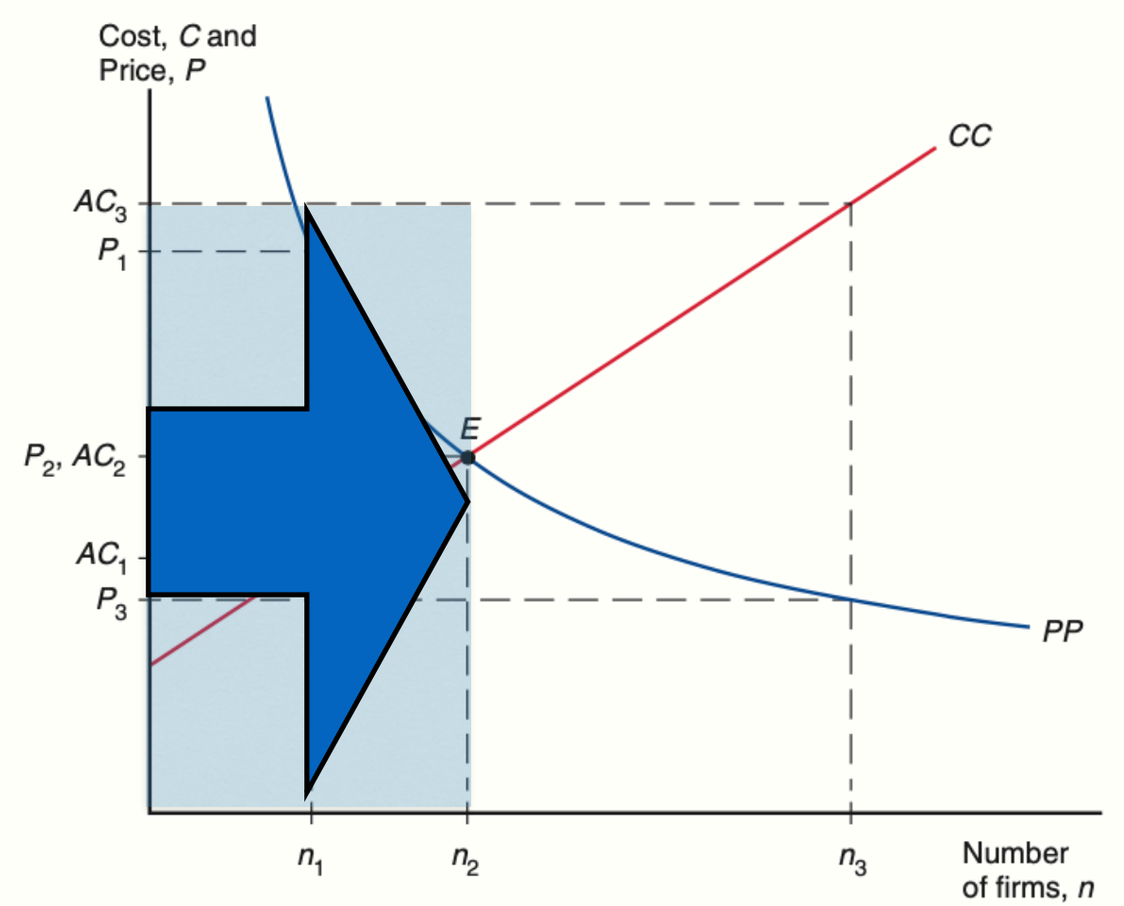

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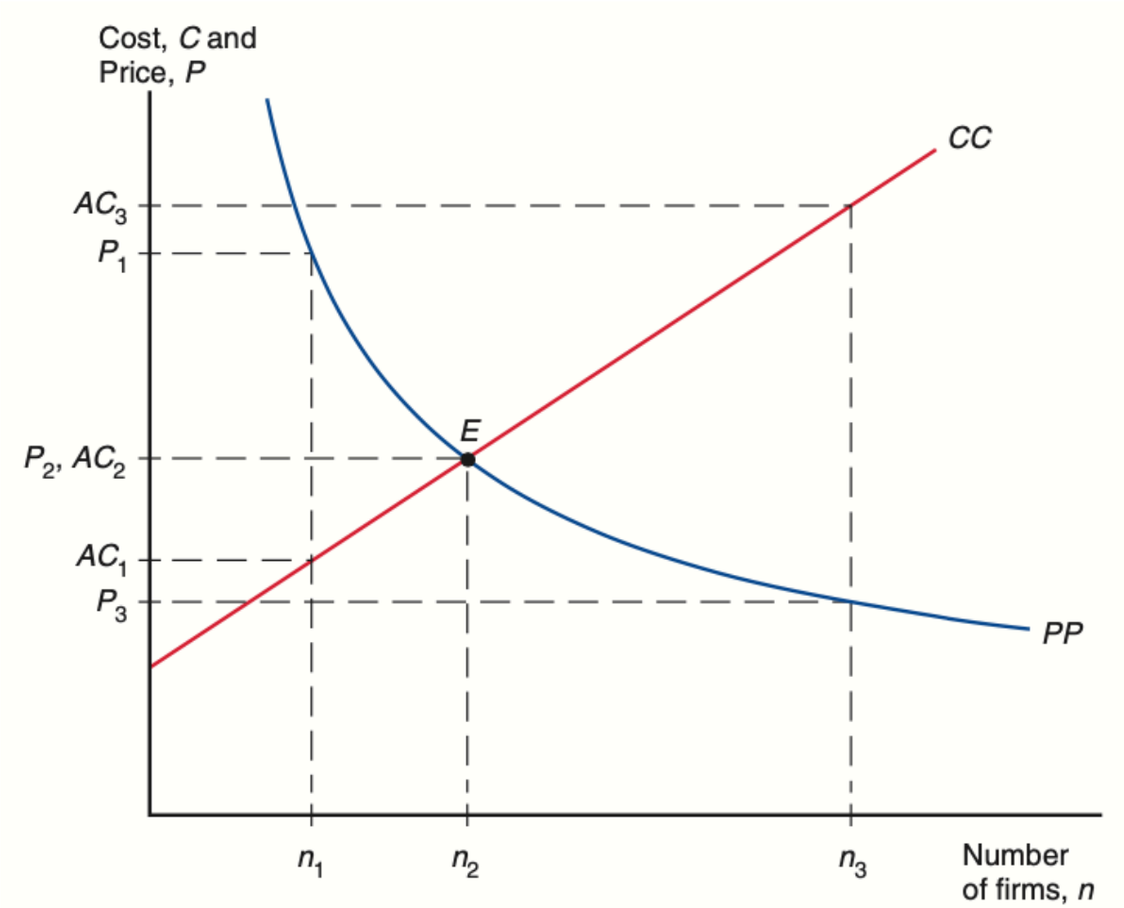
- $\Rightarrow$ Some firms exit
- $\Rightarrow n \downarrow$



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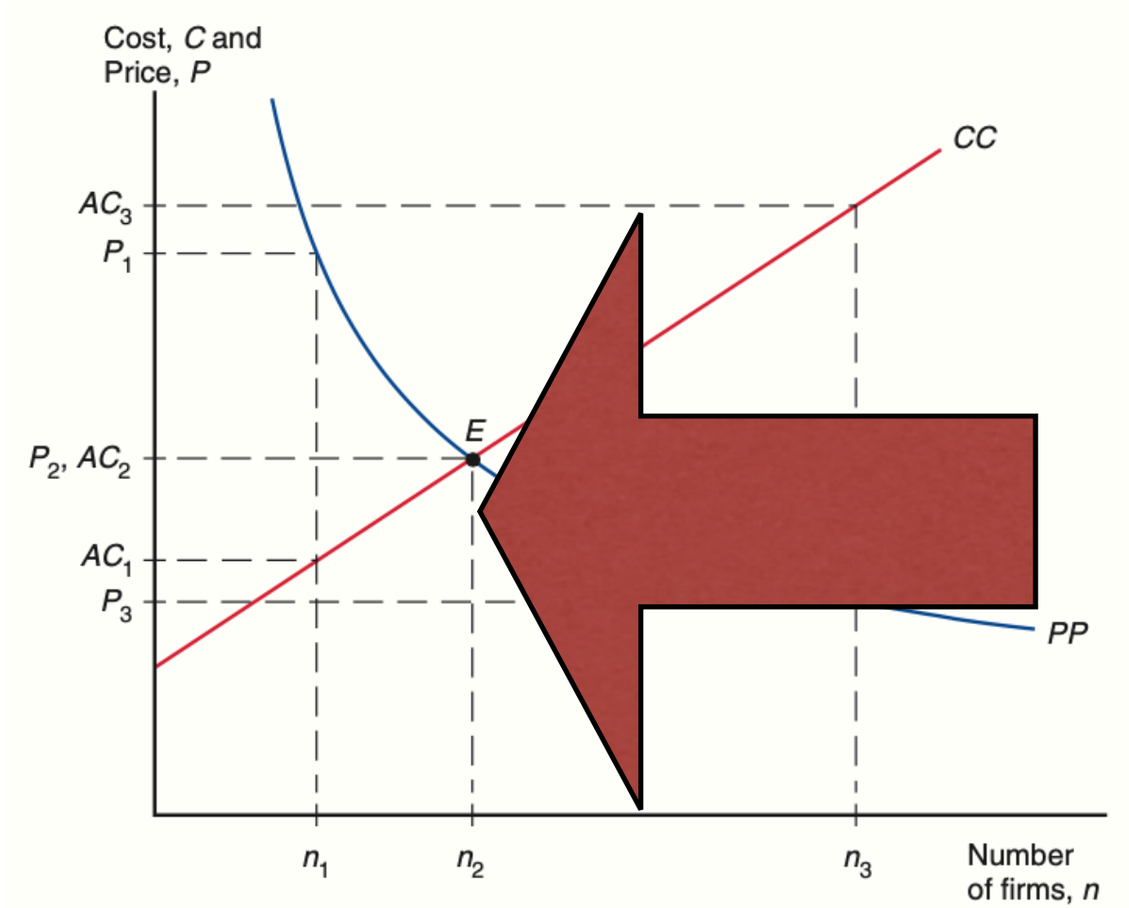

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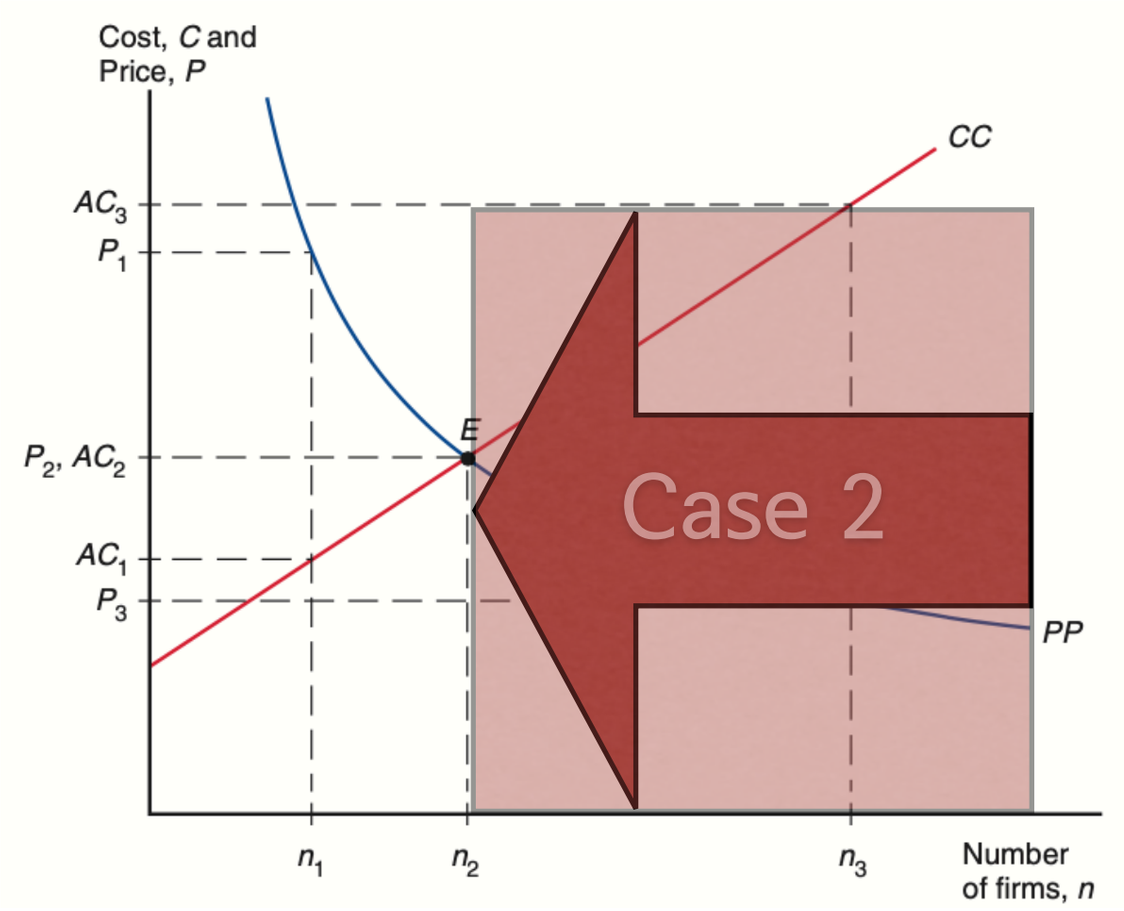
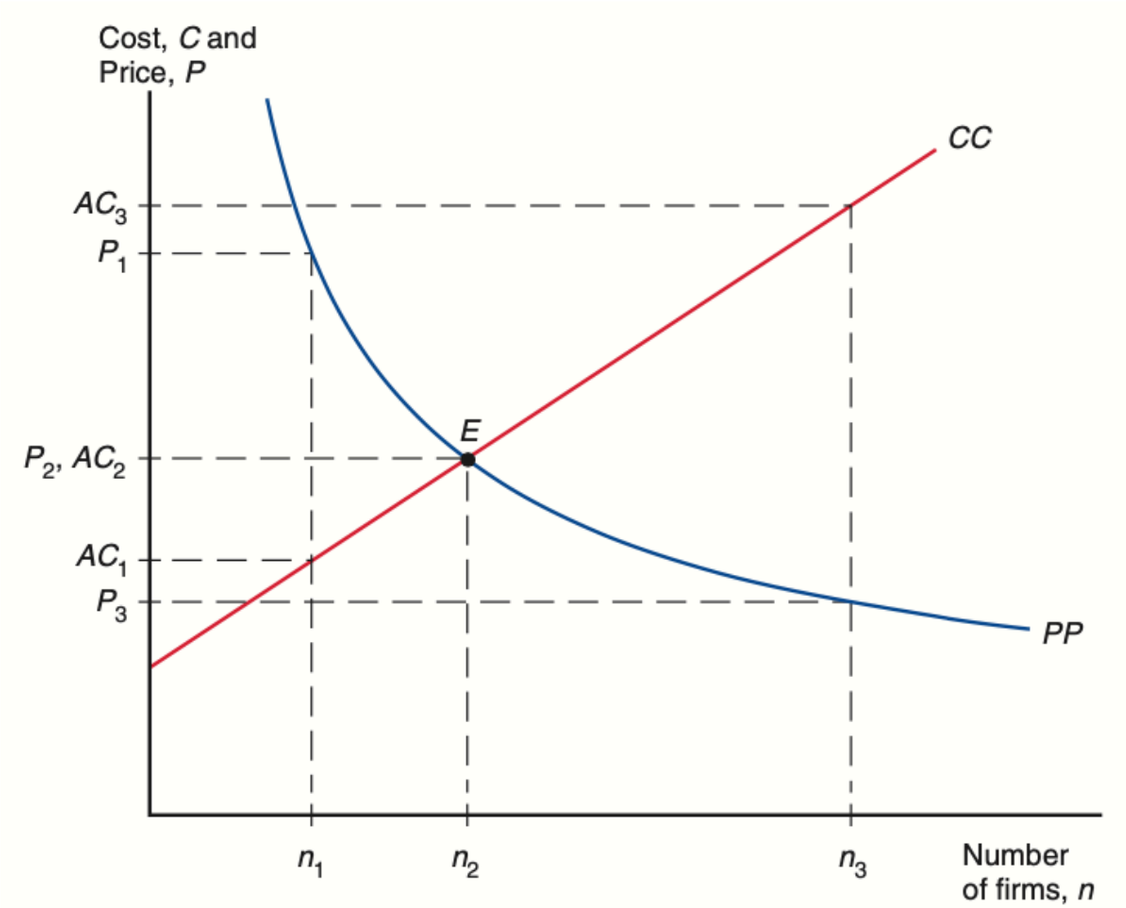


Case 3: $n = n_2$

- $n = n_2$,
  - $P_2 = AC_2$
  - Profit = 0
    - Average profit
- n does not change:
  - Stable equilibrium



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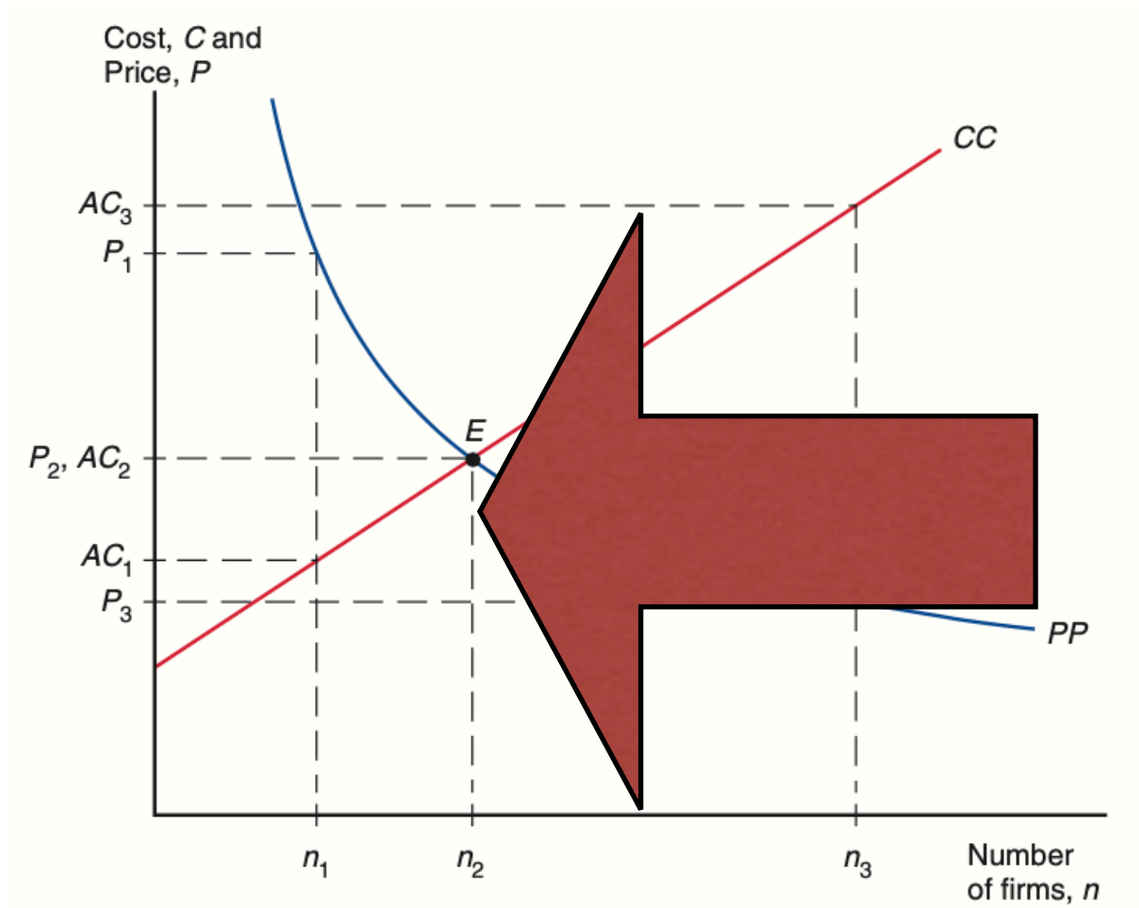

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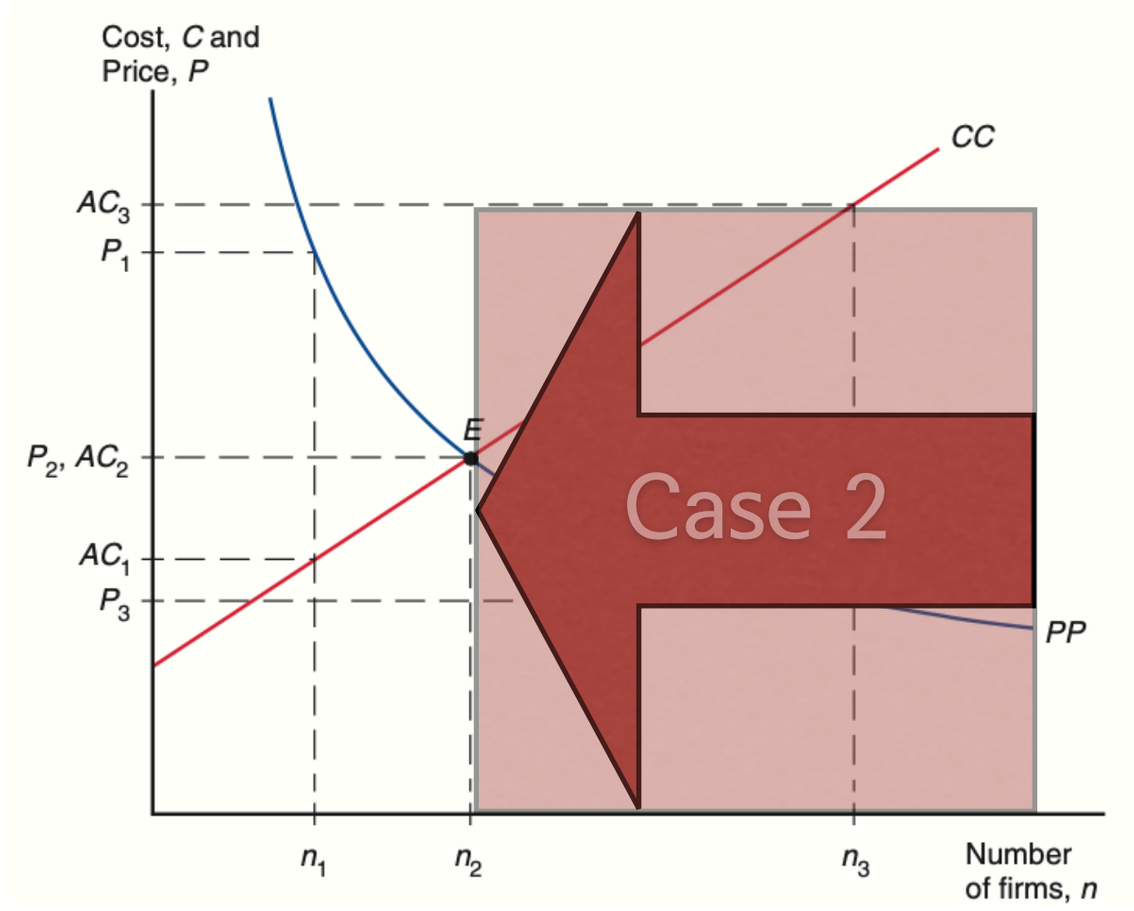

Monopolistic Competition and Trade

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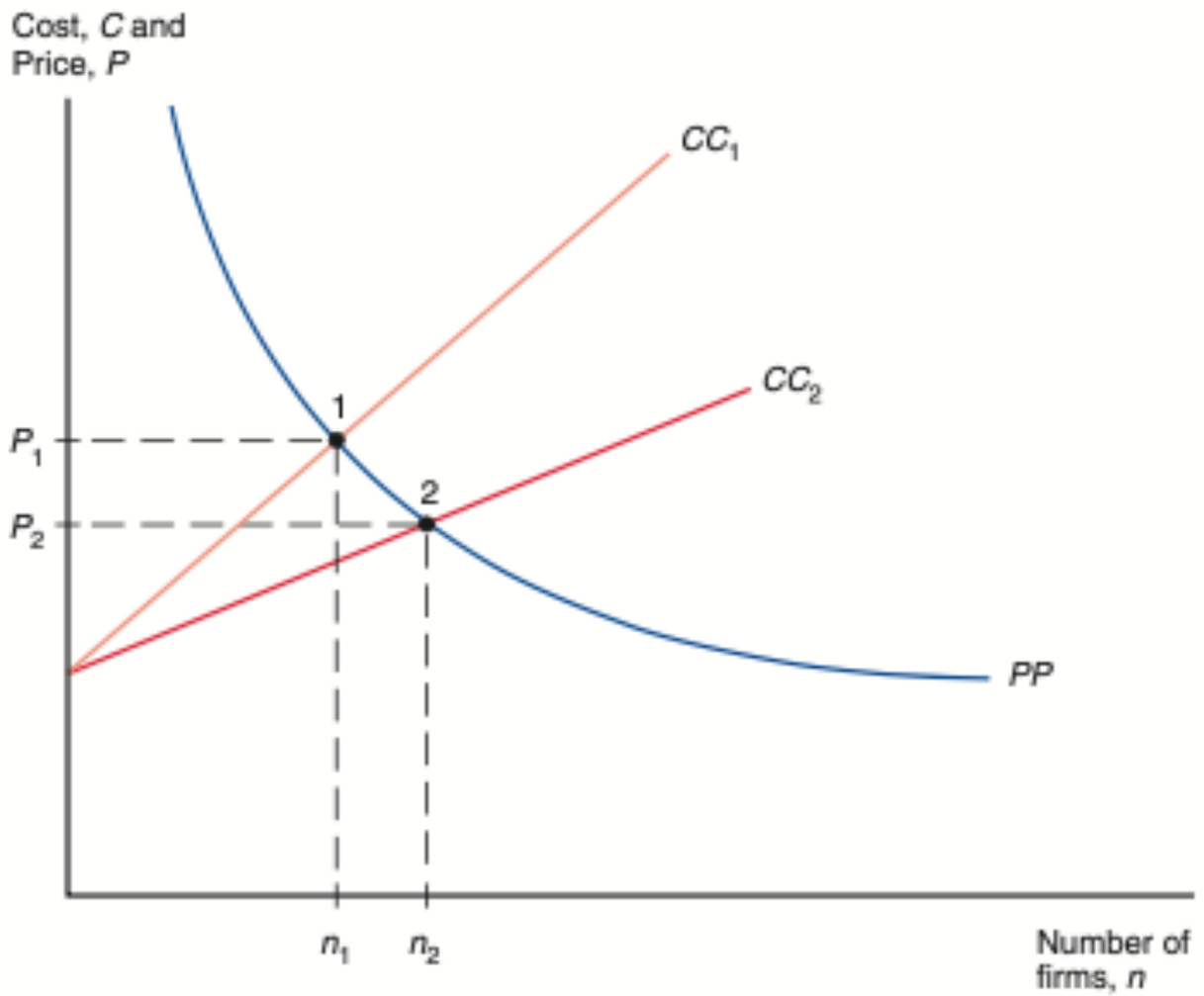
Monopolistic Competition and Trade: Overview

- International trade increases market size (S, n)
- It means
  - more varieties of products can be produced
  - at lower average cost
- The monopolistic competition model can be used to show this results.

The Effects of Increased Market Size ($S \uparrow$)

- Eq 8-6: CC
  - $AC = nF/S + c$
  - $S \uparrow \Rightarrow$ slope $\downarrow$
  - $CC_1 \Rightarrow CC_2$
- Eq 8-10: PP
  - $P = c + \dfrac{1}{nb}$
  - S does not affect to PP
- $P \downarrow, n \uparrow$
  - More variable goods at lower prices



Gains from Integrated Market: A Numerical Example

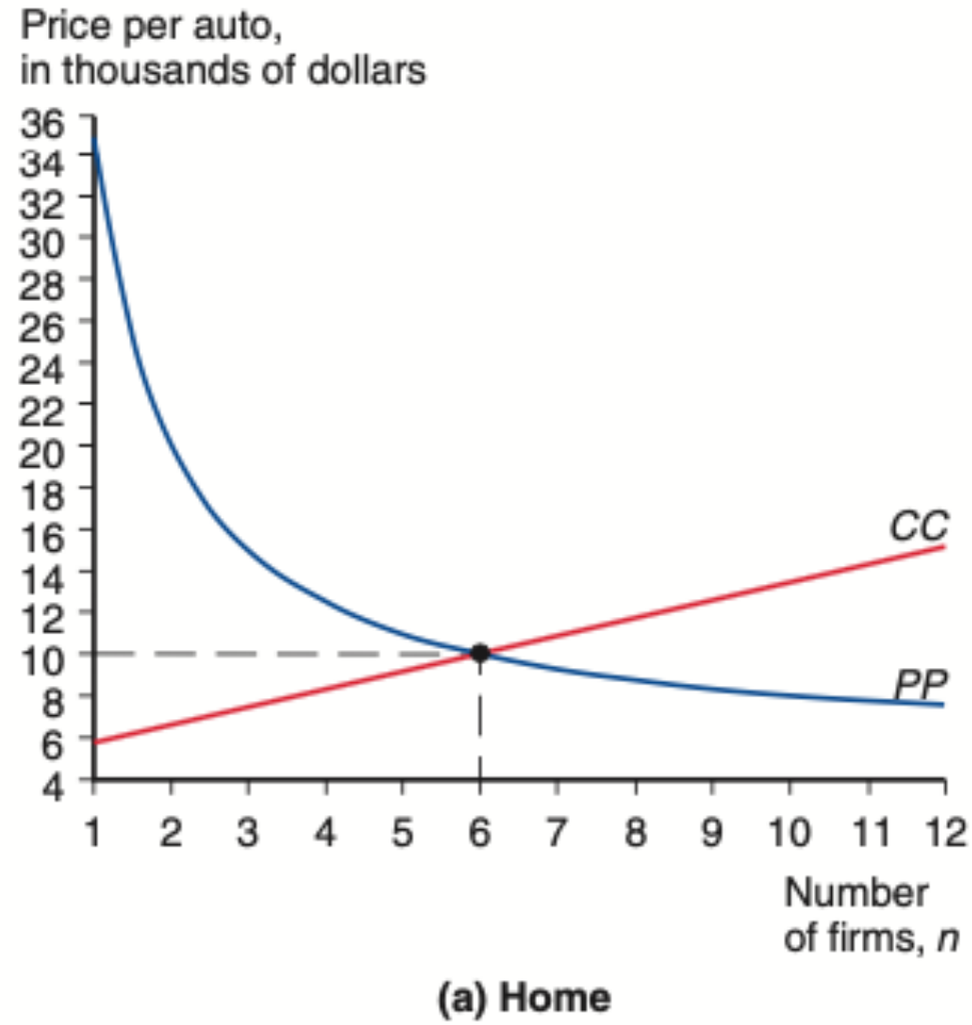
- Suppose automobiles (cars) are produced by a monopolistically competitive industry
- Eq 8-5 (demand curve) with b=1/30000
  - $Q = S[1/n - (1/30000)(P - \bar{P})]$
- F=750,000,000, c=5,000
  - $C = 750{,}000{,}000 + 5{,}000 \times Q$
  - $AC = C/Q = 750{,}000{,}000/Q + 5{,}000$

Numerical Example: Home Country (No Trade)

- Suppose there are two countries: H and F
  - They have same costs of production (assumption)
  - H sells 900,000 cars per year
  - H has 6 firms
  - Price: $10,000
- Eq8-10:

$$P = c + 1/(bn) = 5000 + 1/[(1/30000) \times 6] = 10000$$

- In equilibrium, Q = 900000/6=150000 units/firm
- $AC = nF/S + c$ = 750000000/150000+5000=10000

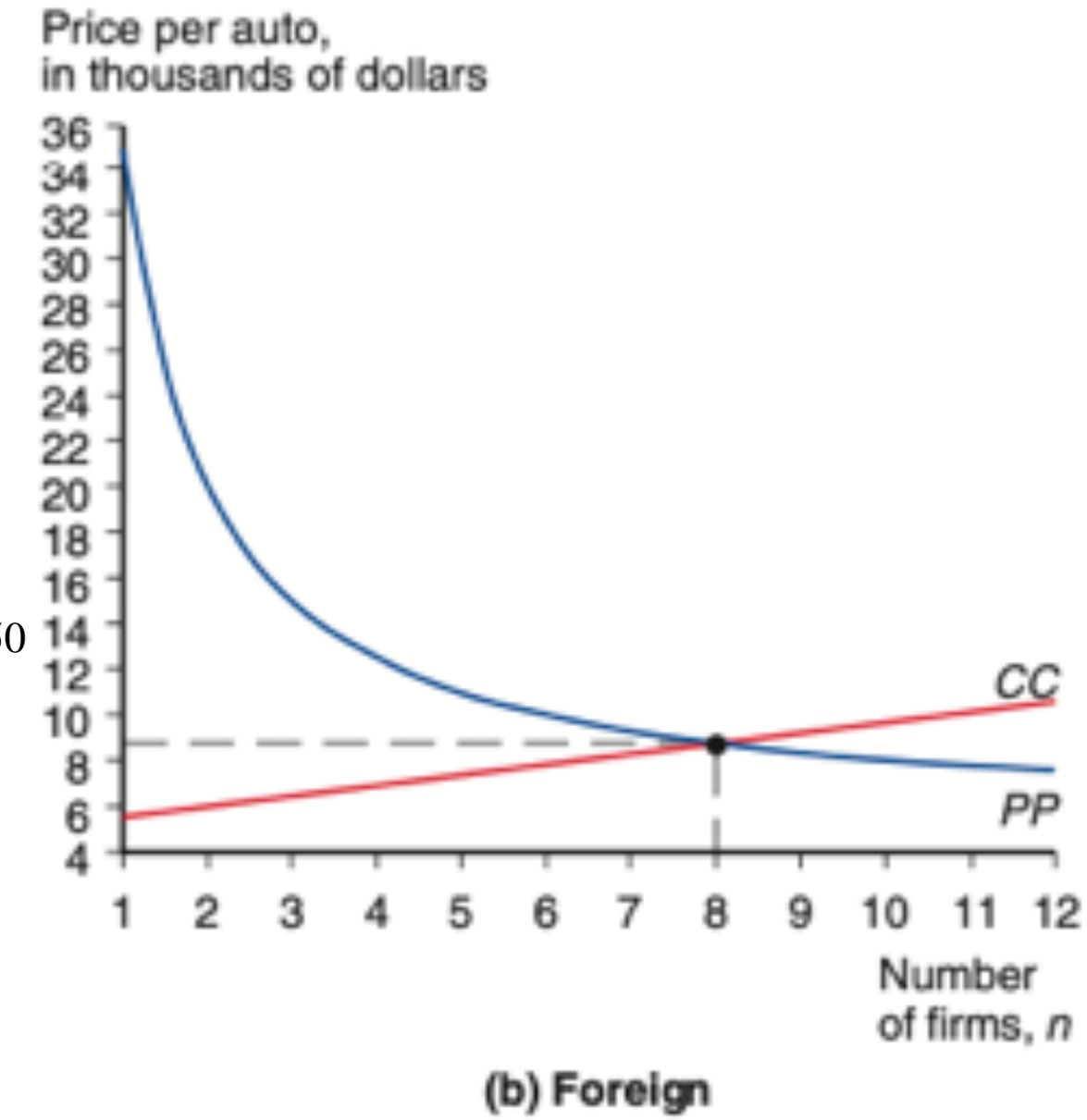


Numerical Example: Foreign Country (No Trade)

- Suppose there are two countries: H and F
  - They have same costs of production (assumption)
  - F sells 1,600,000 cars per year
  - F has 8 firms
  - Price: $8,750
- Eq8-10:

$$P = c + 1/(bn) = 5000 + 1/[(1/30000) \times 8] = 8750$$

- In equilibrium, Q = 1,600,000/8=200,000 units/firm
- $AC = nF/S + c$ = 750000000/200000+5000=8750

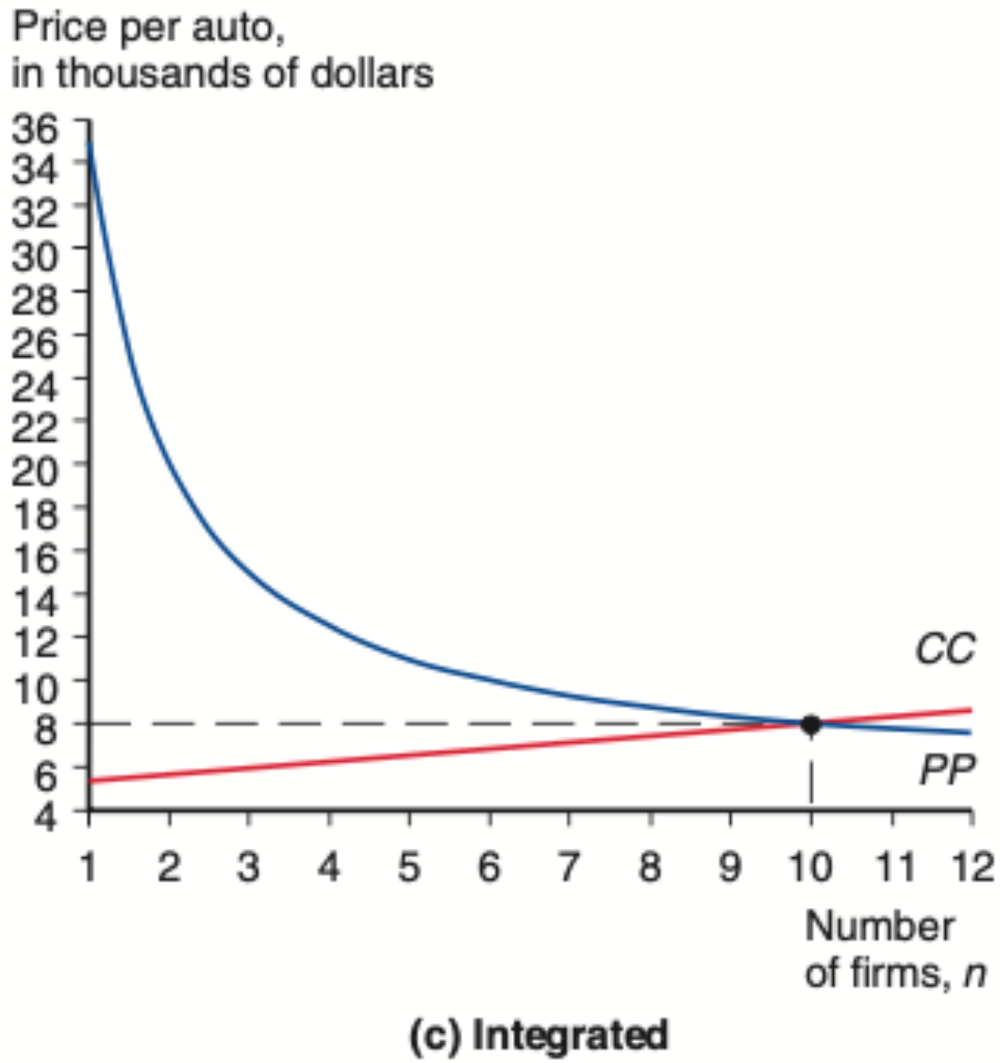


Numerical Example: Integrated Market

- Integrated market:
  - W sells 2,500,000 cars per year
  - W has 10 firms
  - Price: $8,000
- Eq8-10:

$$P = c + 1/(bn) = 5000 + 1/[(1/30000) \times 10] = 8000$$

- In equilibrium, Q = 2,500,000/10=250,000 units/firm
- $AC = nF/S + c$ = 750000000/250000+5000=8000



(c) Integrated

Intra-Industry Trade

- Trade motivation is NOT difference in comparative advantage (Ch.3)
  - ∵ H and F has same technology

TABLE 8–1 Hypothetical Example of Gains from Market Integration

	Home Market, before Trade	Foreign Market, before Trade	Integrated Market, after Trade
Industry output (# of autos)	900,000	1,600,000	2,500,000
Number of firms	6	8	10
Output per firm (# of autos)	150,000	200,000	250,000
Average cost	$10,000	$8,750	$8,000
Price	$10,000	$8,750	$8,000

The Significance of Intra-Industry Trade

$$I := \frac{\min(exports, imports)}{(exports + imports)/2}$$

TABLE 8–2 Indexes of Intra-Industry Trade for U.S. Industries, 2009

Metalworking Machinery	0.97
Inorganic Chemicals	0.97
Power-Generating Machines	0.86
Medical and Pharmaceutical Products	0.85
Scientific Equipment	0.84
Organic Chemicals	0.79
Iron and Steel	0.76
Road Vehicles	0.70
Office Machines	0.58
Telecommunications Equipment	0.46
Furniture	0.30
Clothing and Apparel	0.11
Footwear	0.10

Actively Traded

Mostly Imported (or Exported)

Benefits from Increased Variety of Goods

- Christian Broda et al. (2006)
  - "Globalization and the Gains from Variety"
  - Estimates the number of available products in US imports TRIPLED in 1972-2001
- Increased product variety for US consumers represented a welfare gain equal to 2.6% of US GDP
- Another example: European Economic Community

Firm Responses to Trade: Winners, Losers, and Industry Performance

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Losers from Trade

- Before trade, there were 6+8=14 firms
- After trade, there are 10 firms
- 4 firms exited: Losers

TABLE 8–1 Hypothetical Example of Gains from Market Integration

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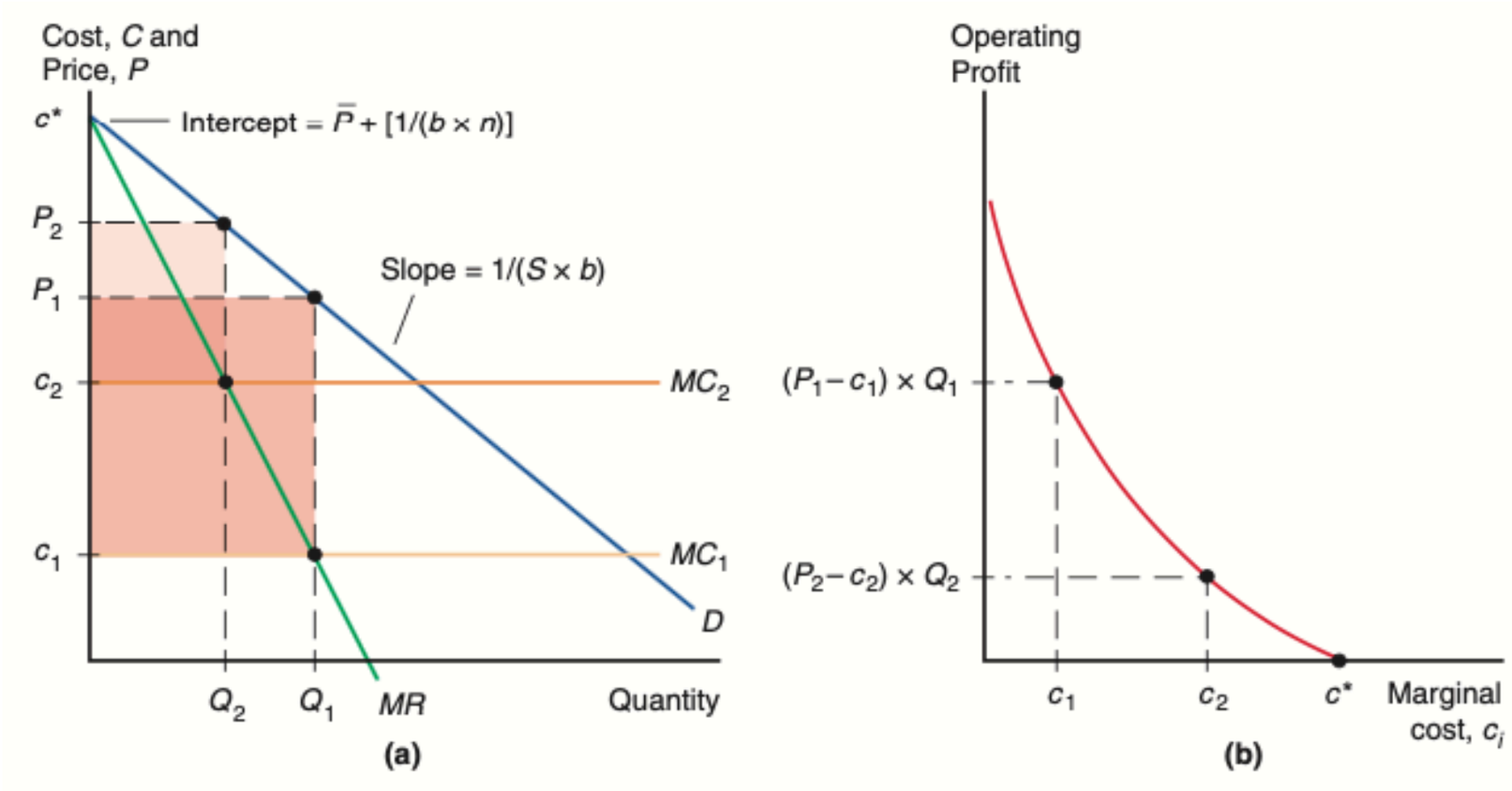
Winners and Losers from Trade

- Winners: Better-performing firms
  - Expand after trade
- Losers: Worse-performing firms
  - Exit after trade
- Average industry performance improve
- Daneil Trefler (2004) Canada-US FTA
  - Canadian firms' productivity 14-15% ↑

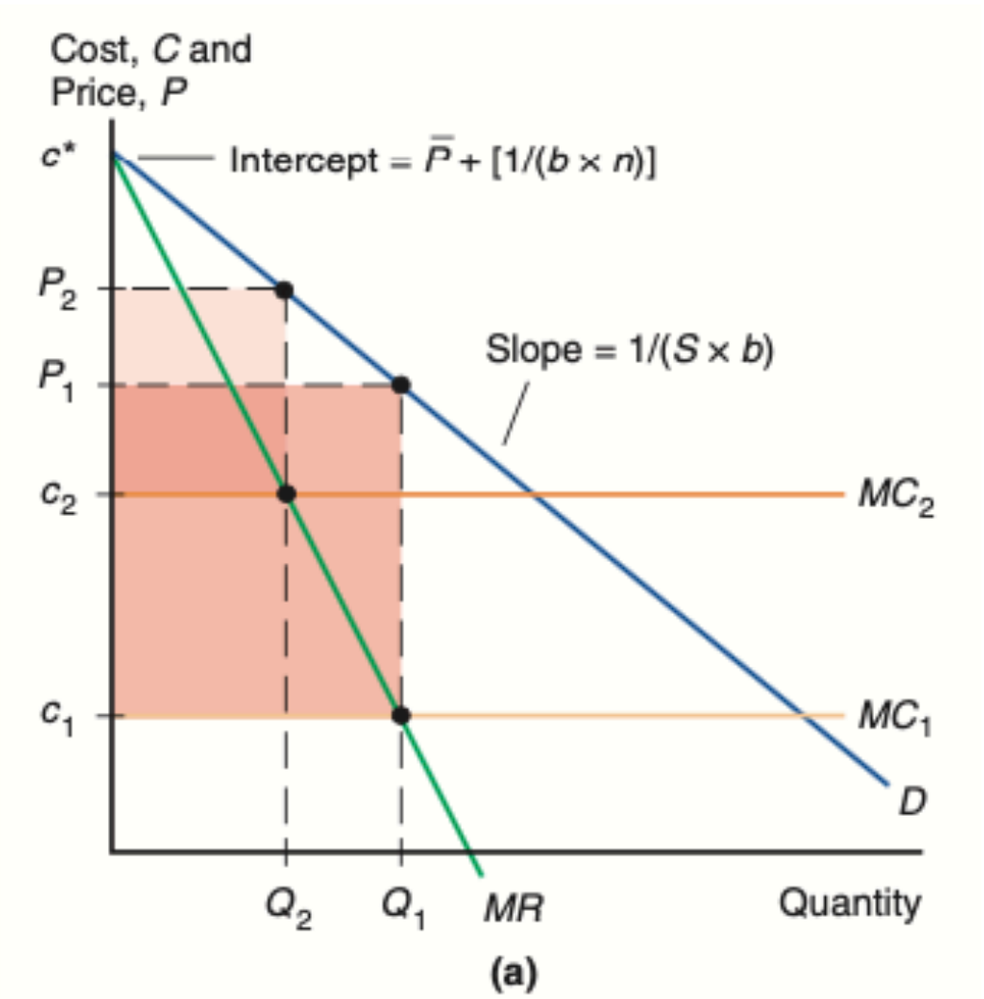
Performance Differences across Producers

- Relax the symmetry assumption of the monopolistic competition model:
  - From now, firms have different cost curves
  - Firm 1, Firm 2 have $c_1 < c_2$,

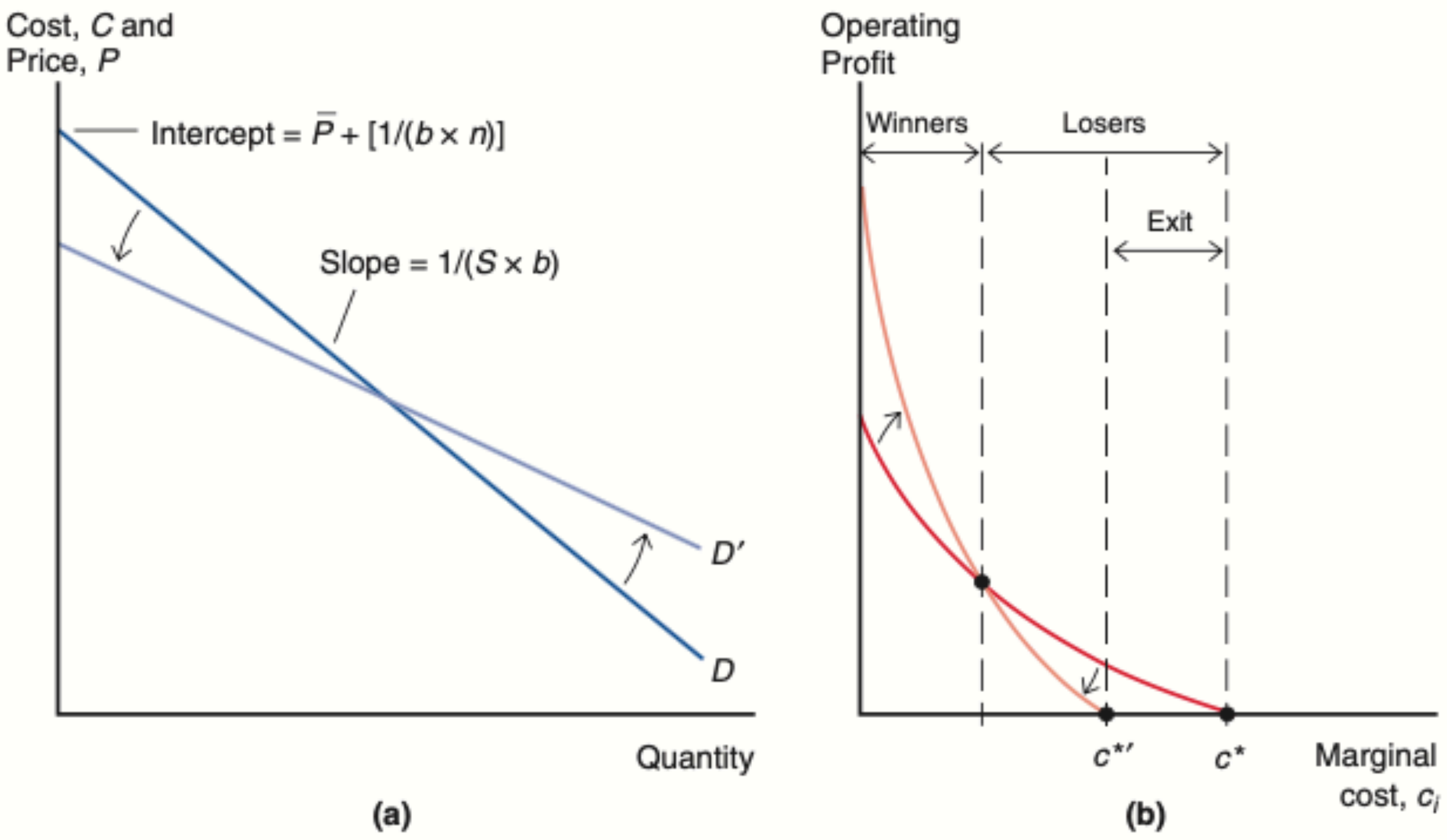


- Lower MC firm:
  - set a lower price
  - higher markup over MC
  - produce more output
  - earn higher profits

- c^*: cost cutoff
- If $c_i > c^*$
  - Firm i will exit



The Effects of Increased Market Size ($S \uparrow$)



Trade Costs and Export Decisions

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Effect of the trade cost

- t = trade cost
- Only part of the firms export

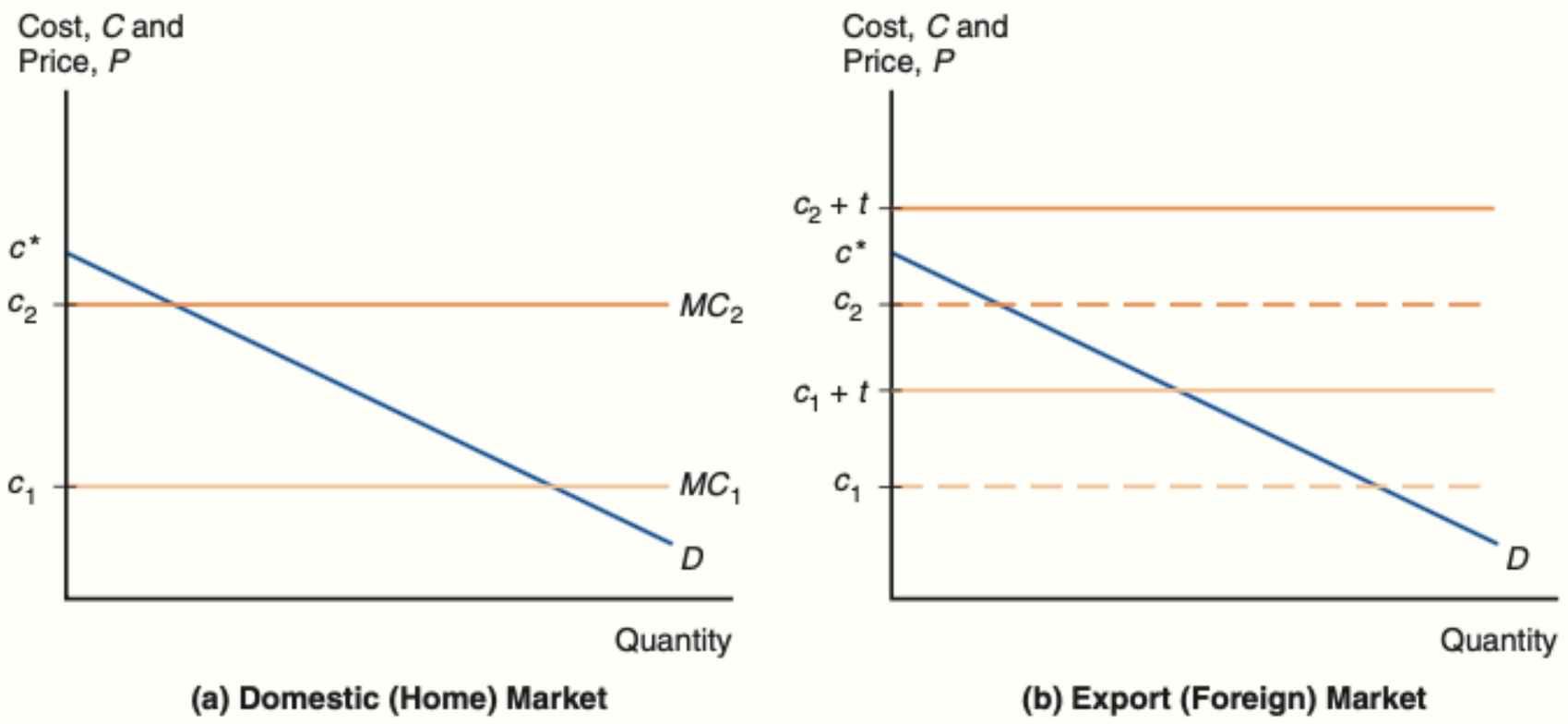
TABLE 8–3 Proportion of U.S. Firms Reporting Export Sales by Industry, 2016

Printing	15%
Furniture	16%
Wood Products	21%
Apparel	22%
Fabricated Metals	30%
Petroleum and Coal	34%
Transportation Equipment	57%
Machinery	61%
Chemicals	65%
Electrical Equipment and Appliances	70%
Computer and Electronics	75%

Source: A. B. Bernard, J. B. Jensen, S. J. Redding, and P. K. Schott, "Global Firms." NBER Working Paper, 22727 (October 2016).

Export Decisions with Trade Costs

- t = trade cost
- Exporting firms are bigger and more productive



Dumping

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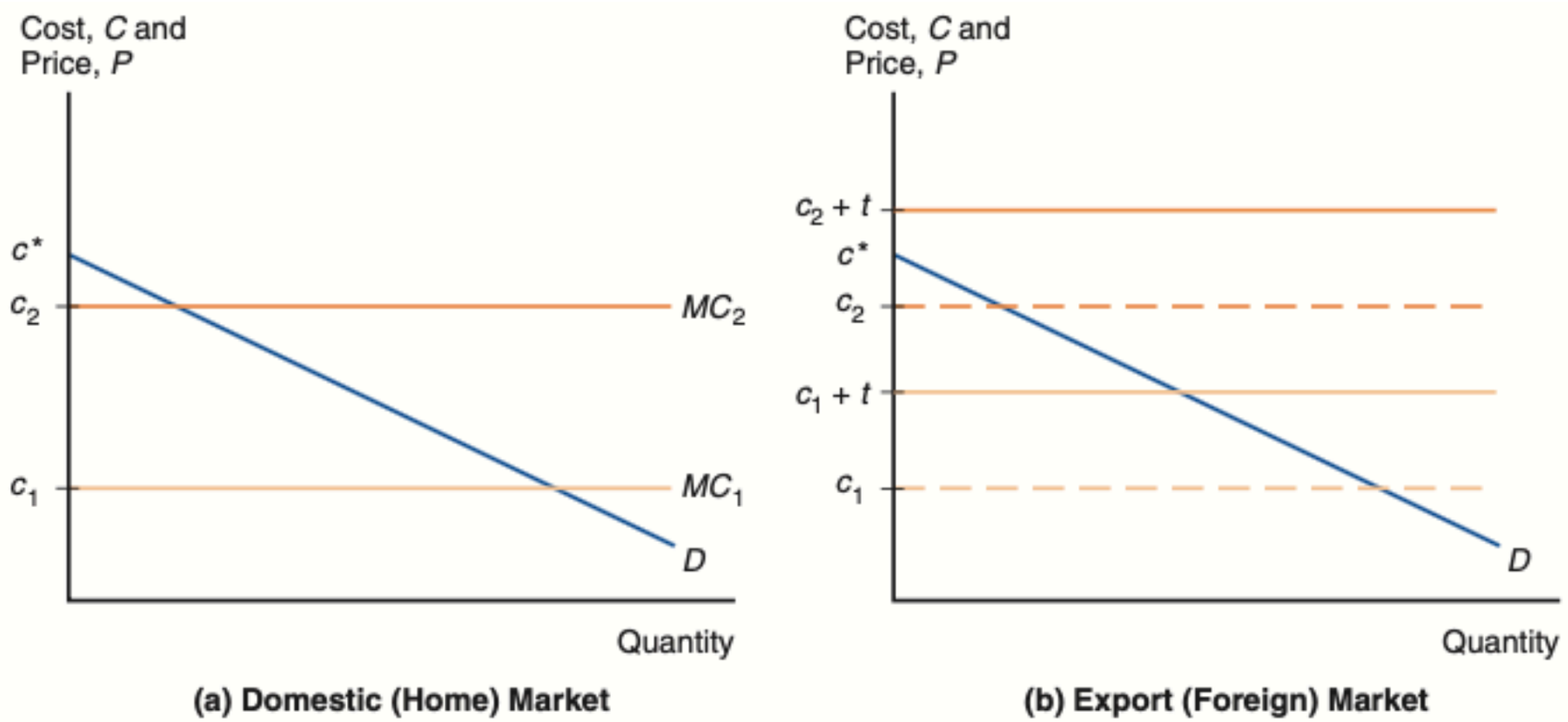
Dumping

- P_1^D, P_1^X: price that firm 1 sets on its domestic (Home) market and export market
- Firm 1 sets a lower markup $P_1^X - (c_1 + t)$ on the export market < $P_1^D - c_1$ on the domestic market
- That is considered "dumping": regarded as unfair ⇒ panelty to firm1 as "antidumping duty" imposed



Controversies About Dumping

- Economists believe that the enforcement of dumping claim is misguided
- There is no good economic justification for dumping to be considered particularly harmful
- In practice, antidumping laws can be used to erect barriers to trade by discriminating against exporters in a market

Next Topic

- Multinationals and Outsourcing (Ch8)
- The Firms Decision Regarding FDI
- The Instruments of Trade Policy (Ch9)

Thank you!

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Thank you!

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