

Lecture 7c:

Firm Heterogeneity

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C181 – International Trade

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3- Facts on Firm Heterogeneity

Related topics to be discussed:

Facts on firm heterogeneity:

- Are all firms identical?
- Do all firms export?
- Are exporters smaller or larger than other firms?
- Are exporters more productive?
- Do firms tend to export to the same destinations?
- Does trade affect firms symmetrically?

3- Facts on Firm Heterogeneity

Are all firms identical?

The answer is obviously “no”

But the differences between firms are usually understated!!

3- Facts on Firm Heterogeneity

FACT 1:

- Firms are extremely heterogeneous:

About 50% of US output from the 0.3% largest firms

Zipf's law:

If n^{th} ranked firm has size s , $(n/2)^{\text{th}}$ firm has size $2s$

3- Facts on Firm Heterogeneity

Do all firms exports?

Again, the answer is “no”

TABLE 1—PLANT-LEVEL EXPORT FACTS

Export status	Percentage of all plants
No exports	79
Some exports	21
Export intensity of exporters (percent)	Percentage of exporting plants
0 to 10	66
10 to 20	16
20 to 30	7.7
30 to 40	4.4
40 to 50	2.4
50 to 60	1.5
60 to 70	1.0
70 to 80	0.6
80 to 90	0.5
90 to 100	0.7

Note: The statistics are calculated from all plants in the 1992 Census of Manufactures.

3- Facts on Firm Heterogeneity

FACT 2:

- Only a small fraction of firms export (21% of US firms in 1992)

FACT 3:

- Most exporters only export a small fraction of their output

3- Facts on Firm Heterogeneity

Are exporters larger?

3- Facts on Firm Heterogeneity

FACT 4:

- **Exporters are much bigger:**

Total output 5.2 larger than non-exporters

3- Facts on Firm Heterogeneity

FACT 4:

- **Exporters are much bigger:**

Total output 5.2 larger than non-exporters

... Even if you don't count their export sales:

Domestic sales 4.8 larger than non-exporters

3- Facts on Firm Heterogeneity

Are exporters more productive?

3- Facts on Firm Heterogeneity

FACT 5:

- Exporters are more productive
productivity premium: 33%

TABLE 2—PLANT-LEVEL PRODUCTIVITY FACTS

Productivity measure (value added per worker)	Variability (standard deviation of log productivity)	Advantage of exporters (exporter less nonexporter average log productivity, percent)
Unconditional	0.75	33
Within 4-digit industries	0.66	15
Within capital-intensity bins	0.67	20
Within production labor-share bins	0.73	25
Within industries (capital bins)	0.60	9
Within industries (production labor bins)	0.64	11

Notes: The statistics are calculated from all plants in the 1992 Census of Manufactures. The “within” measures subtract the mean value of log productivity for each category. There are 450 4-digit industries, 500 capital-intensity bins (based on total assets per worker), 500 production labor-share bins (based on payments to production workers as a share of total labor cost). When appearing within industries there are 10 capital-intensity bins or 10 production labor-share bins.

3- Facts on Firm Heterogeneity

- Observed productivity differences in various countries:
US (Bernard et al 1997), **Taiwan and Korea** (Aw, Chung and Roberts, 2000), **France** (Eaton Kortum Kramarz 2004), **Germany** (Bernard and Wagner 2001), **Columbia, Mexico, Morocco** (Clerides et al 1998), etc.
- Various dimensions (Bernard and Jensen 1999):
Exporters pay higher wages, have higher capital-labor ratio, employ more skilled labor, have higher TFP, etc.

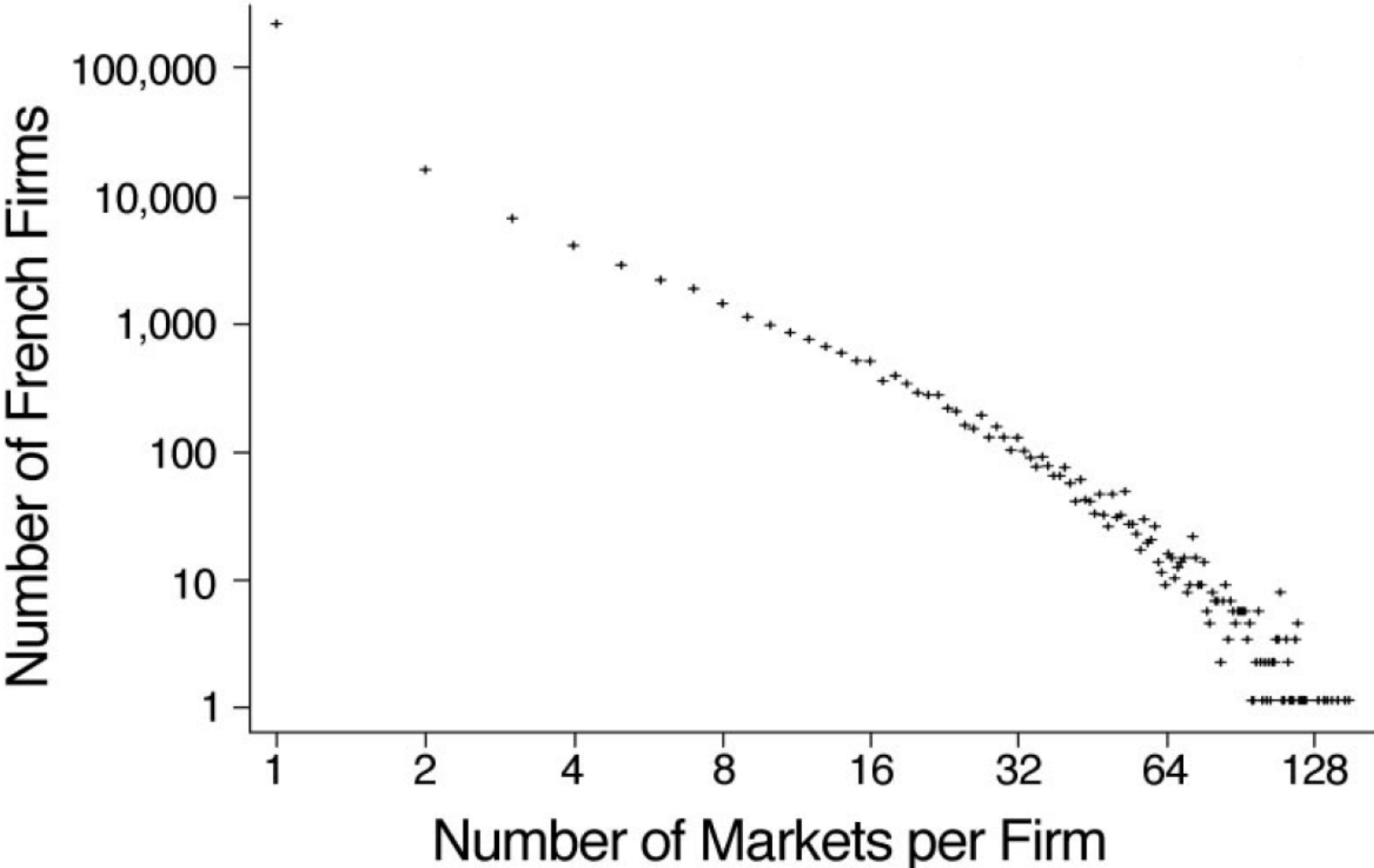
3- Facts on Firm Heterogeneity

Export destinations

FACT 6:

- Only a few exporters sell to many markets

Firms in France:



3- Facts on Firm Heterogeneity

Effect of trade

FACT 7:

- After trade liberalization, less productive firms exit the market while more productive firms expand

3- Facts on Firm Heterogeneity

Conclusions:

- Fact 1: Firms differ widely
- Fact 2: Few firms export
- Fact 3: And they export a small portion of their output
- Fact 4: Exporters are bigger
- Fact 5: Exporters are more productive
- Fact 6: Few firms export to many destinations
- Fact 7: Less productive firms more likely to exit after trade liberalization

4- Modeling Firm Heterogeneity

Theory:

Why differences in costs matter?

1- Different firms have different MC's

2- Trade costs affect exporters

Implications for:

- Quantities,
- markups,
- profits,
- and **export participation**

4- Modeling Firm Heterogeneity

This lecture:

We will be able to explain

- Why firms have very different sizes
- Why trade makes unproductive firms disappear
- Why a trade liberalization can lead to an increase in aggregate productivity
- Why some firms export while other don't
- Why export sales tend to be smaller than domestic sales

4- Modeling Firm Heterogeneity

Sources of heterogeneity

1st step: understand heterogeneity among firms:

- We will assume that firms have the same fixed cost (e.g. R&D costs) but differ in their marginal cost

4- Modeling Firm Heterogeneity

Sources of heterogeneity

1st step: understand heterogeneity among firms:

- We will assume that firms have the same fixed cost (e.g. R&D costs) but differ in their marginal cost

2nd step: understand difference between exporters and non-exporters:

- We will assume that there is a higher marginal cost associated with exporting

4- Modeling Firm Heterogeneity

Optimal quantities and prices

- **Same demand system:** $Q = S \cdot [1/n - b(P - \bar{P})]$

yields again: $MR = P - \frac{Q}{bS}$

→ All firms face the same MR curve (as a function of Q)

- **Optimum:** More productive firms: lower/higher MR?

4- Modeling Firm Heterogeneity

Optimal quantities and prices

- **Same demand system:** $Q = S \cdot [1/n - b(P - \bar{P})]$

yields again: $MR = P - \frac{Q}{bS}$

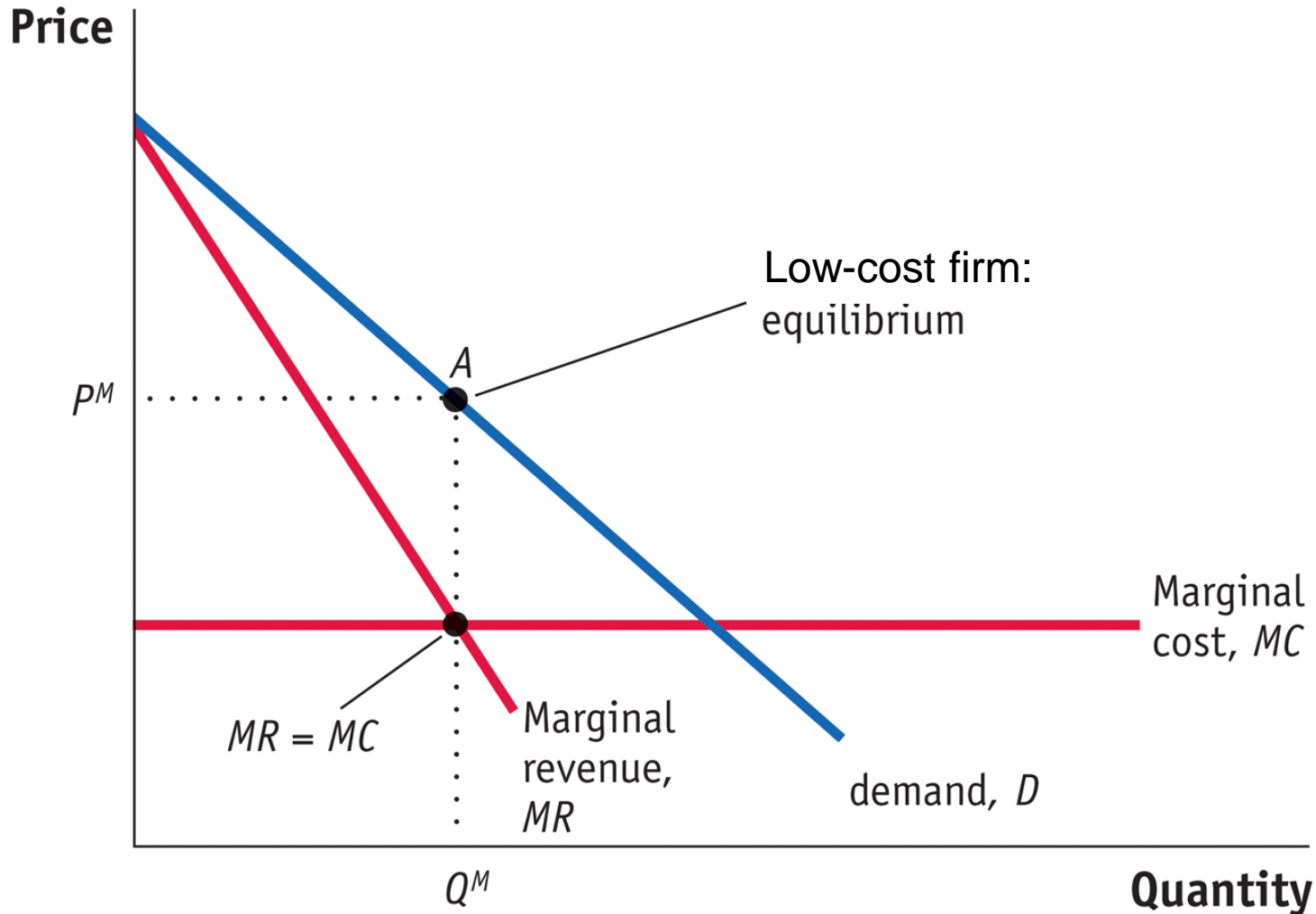
→ All firms face the same MR curve (as a function of Q)

- **Optimum:** MR = MC

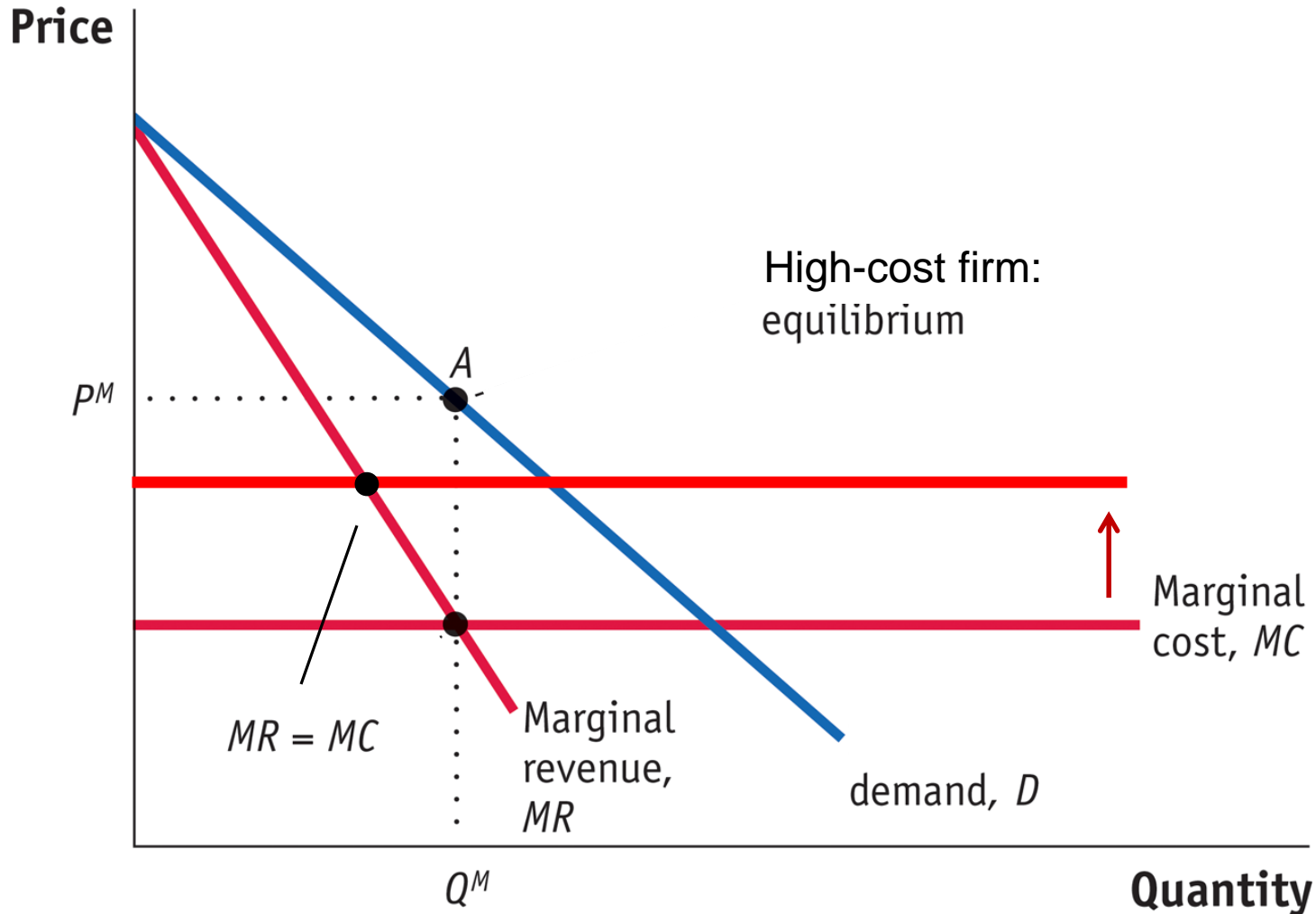
→ Hence more productive firms will have a lower MR

→ And produce more

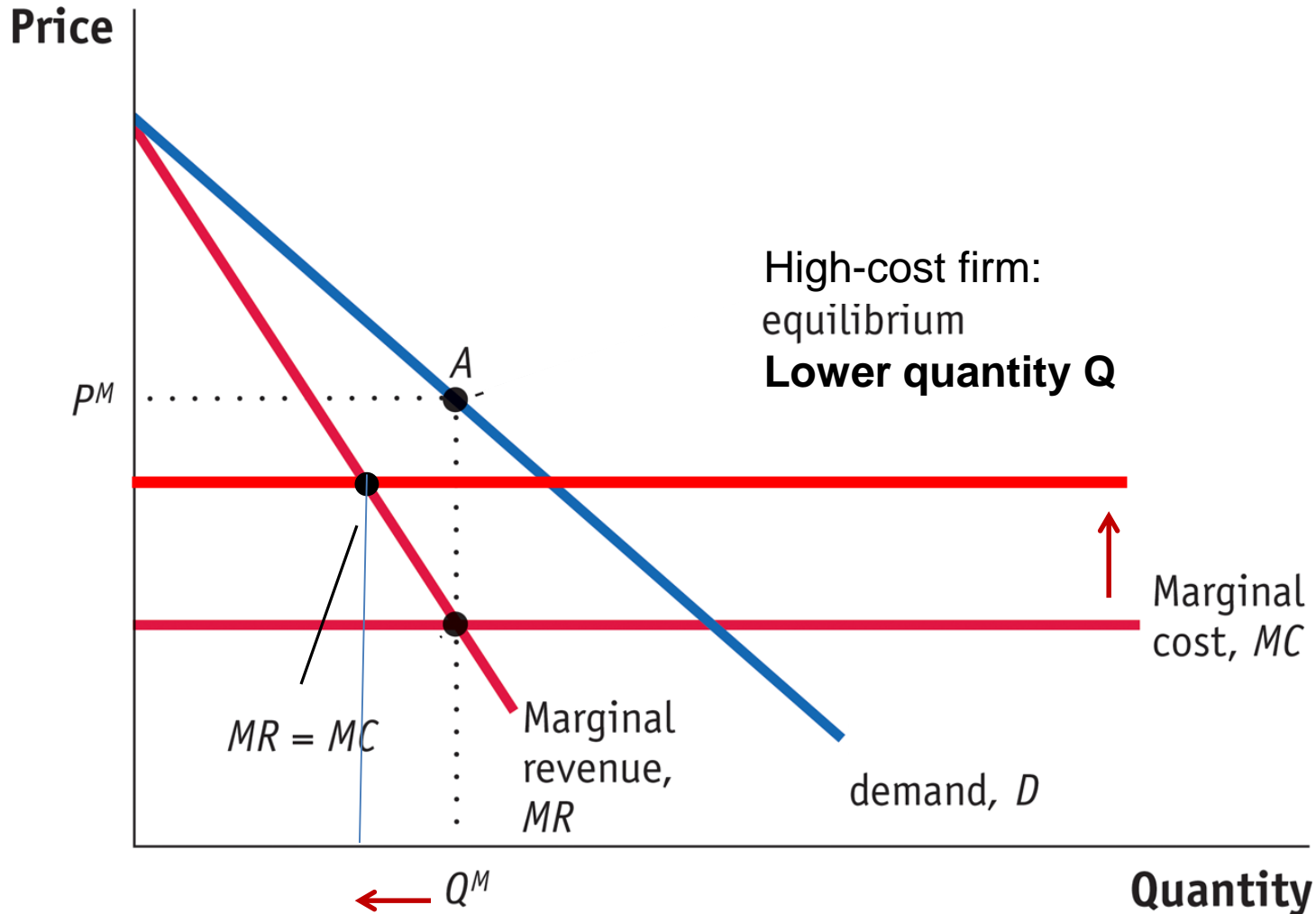
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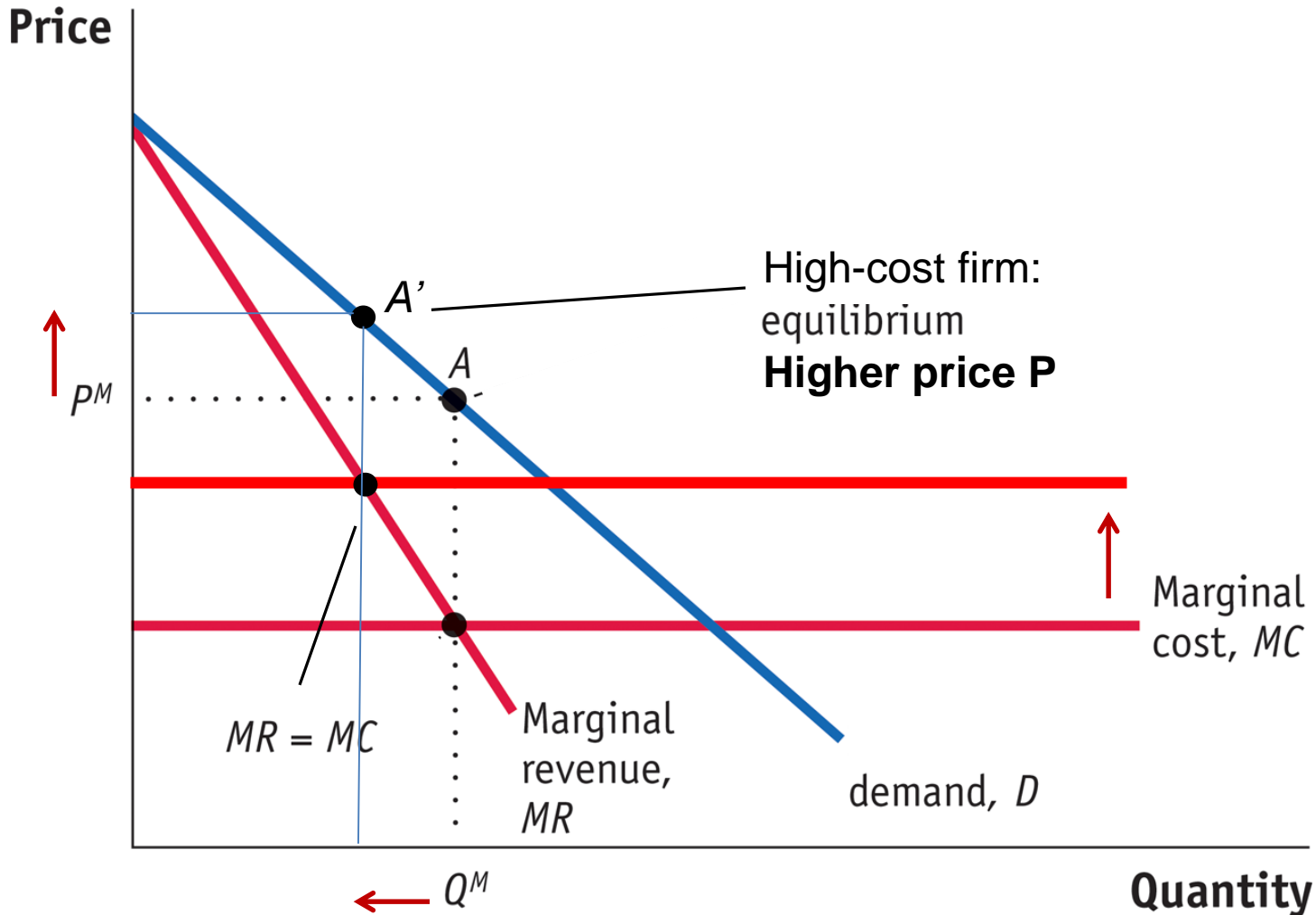
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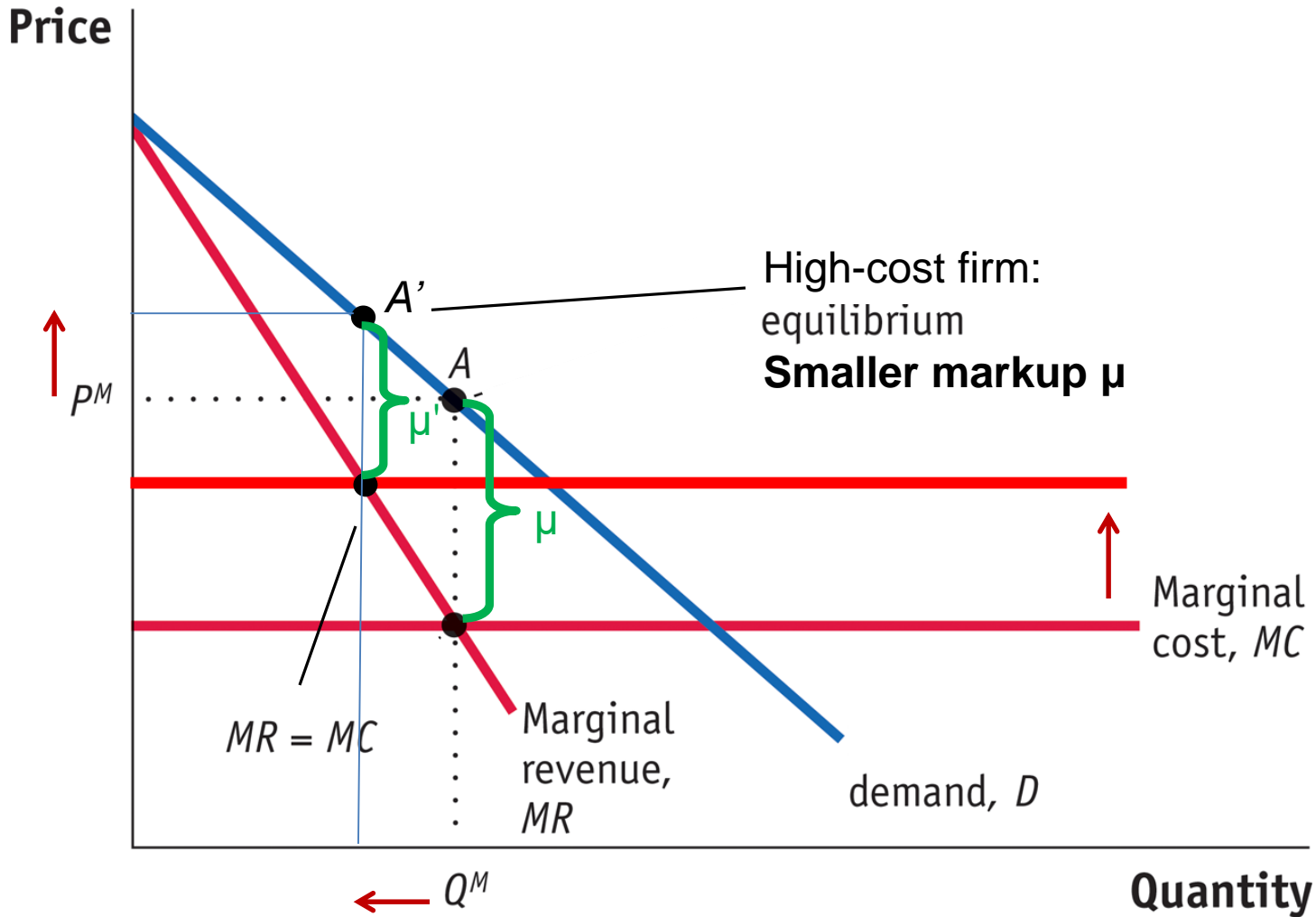
4- Modeling Firm Heterogeneity



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4- Modeling Firm Heterogeneity

Profits and “operating profits”:

- **Profits:**

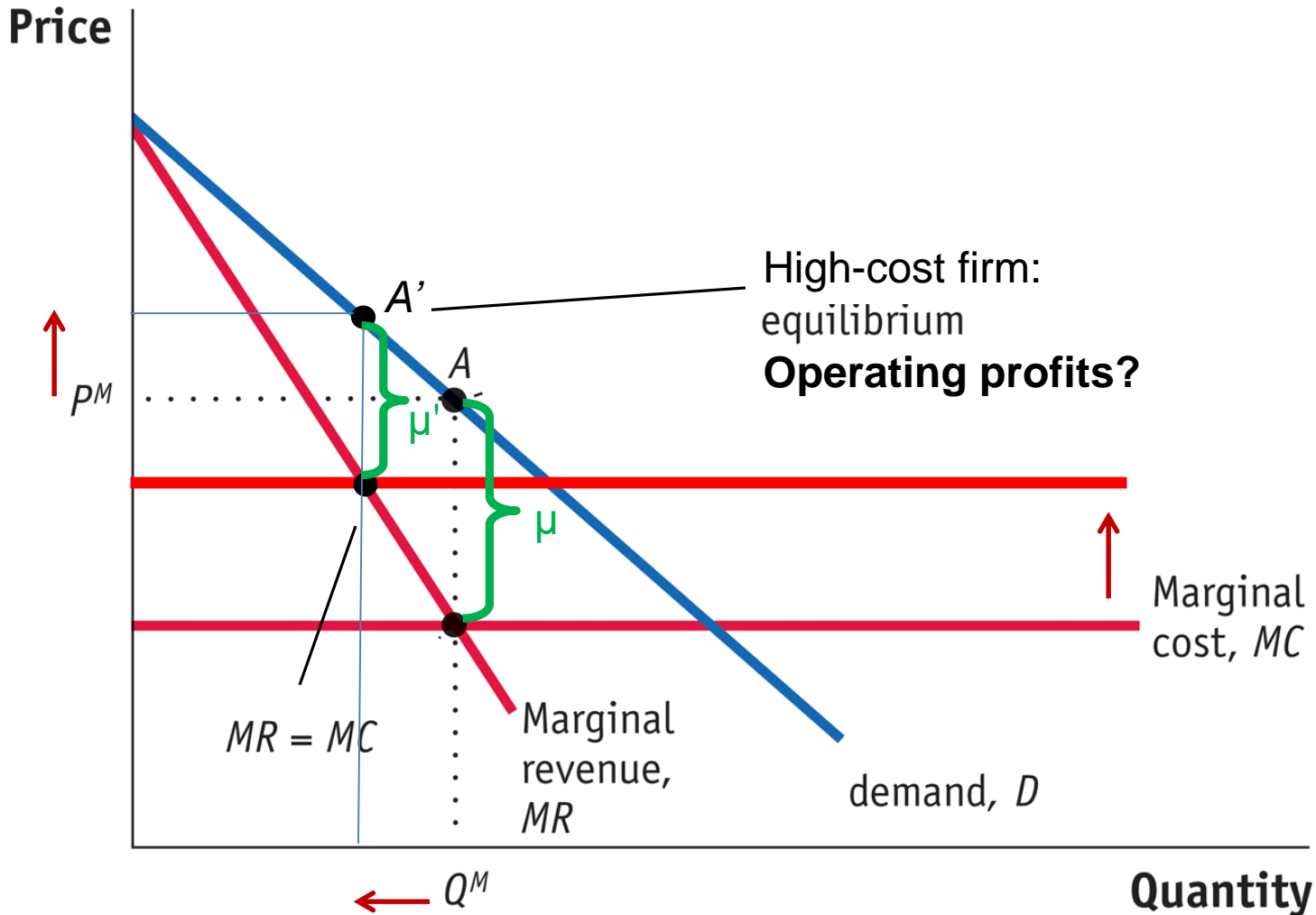
$$\begin{aligned}\text{Profits} &= \text{revenues} - \text{costs} \\ &= P \cdot Q - (c \cdot Q + F) \\ &= (P - AC) \cdot Q\end{aligned}$$

- **“Operating profits”:**

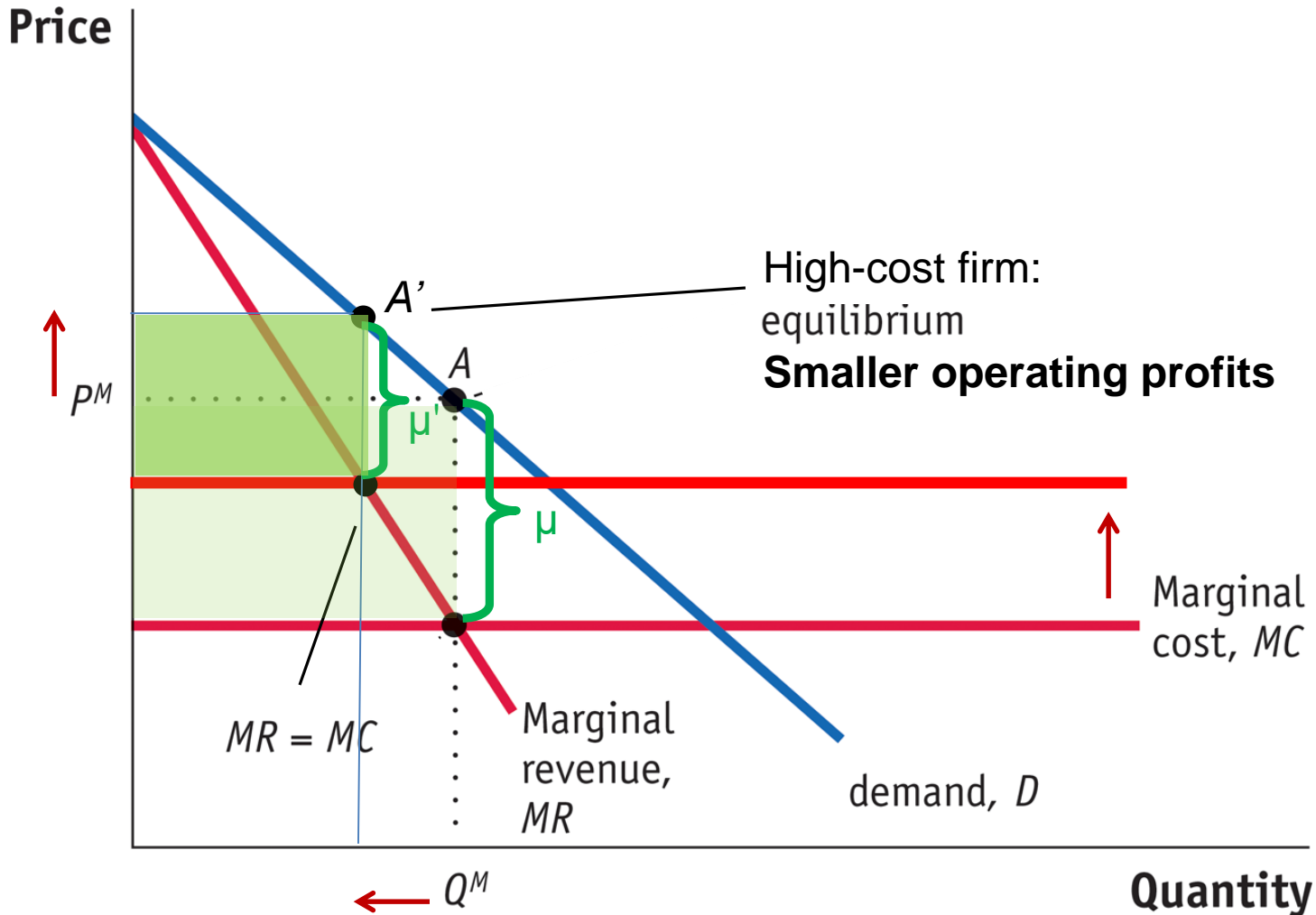
profits once fixed costs are incurred:

$$\begin{aligned}\text{OP} &= \text{revenues} - \text{variable costs} \\ &= P \cdot Q - c \cdot Q \\ &= \text{markup} \times Q\end{aligned}$$

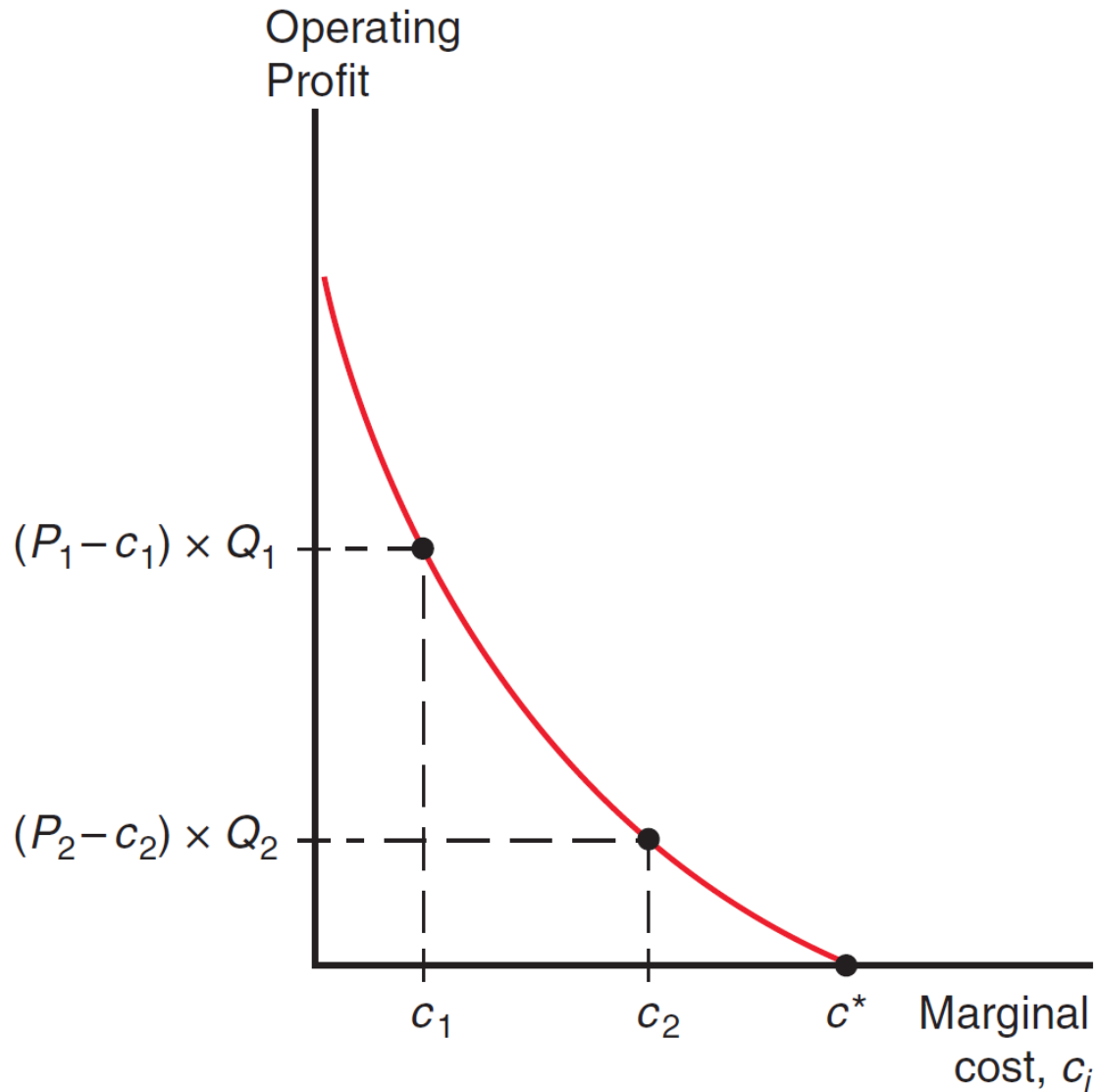
4- Modeling Firm Heterogeneity



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4- Modeling Firm Heterogeneity

Profits and “operating profits”:

- **Profits:**

Profits = Operating profits – Fixed costs

→ profits are smaller for high-cost firms

→ High-cost firms more likely to end up with negative profits

4- Modeling Firm Heterogeneity

Effect of trade:

- **Heterogeneous effect:**

Does trade affect heterogeneous firms differently?

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Effect of trade:

- **Heterogeneous effect:**

How does trade affect MR?

$$MR = P - \frac{Q}{bS} = \left(\frac{1}{bn} + \bar{P} \right) - \frac{2}{bS} * Q$$

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Effect of trade:

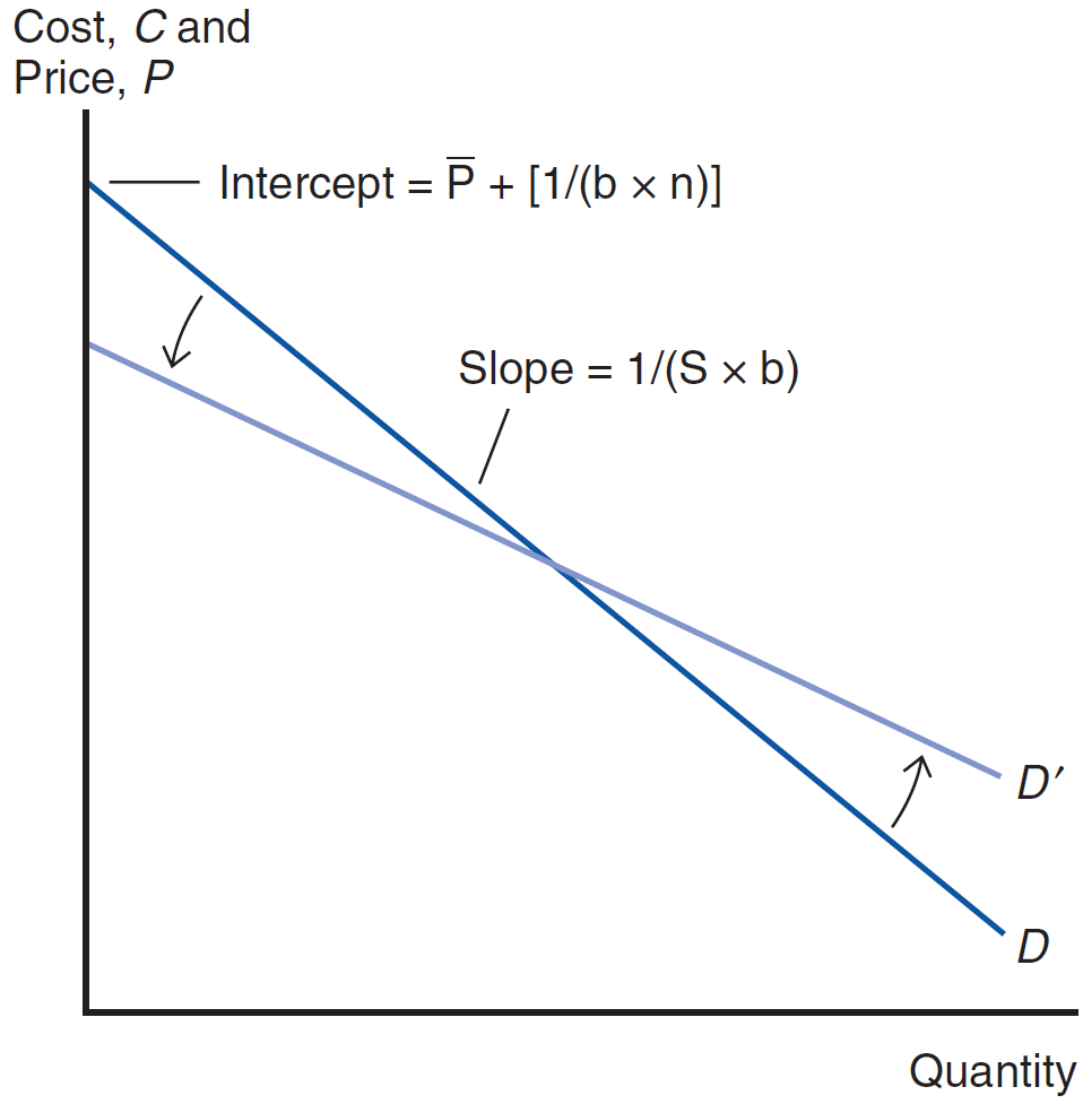
- **Heterogeneous effect:**

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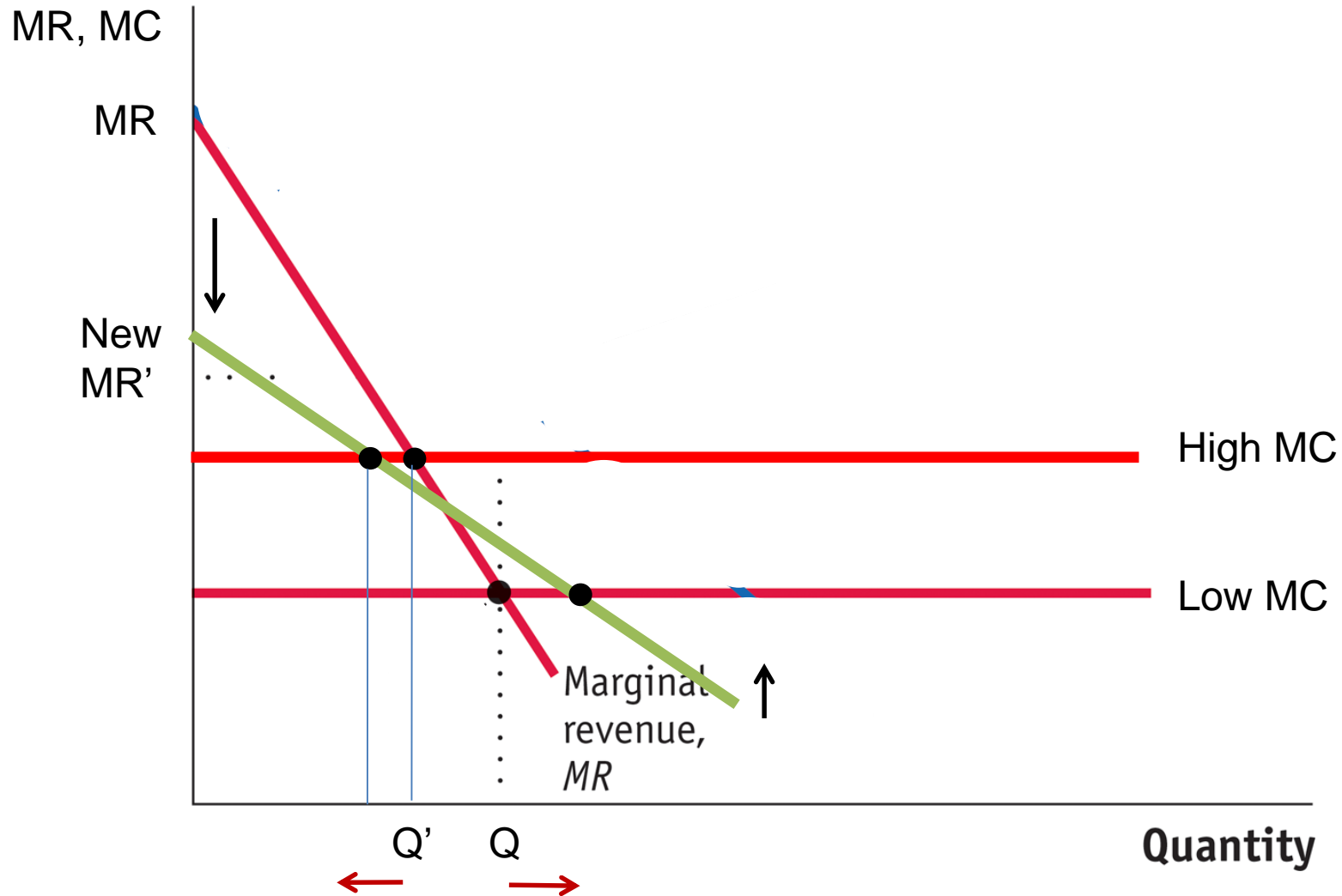
$$MR = P - \frac{Q}{bS} = \left(\frac{1}{bn} + \bar{P} \right) - \frac{2}{bS} * Q$$

- Trade lowers prices:
→ **lower intercept**
- Larger market size:
→ **flatter slope**

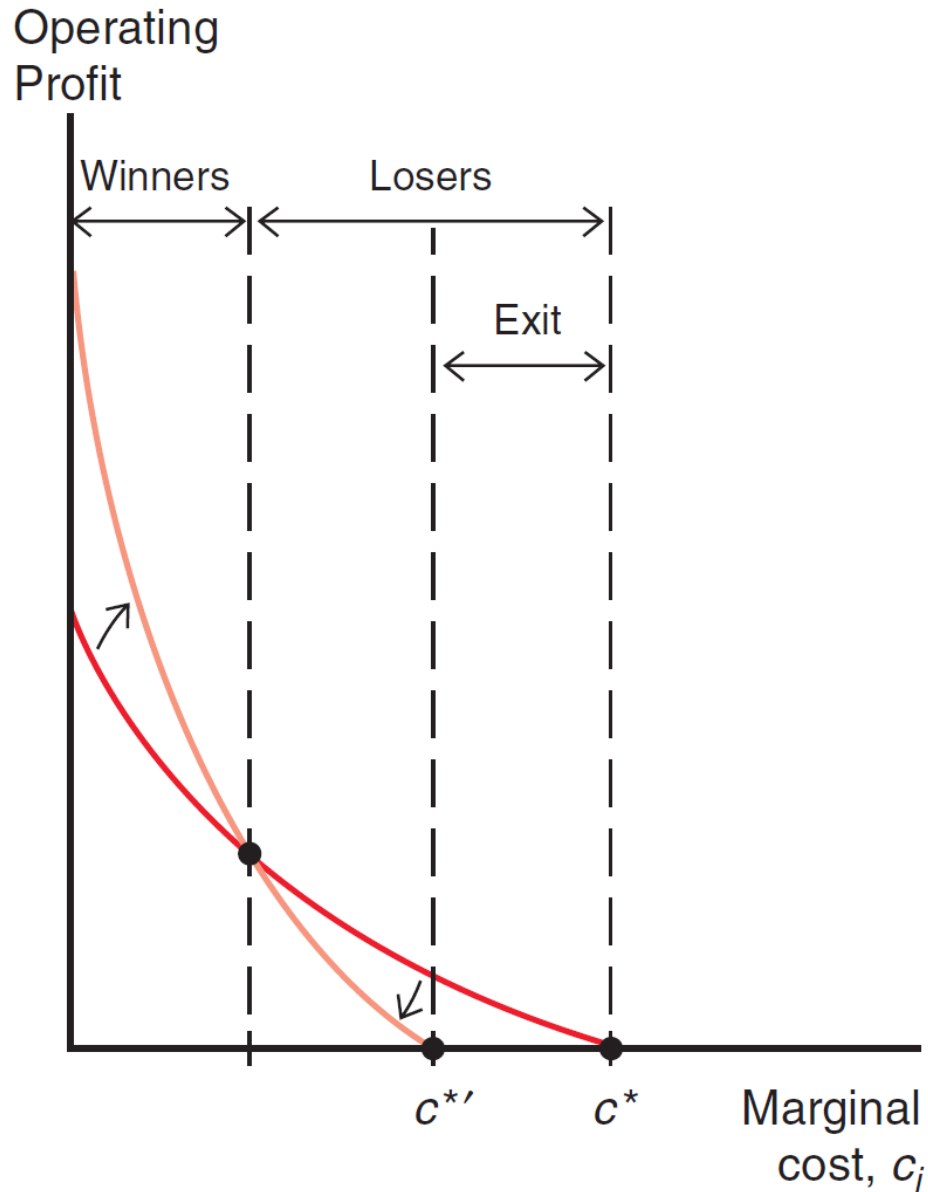
Effect of trade on MR:



Effect of trade on quantities:



Effect of trade on operating profits:



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Effect of trade:

- **Heterogeneous effect:**
- High-cost firms shrink, productive firms expand:
- Profits increase for productive firms
- High-cost firms have smaller profits and some of them exit

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Effect of trade:

→ **SELECTION effect:**

- Productive firms thrive, unproductive firms exit:

Key result: trade leads to average productivity gains!

4- Modeling Firm Heterogeneity

Summary: Effects of trade

With homogenous firms (long run):

- Firms exit so that profits are zero at equilibrium
- Higher production per firm, lower costs, lower prices

With **heterogeneous** firms (long run):

- Only the least productive firms exit
- Only the most productive firms expand
- *New source of gains: higher average productivity*

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Illustration: effect of NAFTA in Canada

Productivity Gains

Estimates: 15% average productivity increase for Canada after NAFTA in sectors most affected

4- Modeling Firm Heterogeneity

Sources of heterogeneity

1st step: understand heterogeneity among firms:

NOW:

2nd step: understand difference between exporters and non-exporters:

4- Modeling Firm Heterogeneity

Export participation

Next questions to answer:

- Why few firms export?
- Why are exporters more productive?
- Why firms export less than they sell domestically?

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Exporters vs. non-exporters

Trade costs:

- We will assume that there is a higher marginal cost associated with exporting:
low-MC for domestic sale, high-MC for exports

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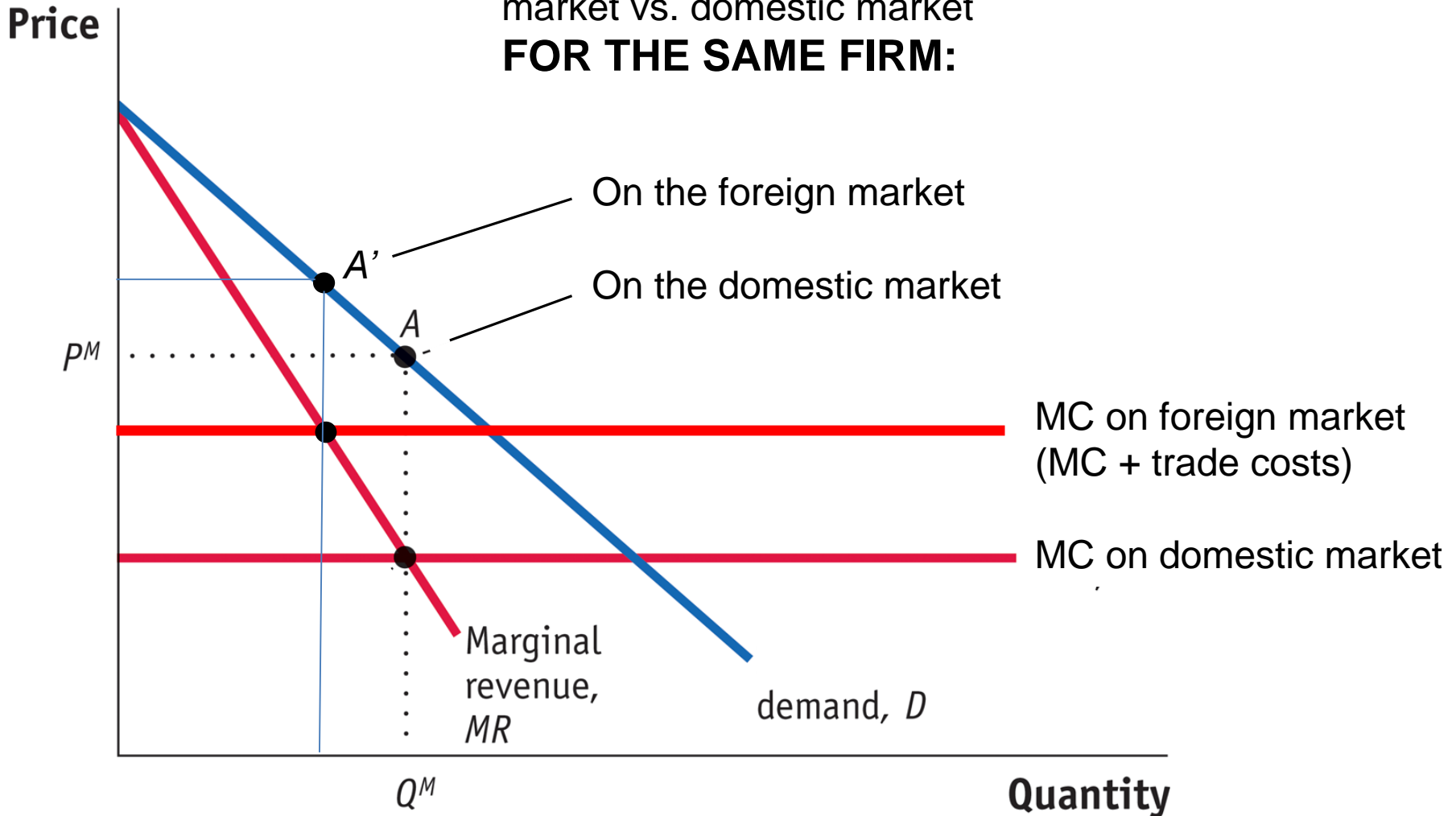
Exporters vs. non-exporters

Consequences of trade costs:

- Exported quantities to another market tend to be small
- Markups on another market tend to be smaller
- Profits on another market tend to be smaller

Effect of trade costs on performance:

Performance on the foreign market vs. domestic market
FOR THE SAME FIRM:



4- Modeling Firm Heterogeneity

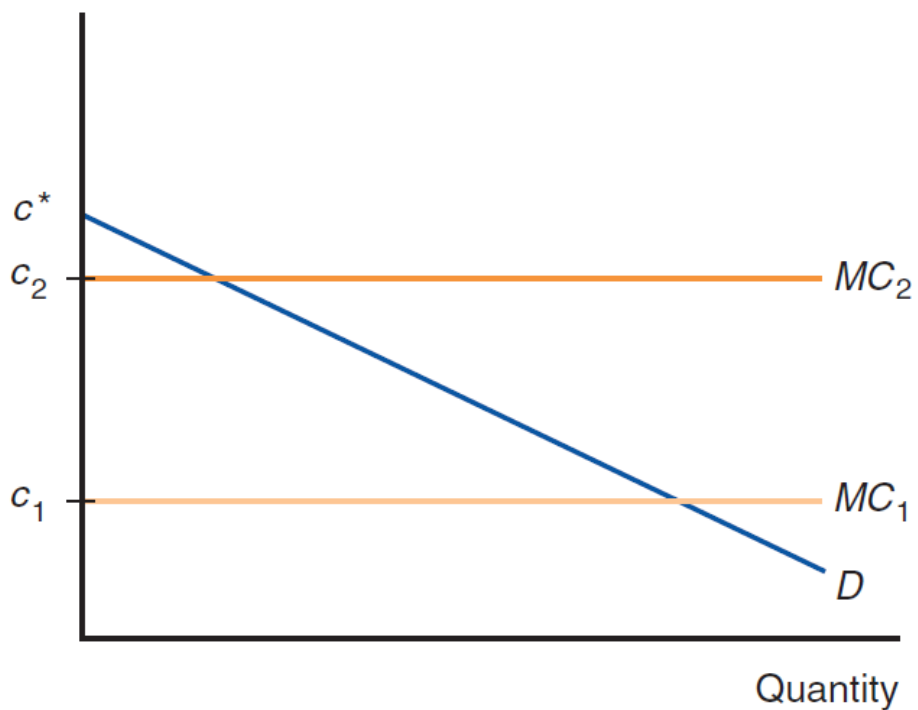
Exporters vs. non-exporters

Consequences of trade costs:

- Exported quantities to another market tend to be small
 - Markups on another market tend to be smaller
 - Profits on another market tend to be smaller
- Hence not all firms export!**

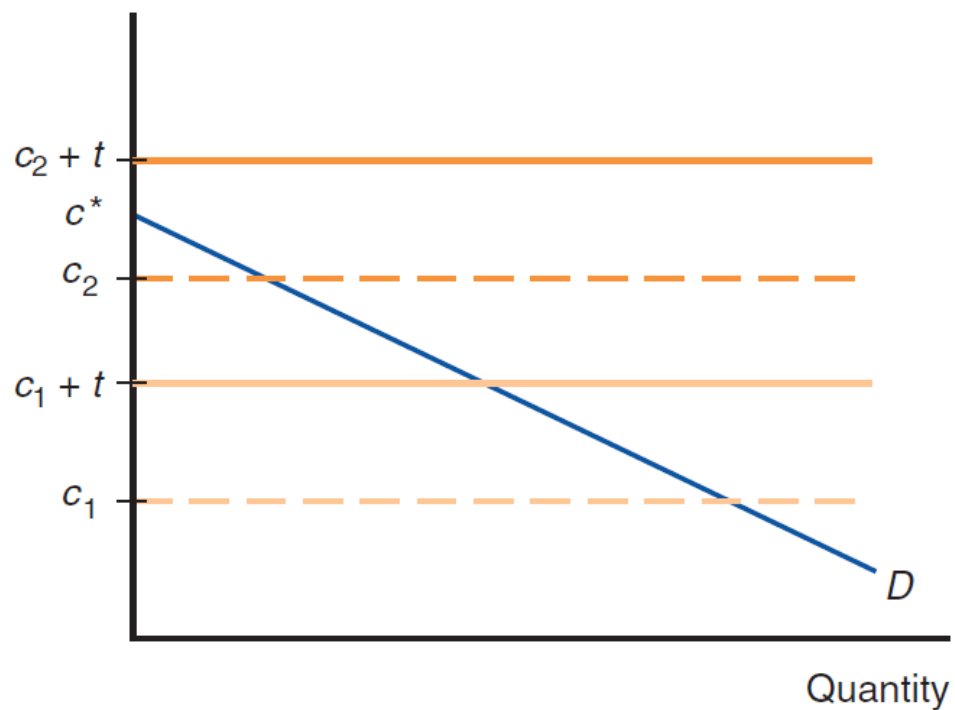
Not all firms export:

Cost, C and
Price, P



(a) Domestic (Home) Market

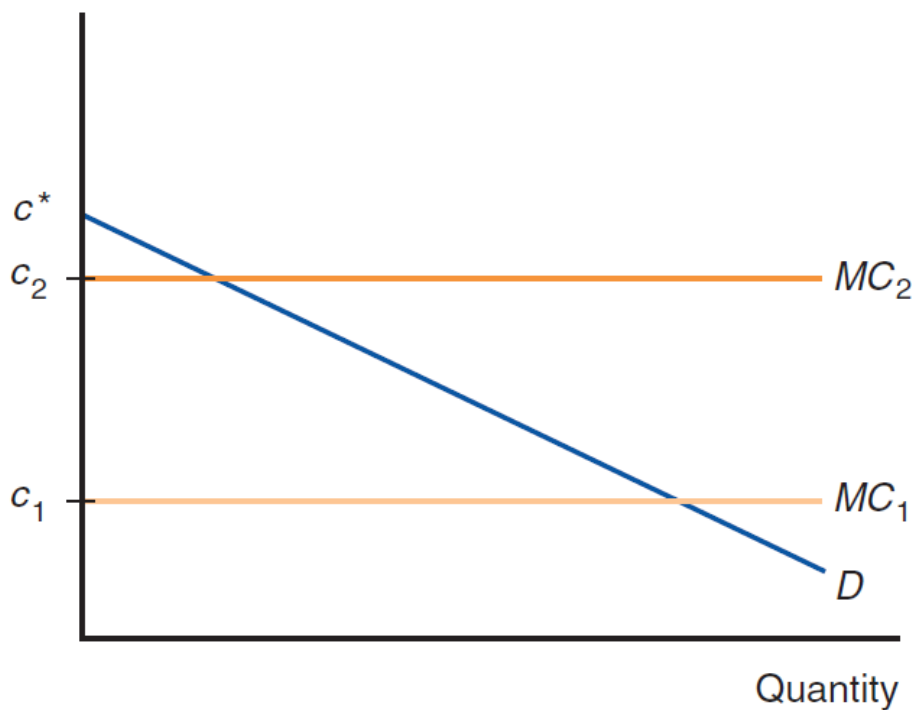
Cost, C and
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(b) Export (Foreign) Market

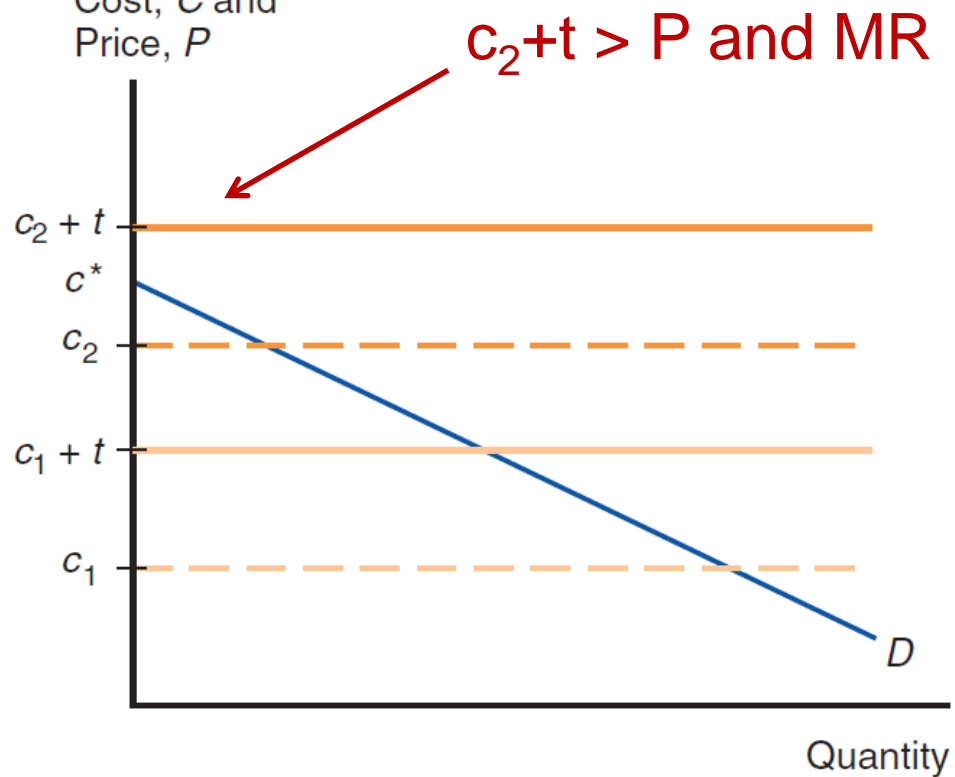
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(a) Domestic (Home) Market

Cost, C and
Price, P



(b) Export (Foreign) Market

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Exporters vs. non-exporters

Consequences of trade costs:

- Exported quantities to another market tend to be small
- Markups on another market tend to be smaller
- Profits on another market tend to be smaller

- Hence not all firms export
- Only the **most productive firms export**

4- Modeling Firm Heterogeneity

Export participation: Summary and Intuition

- Why few firms export?
- Why are exporters more productive?

Answer: Because trade costs impose an additional burden on marginal costs that only the most productive firms can bear

- Why firms export less than they sell domestically?

Answer: Trade costs make firms relatively more performant at home

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Clicker question

4- Modeling Firm Heterogeneity

Clicker question

1- Do you expect more productive firms...

- a) To sell more and have lower markups?
- b) To sell more and have higher markups?
- c) To sell less and have lower markups?
- d) To sell less and have higher markups?

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Clicker question

2- As a country opens to trade, do you expect...

- a) All firms to expand?
- b) All firms to shrink?
- c) The smallest firms to shrink and the largest to expand?
- d) The largest firms to shrink and the smallest to expand?

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Clicker question

3- A firm with a relatively higher MC is facing:

- a) A lower MR curve
- b) A higher MR curve
- c) Same MR curve but moves upward along the curve