

# Producer Theory

Lecture 11: Companies — Profit Maximization

Paulo Fagandini

2026

# Recap: Lecture 10

What we covered last time:

- **Short run** vs **Long run**: fixed inputs vs all variable
- **Cost types**: FC, VC, TC and their per-unit versions (AFC, AVC, ATC)
- **Marginal cost (MC)**: the extra cost of one more unit — the key curve
- **MC crosses AVC and ATC at their minimums** (the “exam grade” rule)
- **LRAC**: the long-run envelope — economies and diseconomies of scale

...

 **Today**: Now that we know costs, how does a firm decide **how much to produce** to make the most profit?

# Perfect Competition

# What Kind of Market Are We Studying?

## PERFECT COMPETITION

---

A market structure where:

1. **Many** buyers and many sellers
2. **Identical** (homogeneous) products
3. **Free entry and exit** — firms can enter or leave the market
4. **Perfect information** — everyone knows prices and quality

**Result:** No single firm can influence the market price. Each firm is a **price taker**.

### ✓ Close to perfect competition:

- Agricultural products (wheat, rice)
- Basic tourism services in competitive areas (generic hostels, taxis)
- Street food vendors in a tourist market

### ✗ Not perfect competition:

- Airlines (few carriers, differentiated)
- Luxury hotels (brand, location matter)
- Disney parks (unique product)

# The Price Taker

## PRICE TAKER

A firm in perfect competition **cannot choose its price**. The market determines the price through supply and demand. The firm just decides **how much to produce** at that price.

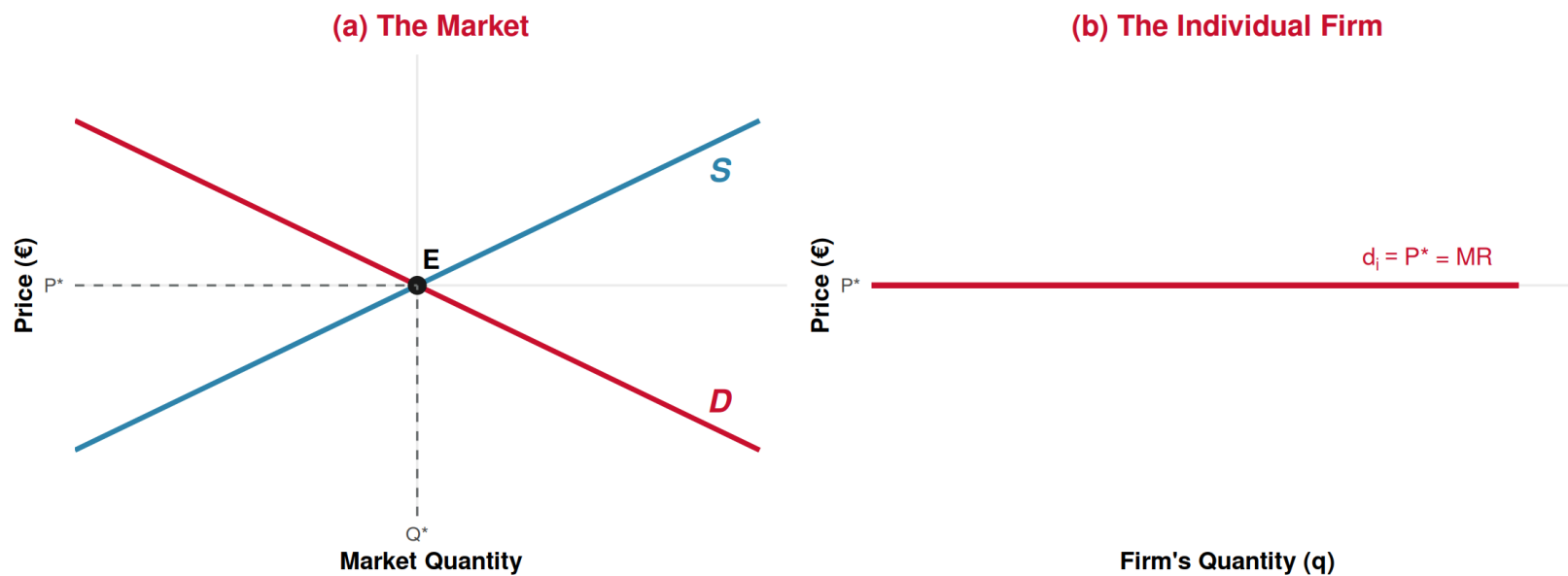
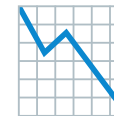
### Think of it this way:

- A wheat farmer can't charge €5/kg when the market price is €3/kg — nobody would buy
- There's no reason to charge €2/kg either — they can sell all they want at €3/kg
- So the only decision is: **how many kilograms to produce?**

...

**Tourism analogy:** Imagine dozens of identical beach umbrella rental stands on a long Algarve beach. If one charges €12/day when all others charge €10/day, tourists just walk to the next stand. The market price is €10 — take it or leave it.

# The Firm's Demand Curve in Perfect Competition



**Left:** Market supply and demand determine the equilibrium price  $P^*$ .

**Right:** Each individual firm faces a **perfectly horizontal demand curve** at  $P^*$ . It can sell as much as it wants at this price — but **nothing** above it.

👉 For a price taker: **Price = Marginal Revenue**. Every extra unit sold brings in exactly  $P^*$ .

# The Profit Maximization Problem

# Profit: The Basics

## PROFIT

$$\pi = TR - TC$$

where  $TR = P \times Q$  (total revenue) and  $TC = FC + VC$  (total cost).

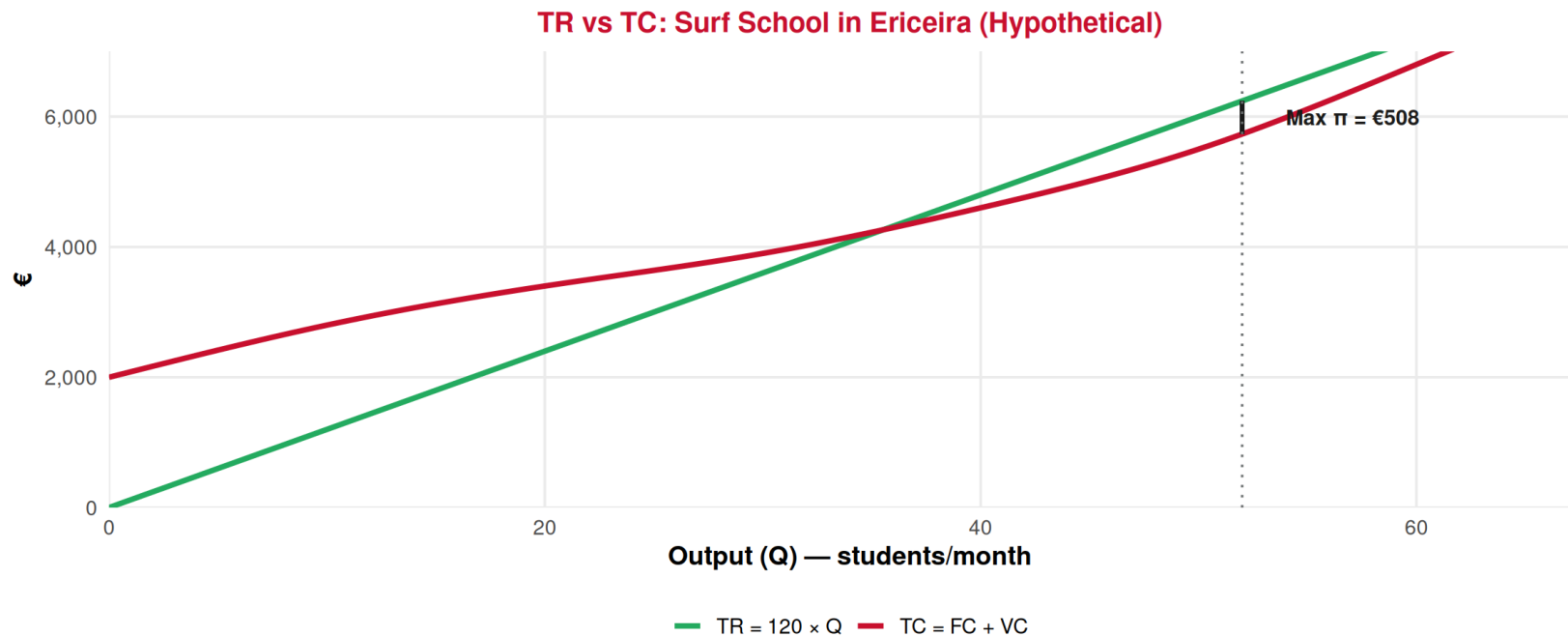
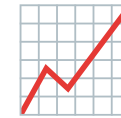
**The firm's question:** At what quantity  $Q$  is  $\pi = TR - TC$  as large as possible?

**Two equivalent approaches** to find the answer:

Approach	Method	Rule
<b>1</b> TR vs TC	Compare total revenue and total cost curves	Maximize the <b>gap</b> $TR - TC$
<b>2</b> MR vs MC	Compare marginal revenue and marginal cost	Produce where $MR = MC$

Both give the **same answer!** Approach **2** is more practical and leads us to the supply curve.

# Approach 1: TR vs TC — The Total Curves



👉 **Profit** = vertical gap between TR and TC. Maximum profit is where this gap is **widest** — at around  $Q^* \approx 52$  students.

*This uses the surf school data from last lecture's exercise, with  $P = \text{€}120/\text{student}$ .*

# Approach 2: MR vs MC — The Per-Unit View

## THE PROFIT-MAXIMIZING RULE




Produce the quantity where **Marginal Revenue = Marginal Cost**:

$$MR = MC$$

In **perfect competition**, since  $P = MR$ , this becomes:

$$P = MC$$

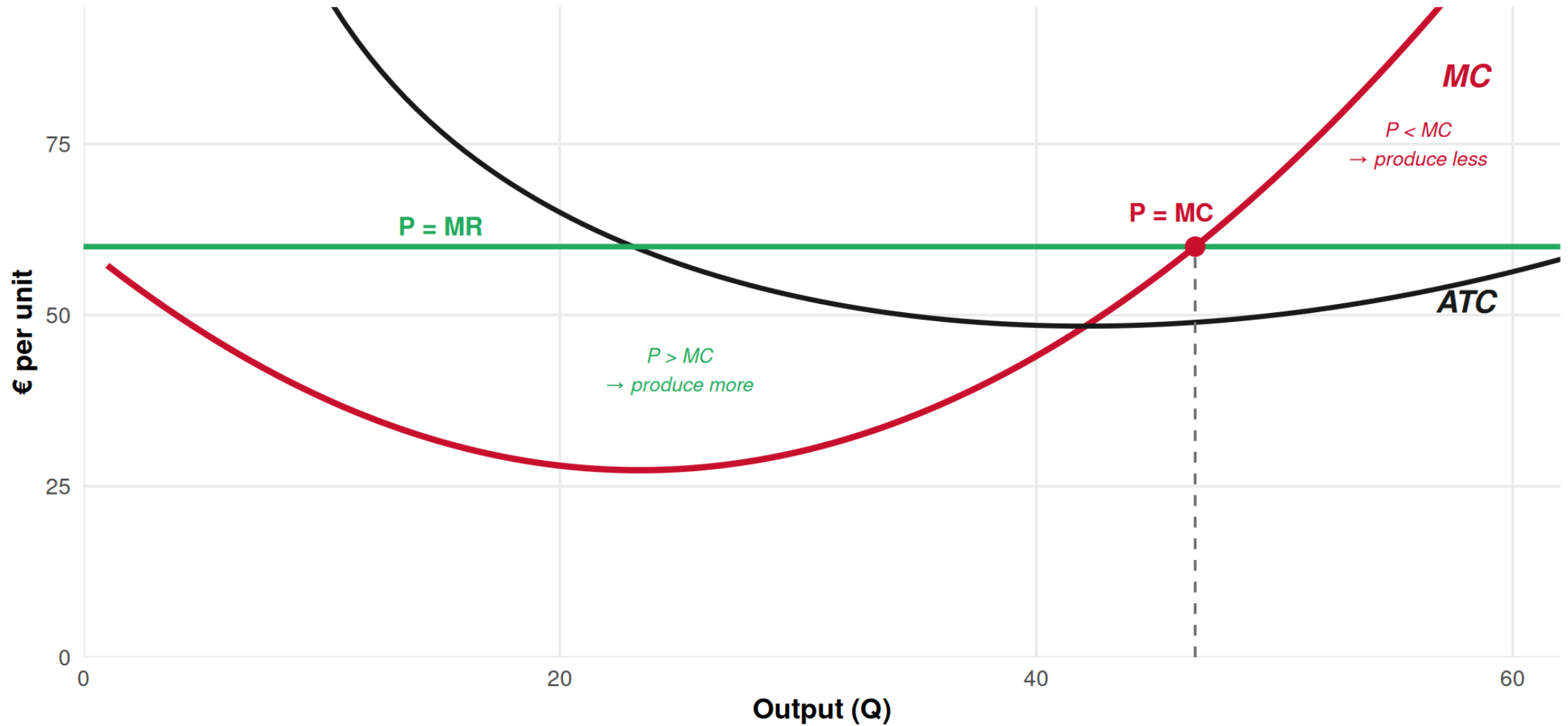
**Why does this work?** Think about it one unit at a time:

- If  $P > MC$  for the next unit → producing it **adds to profit** → produce more! 
- If  $P < MC$  for the next unit → producing it **reduces profit** → produce less! 
- If  $P = MC$  → you're at the **sweet spot** — no way to increase profit further 

 This is just **marginal analysis** from Lecture 3 applied to the firm!

# P = MC Graphically

Profit Maximization:  $P = MC$  (Hypothetical)



# Reading Profit on the Graph



## PROFIT AS A RECTANGLE

At the profit-maximizing quantity  $Q^*$  :

$$\pi = (P - ATC) \times Q^*$$

This appears on the graph as a **rectangle** with height  $(P - ATC)$  and width  $Q^*$ .

### Three possible outcomes:

-   $P > ATC \rightarrow$  **Positive profit** (green rectangle)
- $\leftrightarrow P = ATC \rightarrow$  **Zero economic profit** (breakeven)
-   $P < ATC \rightarrow$  **Loss** (red rectangle)

...

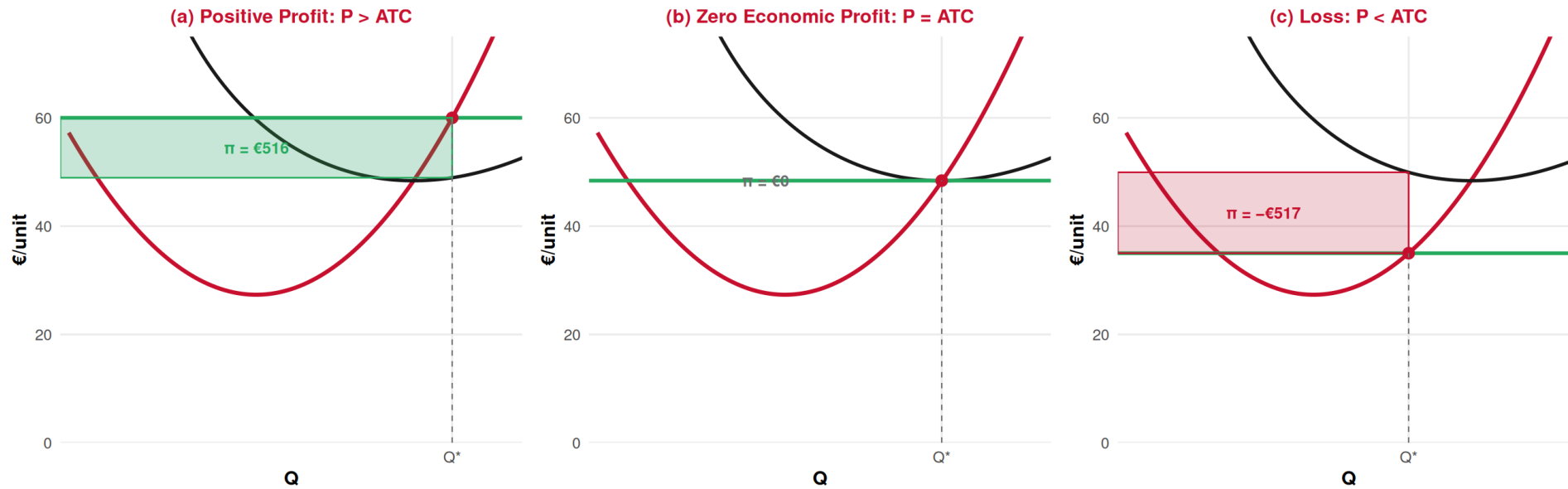
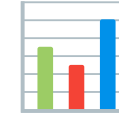
 Next lecture we'll explore the loss case in detail: when should a firm **shut down** vs. **keep operating at a loss**?

### Important nuance: “Zero economic profit” is **not bad**!

It means the firm covers **all** costs, including the owner's opportunity cost of time and capital.

The firm earns a **normal return** — the same as its best alternative. No reason to leave!

# Profit, Zero Profit, and Loss: Three Scenarios



In all three cases, the firm produces where  $P = MC$ . What changes is the **relationship between P and ATC** at that quantity.

# Worked Example: Tourism

# Bottle Factory from the Textbook :bottle:

The sebenta's glass bottle factory has FC = €40/day and the following cost structure:

Q (bottles/day)	Total Revenue (€0.35/bottle)	Labor Cost (€)	TC (€)	Profit (€)	MC (per 100 bottles)
0	0	0	40	-40	—
100	35	10	50	-15	0.10
200	70	20	60	10	0.10
300	105	40	80	25	0.20
<b>400</b>	<b>140</b>	<b>70</b>	<b>110</b>	<b>30</b>	<b>0.30</b>
500	175	110	150	25	0.40
600	210	160	200	10	0.50
700	245	220	260	-15	0.60

Source: Course textbook (sebenta), Table 10

👉 Maximum profit (€30/day) at **Q = 400 bottles/day**. This is where MC is closest to the price (€0.35/bottle) on the rising portion of MC!

# What If the Price Changes?

The textbook shows what happens when the bottle price **rises to €0.45/bottle**:

Q (bottles/day)	TR at €0.35	TR at €0.45	TC (€)	Profit at €0.35	Profit at €0.45
0	0	0	40	-40	-40
100	35	45	50	-15	-5
200	70	90	60	10	30
300	105	135	80	25	55
400	140	180	110	30	70
<b>500</b>	<b>175</b>	<b>225</b>	<b>150</b>	<b>25</b>	<b>75</b>
600	210	270	200	10	70
700	245	315	260	-15	55

Source: Course textbook (sebenta), Tables 10 & 11

 **Key insight:** When price rises from €0.35 to €0.45, the firm **produces more** (400 → 500 bottles) and **earns more profit** (€30 → €75). The new optimum is where  $MC \approx €0.40$ , closer to the new higher price.





# The General Lesson



## HIGHER PRICE → MORE PRODUCTION → MORE PROFIT

When the market price rises, the  $P = MC$  rule tells the firm to expand output along its MC curve. This is the seed of the **supply curve** (Lecture 13).

### What higher prices do:

-  Price rises
-  New  $P = MC$  intersection at higher  $Q$
-  Revenue rises (both price and quantity)
-  Profit increases

This is why supply curves slope **upward!**

### Tourism application:

When hotel room prices rise in Lisbon during peak season:

- Hotels hire more staff, extend hours
- They serve more guests (higher  $Q$ )
- Profit per room rises
- More production at higher cost →  $P = MC$  at a new, higher quantity

# What About Changes in Fixed Costs?

The textbook shows an important result: when **fixed costs rise** (from €40 to €70/day), the **profit-maximizing quantity stays the same** ( $Q = 400$ ).

**Why?** Because  $P = MC$  doesn't involve FC at all! MC only reflects changes in **variable costs**.

## FIXED COSTS DON'T AFFECT THE OPTIMAL QUANTITY

FC shifts the total cost curve **up** (and ATC up), reducing profit, but the **optimal Q** stays where  $P = MC$ .

	FC = €40	FC = €70
Optimal Q	400	400
Profit	€30	€0
MC at Q = 400	€0.30	€0.30

*Same Q, but profit drops by exactly the FC increase (€30).*

...

 FC **does** matter for the **stay or exit** decision — which we cover next lecture!

# Marginal Revenue in Detail

# Why $P = MR$ in Perfect Competition

**Marginal Revenue** is the extra revenue from selling **one more unit**:


$$MR = \frac{\Delta TR}{\Delta Q}$$

In **perfect competition**, the firm sells every unit at the same market price  $P$ :

$$TR = P \times Q \quad \Rightarrow \quad \text{If } Q \text{ goes up by 1: } \Delta TR = P$$

So  $MR = P$  for every unit. That's why the firm's demand curve ( $d_i$ ) is also its MR curve — a **horizontal line** at  $P$ .

...

 **This is specific to perfect competition!** A monopolist (single seller) must lower the price to sell more, so  $MR < P$ . We'll see this in later courses.


For now: **Price taker**  $\rightarrow P = MR \rightarrow$  profit-maximizing rule is simply  $P = MC$ .

# The Marginal Approach: Step by Step

Applying the  $P = MC$  rule to the bottle factory ( $P = €0.35/\text{bottle}$ ):

point\_right: **Stop at  $Q = 400$** : the last unit where  $MR \geq MC$ . Going to 500 would cost more (€0.40) than it earns (€0.35).

Going from...	...to	Extra revenue (MR)	Extra cost (MC)	Profit change	Decision
0 → 100	100	€0.35	€0.10	+€25	✓ Produce
100 → 200	200	€0.35	€0.10	+€25	✓ Produce
200 → 300	300	€0.35	€0.20	+€15	✓ Produce
300 → 400	400	€0.35	€0.30	+€5	✓ Produce
400 → 500	500	€0.35	€0.40	-€5	✗ Stop!

 This step-by-step reasoning confirms the table's answer:  **$Q^* = 400$  bottles/day**.

# Tourism Application

# Hotel Revenue Management: A Profit Maximization Story



## Why do hotels charge different prices at different times?

The  $P = MC$  rule explains dynamic pricing:

☀️ **Peak season** (summer, Lisbon festivals):

- Market price  $P$  is **high** (demand is high)
- $P = MC$  at a **higher Q** → hire more staff, open all rooms
- Profit per room is **large**
- Hotels **expand** services

...

👉 The  $P = MC$  rule doesn't just say "how much to produce" — it explains the **seasonal rhythm** of tourism businesses!

☁️ **Off-season** (January):

- Market price  $P$  is **low**
- $P = MC$  at a **lower Q** → reduce staff, close a wing
- Profit per room is **small** (or even losses)
- Hotels **scale back**

# Summary

## Today's Key Takeaways:

1. **Perfect competition**: many firms, identical product, price taker
2. **Price taker**: the firm faces a horizontal demand curve at the market price  $\rightarrow P = MR$
3. **Profit** =  $TR - TC = (P - ATC) \times Q$
4. **Two approaches**: maximize the gap between TR and TC (total curves), or set  $MR = MC$  (per-unit curves)
5. **The golden rule**: in perfect competition, produce where  $P = MC$  (on the rising portion of MC)
6. If  $P > ATC \rightarrow$  positive profit;  $P = ATC \rightarrow$  zero economic profit;  $P < ATC \rightarrow$  loss
7. **Fixed costs don't affect the optimal Q** — only variable costs (through MC) matter for the production decision
8. **Higher price  $\rightarrow$  higher quantity  $\rightarrow$  higher profit** — this is the seed of the supply curve

**Connection**: Lecture 10 gave us the cost curves. Today we used them to find  $Q^*$ . Next lecture: what if the firm is making a **loss**? When should it shut down vs. continue?

**Next (Lecture 12, March 26)**: Profits, Shutdown and Breakeven Price Levels. Supply.

# Exercises

Practice Time! 

Profit maximization with the  $P = MC$  rule.

# Exercise 1: Multiple Choice

**Question:** A small souvenir shop in Sintra operates in a competitive market. The market price for a standard Sintra tile replica is €8. The shop's marginal cost of producing the 50th tile per day is €6, and the marginal cost of the 51st tile is €8.50. How many tiles should the shop produce?

- A. 49 tiles
- B. 50 tiles
- C. 51 tiles
- D. Cannot be determined without knowing fixed costs

**Answer: B**

At  $Q = 50$ :  $MC = €6 < P = €8 \rightarrow$  producing the 50th tile adds to profit 

At  $Q = 51$ :  $MC = €8.50 > P = €8 \rightarrow$  producing the 51st tile reduces profit 

So produce **50 tiles**. Note: **fixed costs are irrelevant** to this decision (option D is a trap!).

## Exercise 2: Multiple Choice

**Question:** A perfectly competitive firm is producing at  $Q^*$  where  $P = MC = €25$ . At this quantity,  $ATC = €20$ . What can we say about this firm?

- A. The firm is making a loss and should shut down
- B. The firm is earning zero economic profit
- C. The firm is earning a positive economic profit of €5 per unit
- D. The firm should increase output to reduce ATC further

**Answer: C**

Profit per unit =  $P - ATC = €25 - €20 = €5$ . Total profit =  $€5 \times Q^* > 0$ .

The firm is making **positive economic profit**. It should NOT increase output (D is wrong) because  $P = MC$  already — producing more would mean  $MC > P$ , reducing profit.

# Exercise 3: Open Question

A small boat tour operator in Lagos (Algarve) offers coastal cave tours in a competitive market. The market price is **€35 per ticket**. The operator has the following cost structure:

Tours/day (Q)	FC (€)	VC (€)	TC (€)	MC (€/tour)
0	200	0	200	—
1	200	20	220	20
2	200	35	235	15
3	200	55	255	20
4	200	80	280	25
5	200	115	315	35
6	200	165	365	50
7	200	235	435	70

*Hypothetical illustrative example*

- Calculate TR and profit at each output level. At what quantity is profit maximized?
- Verify that this quantity is consistent with the  $P = MC$  rule.
- Calculate ATC at the profit-maximizing quantity. Is the firm earning positive, zero, or negative economic profit?
- Suppose the market price drops to €20. What is the new profit-maximizing quantity? What is profit at this quantity?
- If fixed costs rise from €200 to €300 (e.g., due to a higher boat lease), does the profit-maximizing quantity at  $P = €35$  change? Explain.

# Exercise 3: Solution — Part a

a)  $TR = P \times Q = €35 \times Q$

point\_right: Profit is maximized (least negative = smallest loss) at **Q = 4 or Q = 5** (both yield -€140).

Q	TR (€)	TC (€)	Profit = TR - TC (€)
0	0	200	-200
1	35	220	-185
2	70	235	-165
3	105	255	-150
4	140	280	-140
5	<b>175</b>	<b>315</b>	<b>-140</b>
6	210	365	-155
7	245	435	-190

Looking more carefully: at  $Q = 5$ ,  $MC = €35 = P$  exactly, so  $Q^* = 5$  is the profit-maximizing quantity. At  $Q = 4$ , the 5th tour still adds €35 revenue at €35 cost — it's worth producing.

⚠ Note: the firm is making a **loss** at every output level! But  $Q = 5$  minimizes that loss. Whether to keep operating or shut down is the topic of the next lecture.

## Exercise 3: Solution — Parts b & c

b) Using the  $P = MC$  rule:

- At  $Q = 4$ :  $MC = €25 < P = €35 \rightarrow$  produce the 4th tour ✓
- At  $Q = 5$ :  $MC = €35 = P = €35 \rightarrow$  produce the 5th tour ✓ (MR = MC exactly)
- At  $Q = 6$ :  $MC = €50 > P = €35 \rightarrow$  don't produce the 6th tour ✗

So the rule gives  $Q^* = 5$ , consistent with the table! ✓

c) At  $Q^* = 5$ :

$$ATC = \frac{TC}{Q} = \frac{€315}{5} = €63 \text{ per tour}$$


Since  $P = €35 < ATC = €63$ , the firm is earning **negative economic profit** (a loss):

$$\pi = (P - ATC) \times Q = (35 - 63) \times 5 = -€28 \times 5 = -€140$$

The firm is losing €140/day. 

## Exercise 3: Solution — Parts d & e

d) At  $P = €20$ :

- $Q = 1$ :  $MC = €20 = P \rightarrow$  this is where  $P = MC$  on the rising portion
- $Q = 2$ :  $MC = €15 < P \rightarrow$  but this is the falling portion of  $MC$  (careful!)
- $Q = 3$ :  $MC = €20 = P \rightarrow$  this is on the rising portion 

The profit-maximizing quantity is  $Q^* = 3$  (where  $P = MC$  on the **rising** portion of  $MC$ ).

Profit at  $Q = 3$ :  $TR = 20 \times 3 = €60$ ,  $TC = €255$ ,  $\pi = 60 - 255 = -€195$ .

The loss worsened from  $-€140$  to  $-€195$ . The lower price hurts!

e) If  $FC$  rises from  $€200$  to  $€300$ :

**No, the profit-maximizing quantity does not change!**  $FC$  does not appear in the  $MC$  calculation.  $MC$  stays the same at every quantity, so  $P = MC$  still gives  $Q^* = 5$  at  $P = €35$ .

However, profit falls by exactly  $€100$  (the  $FC$  increase):  $\pi = -€140 - €100 = -€240$ .

 Fixed costs affect **how much** profit you earn, but not **how many** units to produce.

## Next Lecture

**March 26, 2026:** Profits, Shutdown and Breakeven Price Levels. Supply. 

If the firm is making a **loss**, when should it keep operating and when should it **shut down**?



**Hint:** The answer involves comparing  $P$  to **AVC**, not ATC!

# Thank You!

Questions? 🙋

✉️ paulo.fagandini@ext.universidadeeuropeia.pt

*Next class: Thursday, March 26, 2026*