Chapter 5

The Maths of Profit

Q* such that $\underset{Q}{\text{Max}}\,\Pi(Q) = TR(Q) - TC(Q)$

In any market regime, the optimal Q* satisfies:

$$\frac{\delta TR(Q^*)}{\delta Q} - \frac{\delta TC(Q^*)}{\delta Q} = 0$$

?

$$\frac{\delta TR}{\delta Q}(Q) = P(Q)\left[1 - \left(\frac{1}{\varepsilon(Q)}\right)\right]$$

Optimal quantity depends on elasticity!

And what does elasticity depend on?

Elasticity and market power

The elasticity of demand tells us of the firm's ability to raise the price without losing consumers.

Always the same? No, it depends on the “market power” of the firm.

So depending on the market power of the firm(s) we may observe different prices and quantities.

$$\frac{\delta TR}{\delta Q}(Q) = P(Q)\left[1 - \left(\frac{1}{\varepsilon(Q)}\right)\right]$$

$$\frac{\delta TR(Q^*)}{\delta Q} - \frac{\delta TC(Q^*)}{\delta Q} = 0$$

Market Power and Market Regime

Market regime is identified by the market power of the firms populating that market.

Market Power: inversely related to the degree of market loss when a firm raises its price (elasticity). In the market regime of **perfect competition**, it is minimum, as it would lose **the whole market**.

Perfect Competition

Perfect Competition: **defined** as that market regime in which the firm is a *price-taker* of the market price, i. e. with no market power.

When? When 2 «strange» things happen.

Firms **can** change the price with respect to the market prevailing price, **but it is not profitable/convenient**:

1) if they raise it, they lose **all clients (elasticity =?)**;

furthermore, 2) they do not lower it as they **conjecture** being able to sell at that market price any quantity they wish.

Perfect Competition

Perfect Competition: **defined** as that market regime in which the firm is a *price-taker*, i. e. with no market power.

What conjectures on rivals are coherent with this belief (2) of being able to sell whatever quantity at that market price? Would other firms not react?

How can we have Perfect Competition? The role of size

A) Large number of firms

Our impact on price? Our impact on rival's profits? Minimal.

Example: Industry made of 10.000 identical firms, each producing 100 units of the product, for a total quantity produced of 1.000.000 units, sold at a price of 10 euro per unit.

If one firm were to double (!!!) the produced quantity to 200 units?

Total quantity would rise by 0,01%. Assuming a reasonable elasticity of market demand, equal to e.g. 2, price would decline by ?

0,005% to 9,9995 euro!

The elasticity of demand of the firm instead would equal – (100%/-0,005%) or 20.000.

To make the price go down by 1%, the single firm would have to raise production … 200-fold times. Impossible! So … they think they can sell at the market price any quantity they wish.

Perfect Competition

Perfect Competition: **defined** as that market regime in which the firm is a *price-taker*, i. e. with no market power.

Perfectly competitive firms are therefore rightly convinced not to be able to influence, with their choice on how much to produce and sell, the choices of the other firms. Therefore they make no conjecture about the other's reactions, **we lack strategic interaction** (=monopoly!).

How can we have PC (a price taker)?

A) Not enough. Even if it was a small firm, it could still have market power ((1) raising price without losing all customers)

Ever taken a cappuccino at a Tor Vergata bar? Which one?

B) **Homogeneous good, perfect substitute, or perceived as such, MRS = 1** among bar customers, is a second key condition to have perfect competition

How can we have PC?

A) and B) are not enough.

One million consumers, one million firms selling the same identical good. But… I could still not lose all clients if I raise the price! Why?

C) **Perfect** information, is the third key condition

How can we have PC?

«If B) or C) do not hold,

why do we lose perfect competition?»

Because they could raise price and …

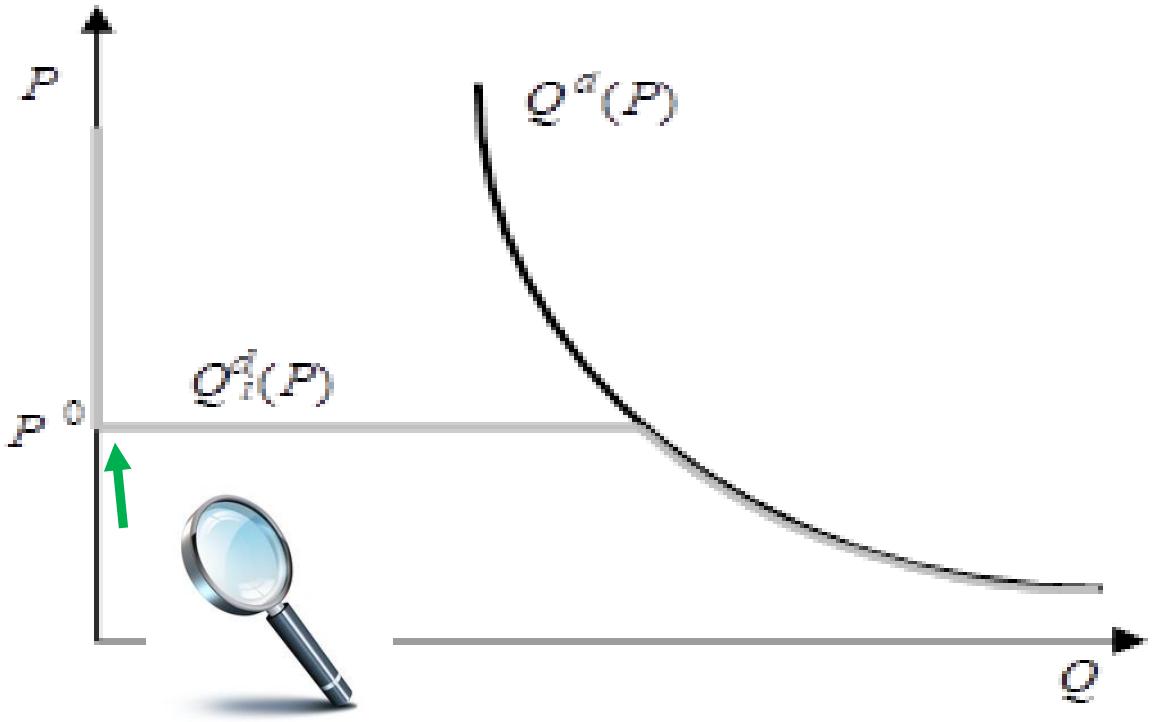
… not lose all the market and therefore… not be price-takers!

How can we have PC, in the LT?

D) Free entry, in the long term

The perceived demand curve of the firm in PC

PS:
Where does P° come from?
We don't know yet.



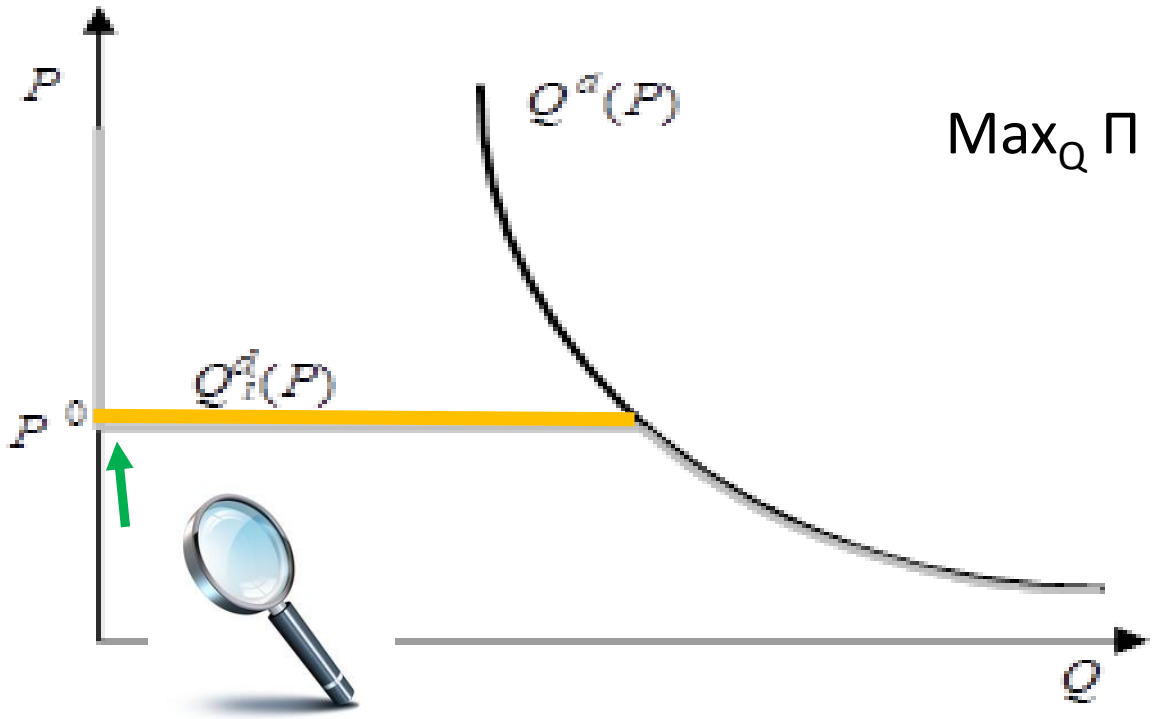
Looking for firm i

Do you see the firm i demand curve in PC?

The demand curve of the PC single firm

$$\frac{\delta TR}{\delta Q}(Q) = P(Q)\left[1 - \left(\frac{1}{\varepsilon(Q)}\right)\right]$$

$$\underset{Q}{\text{Max}}\,\Pi\,(Q) = TR(Q) - TC(Q)$$

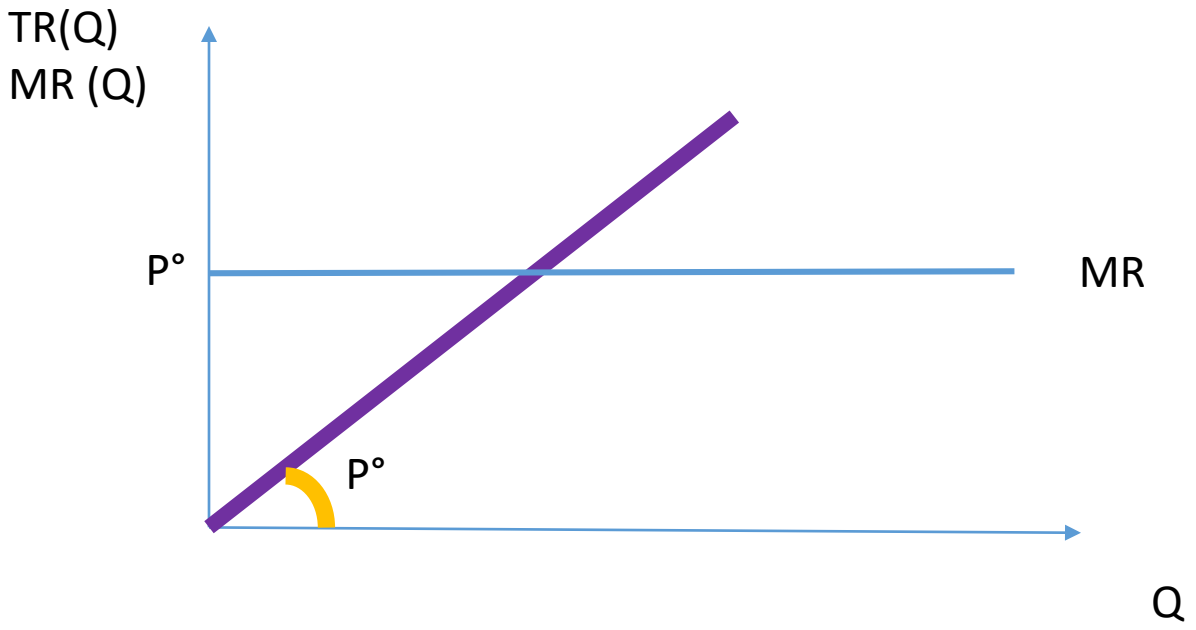


Max_Q Π (Q) = P° **Q** – TC (**Q**)

PS:
Where is the Marginal Revenue function?

MR = P°

Marginal and Total Revenue in Perfect Competition



$$\frac{\delta TR}{\delta Q}(Q) = P(Q)\left[1 - \left(\frac{1}{\varepsilon(Q)}\right)\right]$$

Different from the Total Revenue function of the monopolist!
So also the Marginal Revenue function will be different.

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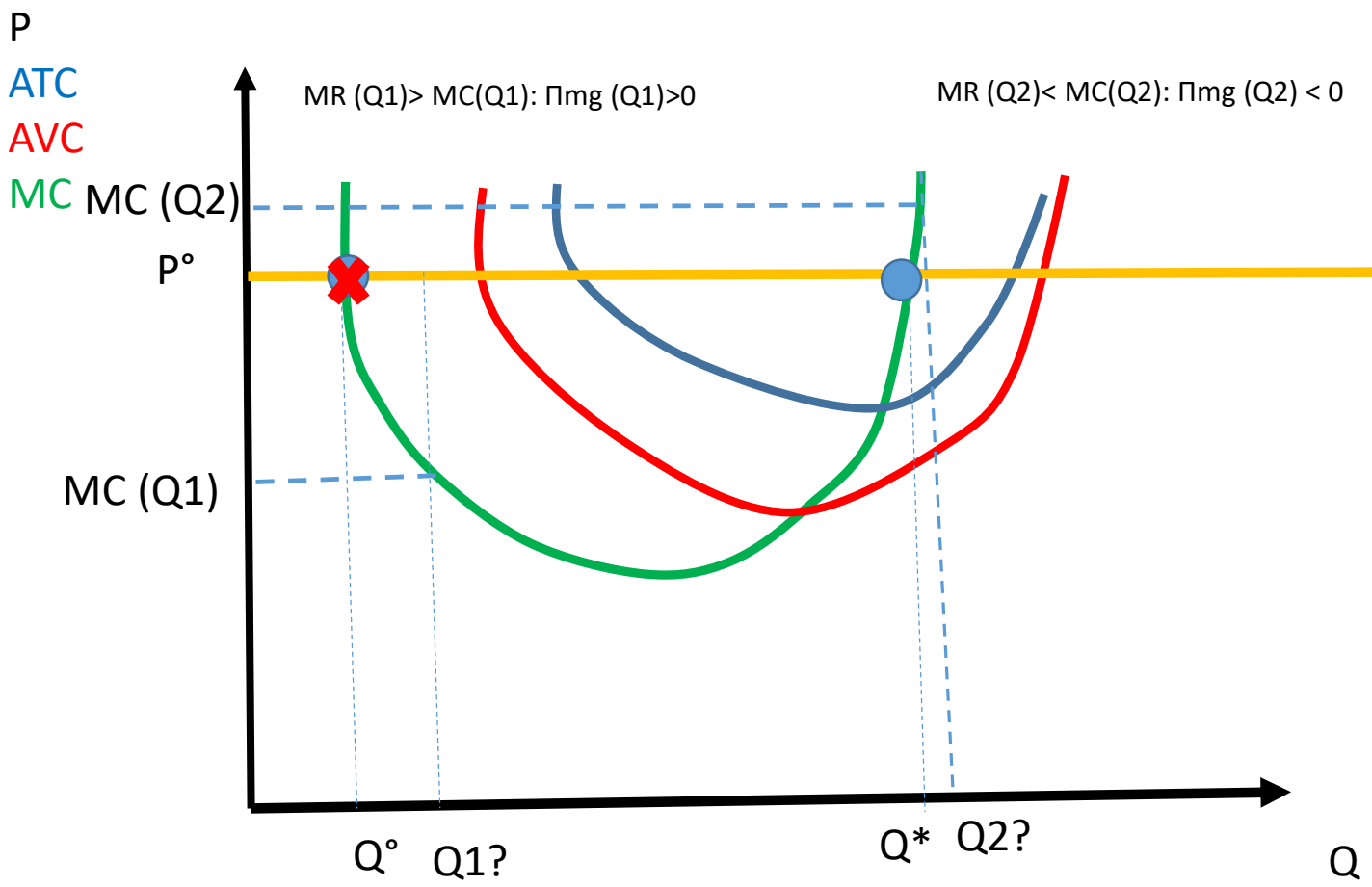
P° and the first point on the ST supply curve

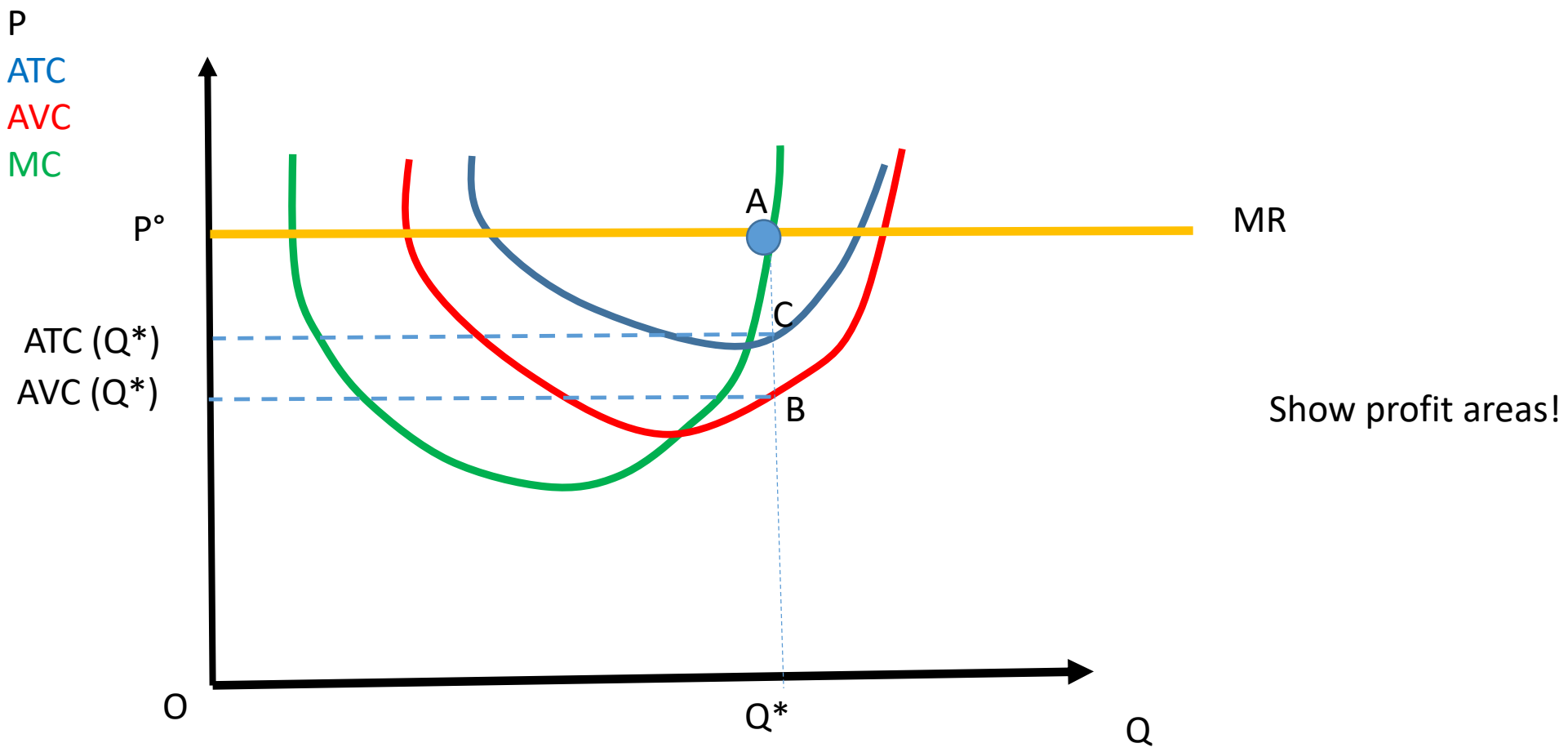


Max_Q Π (Q) = P° **Q** – TC (**Q**)

MC (Q*) = MR(Q*)

Q* such that
(δTC/δQ) = P°

Economic and accounting profits: where are they?

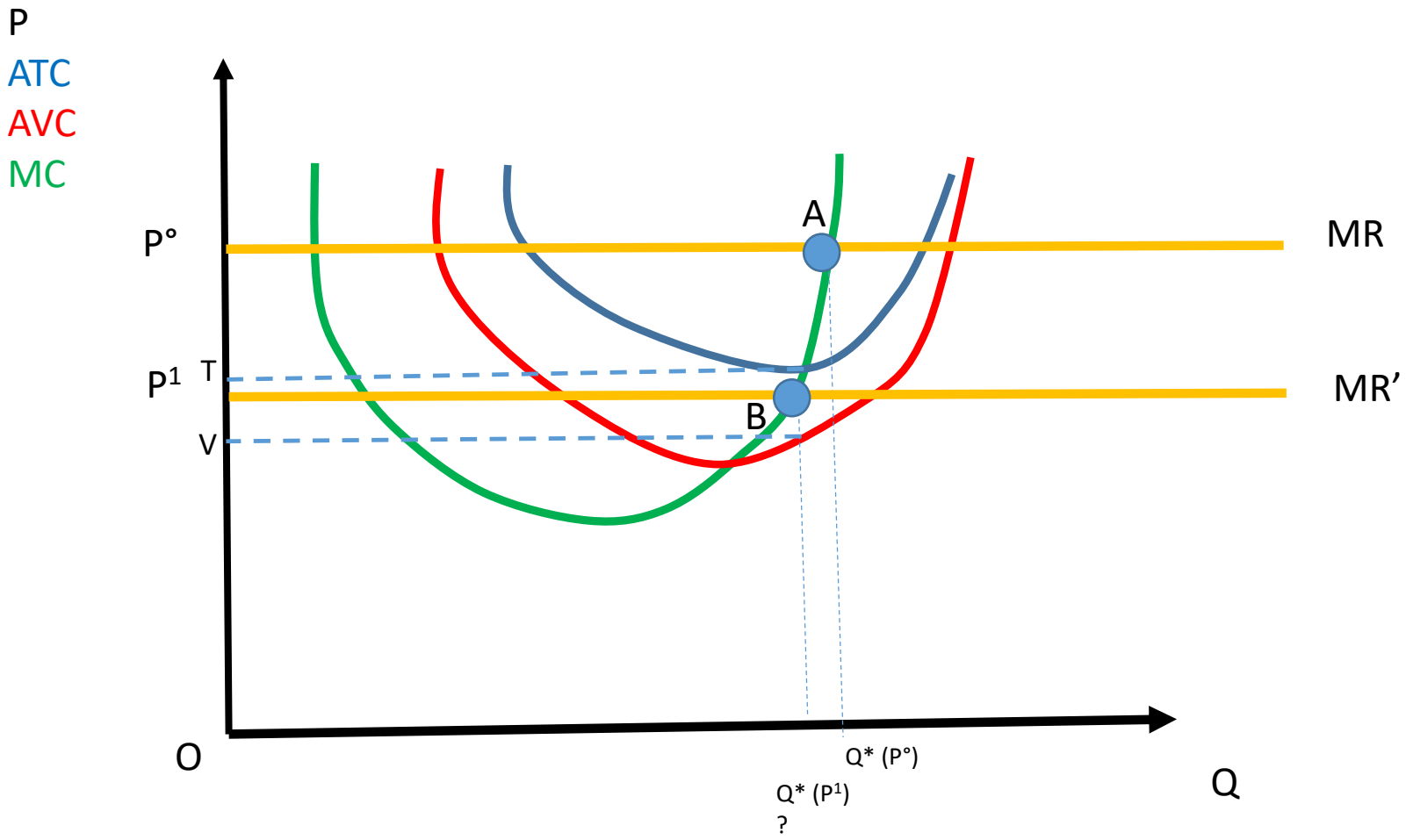


Show profit areas!

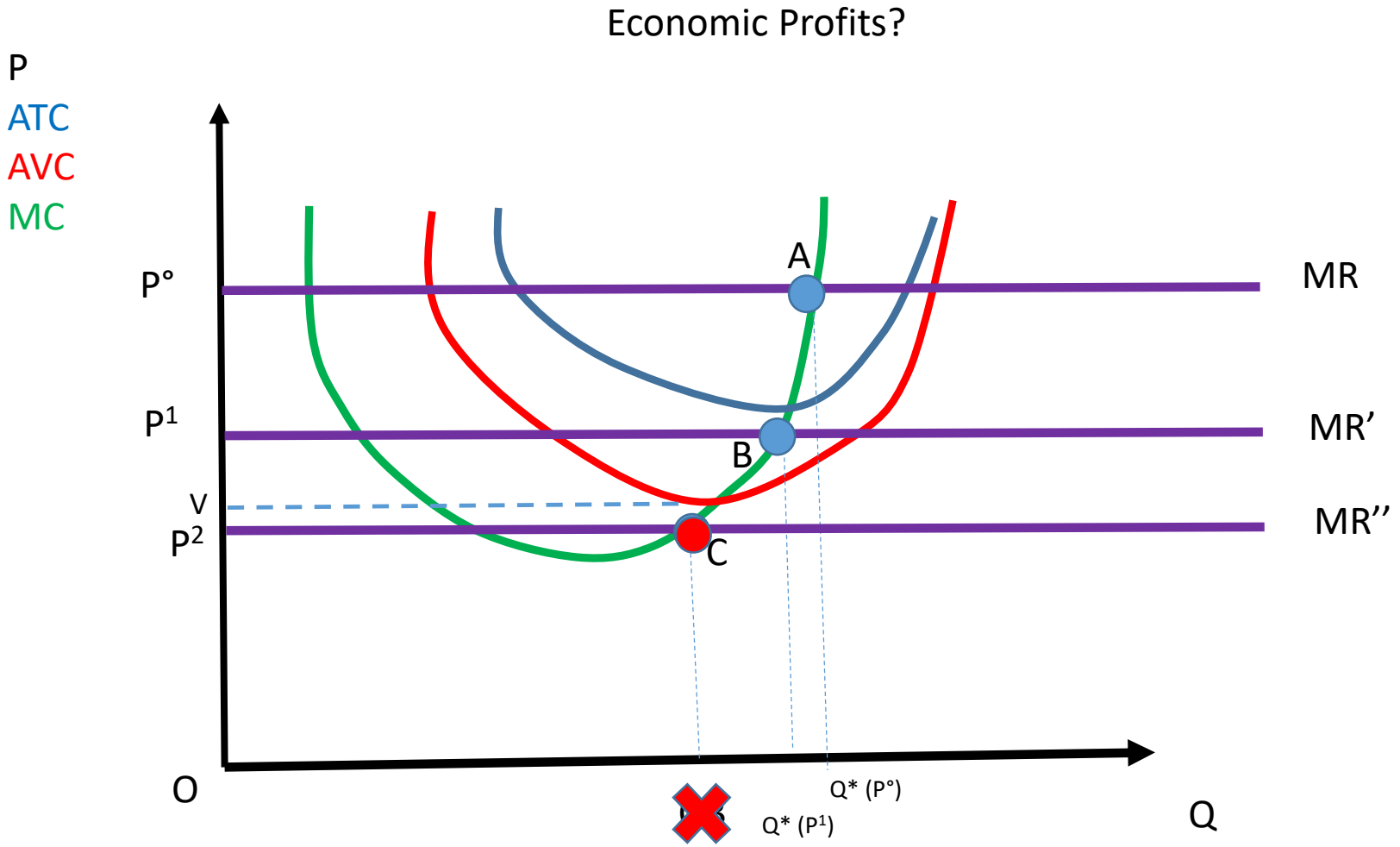
New price P1

Accounting Profits?

Economic Profits?



New price P2



Note that

$$P^2 < \text{AVC}\ (Q^3)$$

implies that

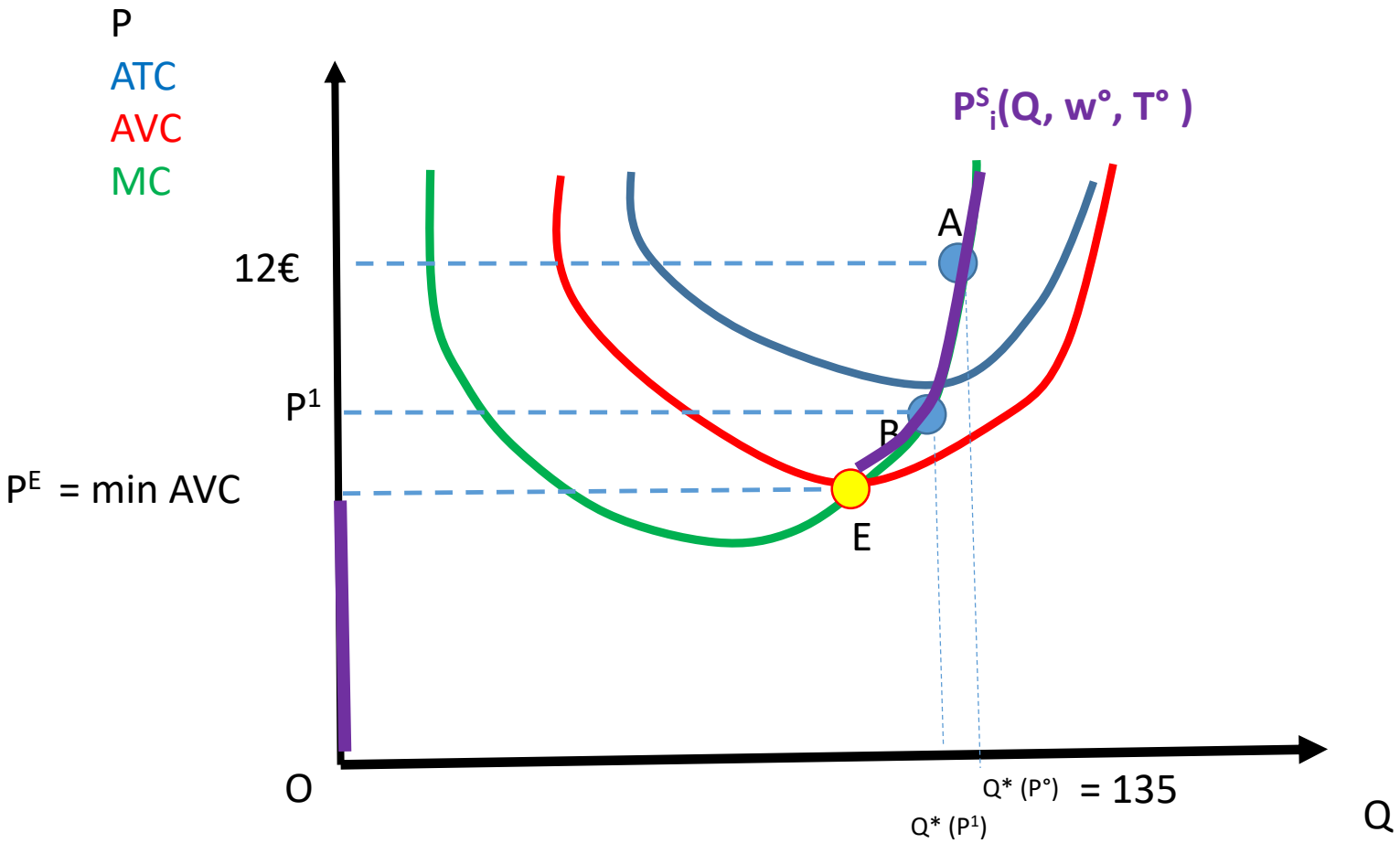
$$P^2\ Q^3 \times < \text{AVC}\ (Q^3)\ Q^3$$

or

$$TR\ (Q^3) < \text{AVC}\ (Q^3)$$

Exit Point and the supply curve of firm «i»

The marginal cost curve and the supply curve of the single firm in perfect competition coincide!
The supply curve therefore depends on the technology T° and the variable input cost (w°).

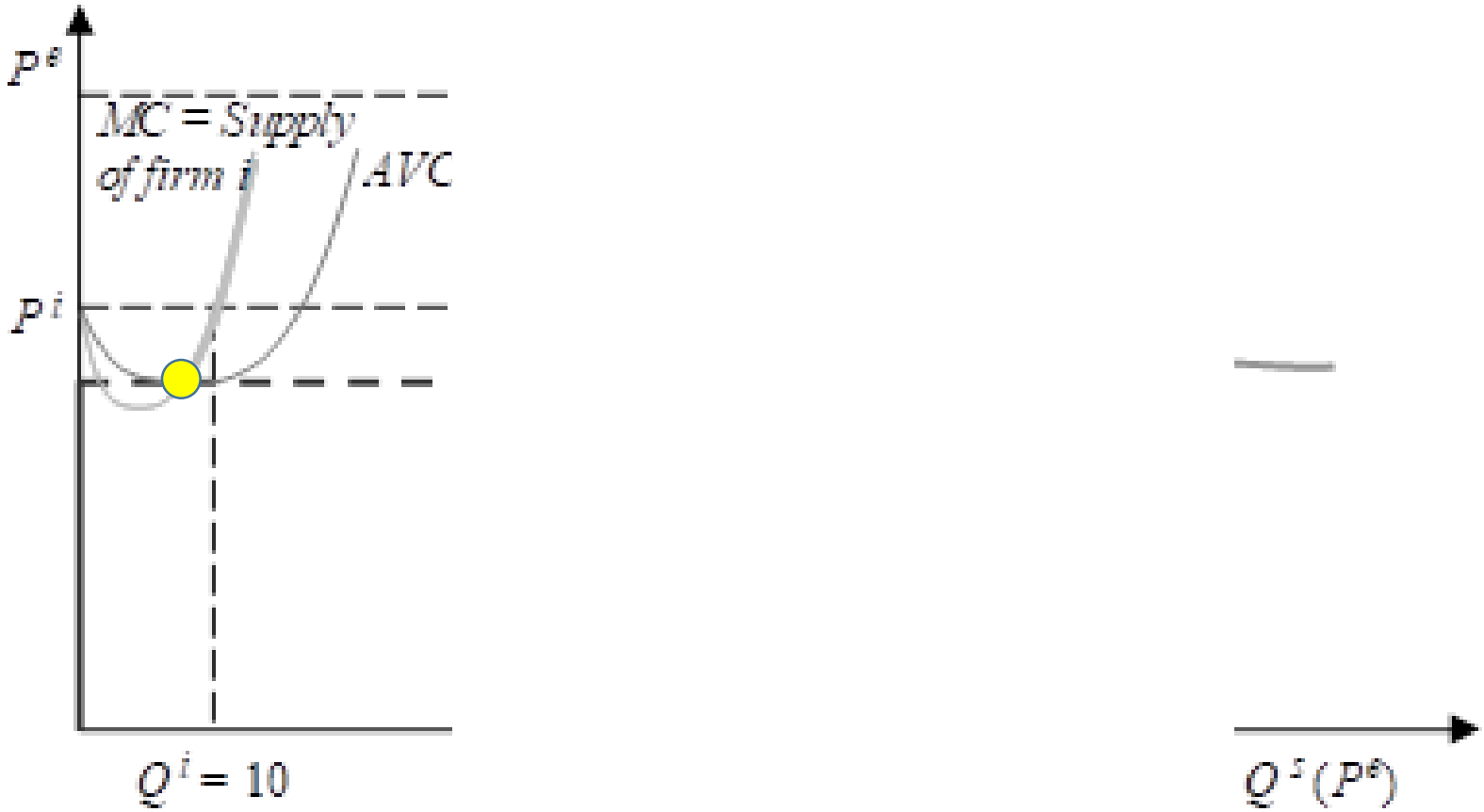


From the x (Q) to the y (MC) axis:
Marginal Cost curve
The 135th unit costs 12 € for the firm

From the y (P) to the x (Q) axis:
Supply curve of firm «i»
At the price of 12 € the firm **desires** to supply 135 units.

The ST supply curve of the industry - Case 1

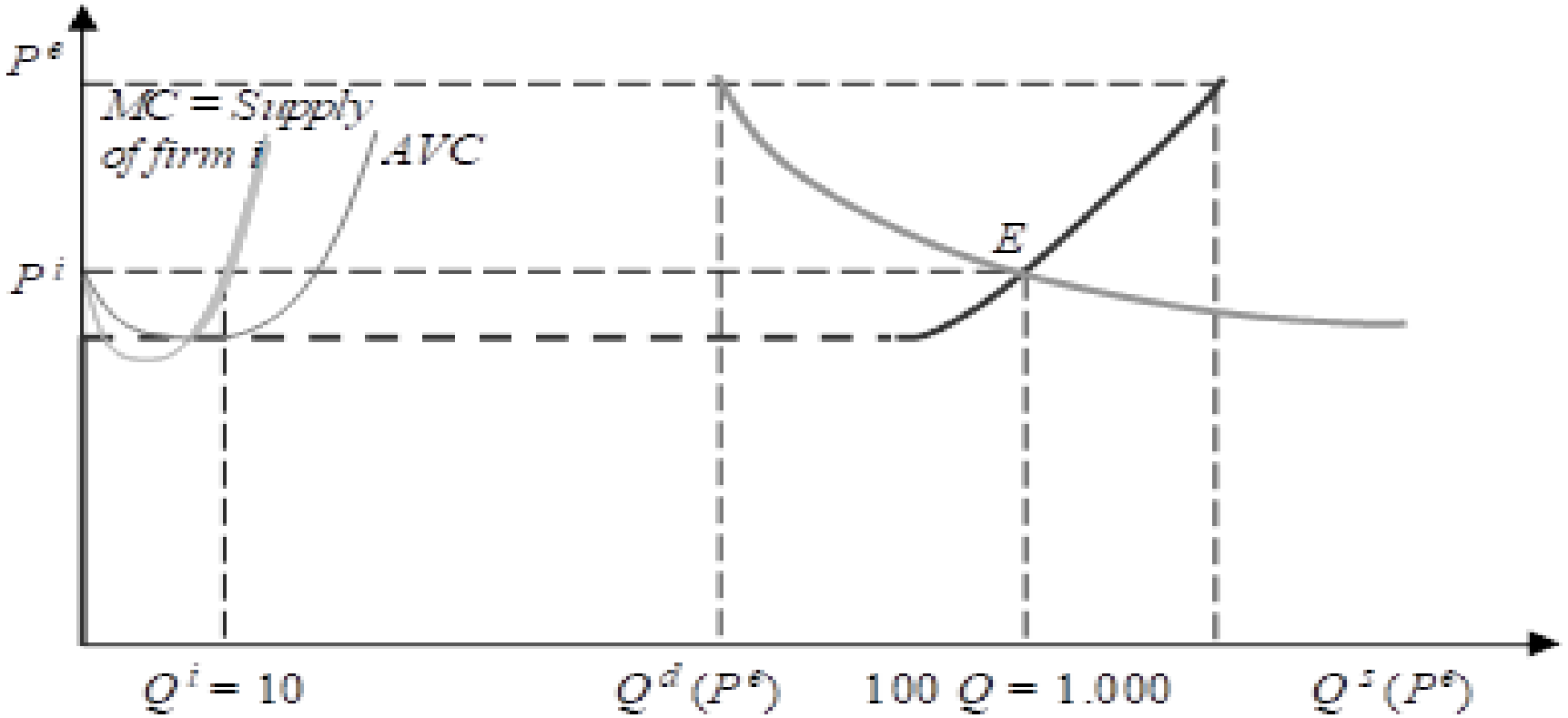
What is the yellow point?



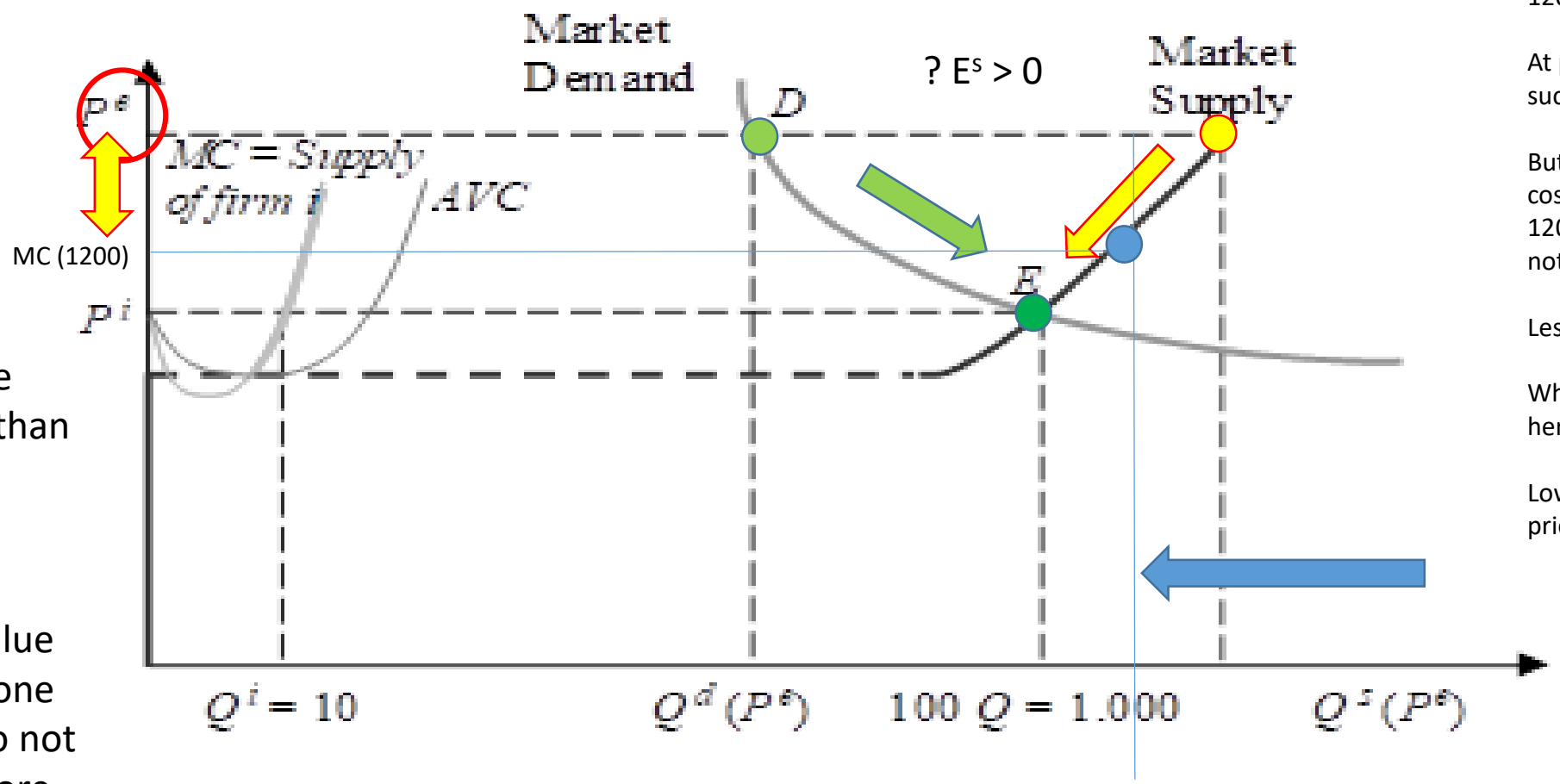
The ST supply curve of the industry - Case 1

Fixed unitary costs of productive factors: w=w°

N° = 100 firms



The ST supply curve of the industry, toward equilibrium - Case 1



Look carefully to this firm. It would like to sell to the 1200th consumer.

At price P° it does not succeed.

But how much does it cost to produce the 1200th quantity it does not sell?

Less than P°!

What would you do in her/his shoes?

Lower infinitesimally price!

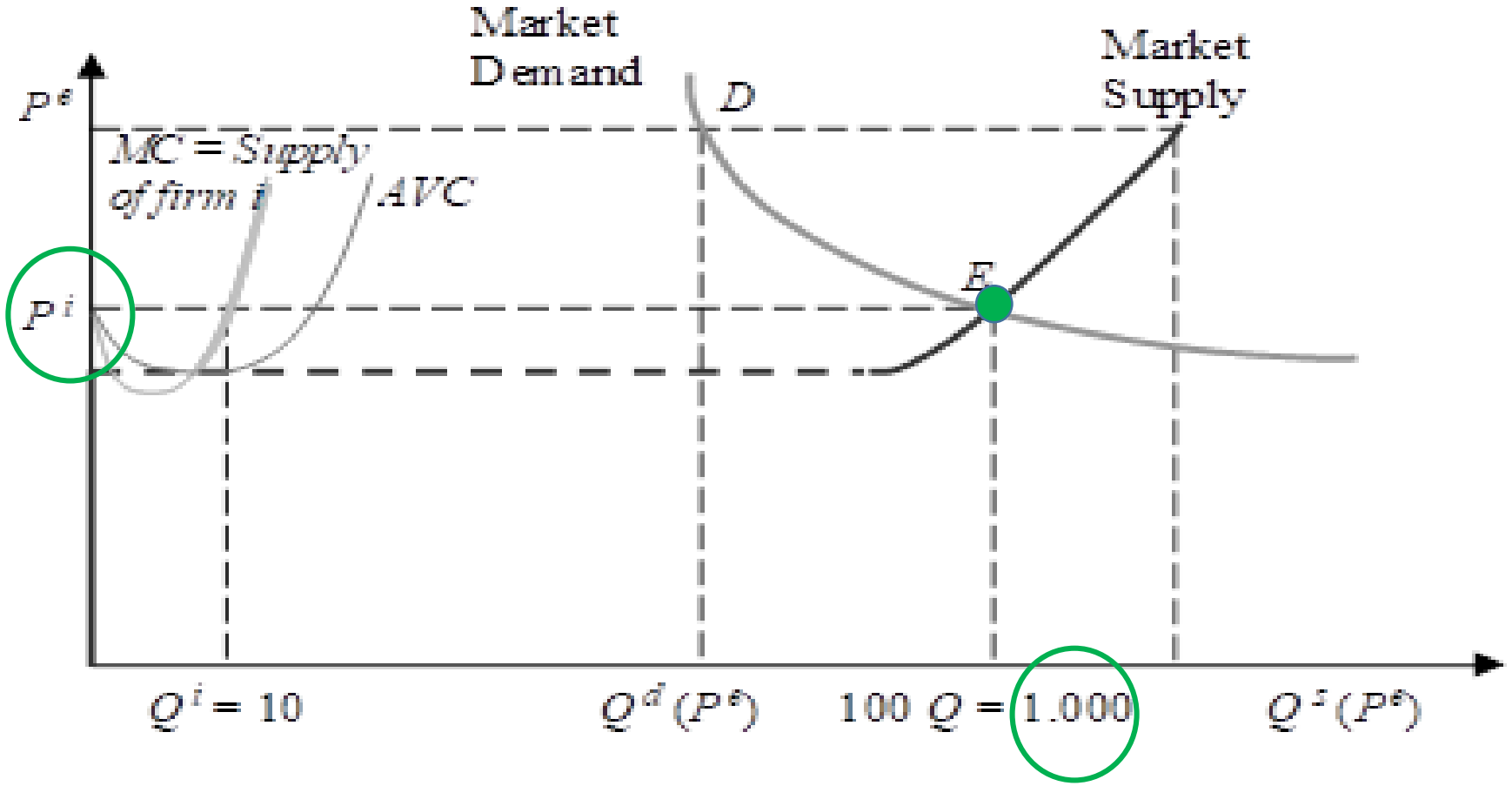
PS: and if the price were to be lower than P^I ? Try to train!

Tip: what is the value for consumers of one unit consumers do not have but wish? More or less than the price?

The ST supply curve of the industry: equilibrium – Case 1

In the short-term, in equilibrium the prices of goods and the quantity produced - P^I and Q (P^I) - are such to guarantee the maximization of profits and of utility and the equality between quantities supplied and demanded in the market. **Short-term extraprofits are positive (P>AVC).**

Preferences **and** technology thus explain a given exchange value (price) we see out there

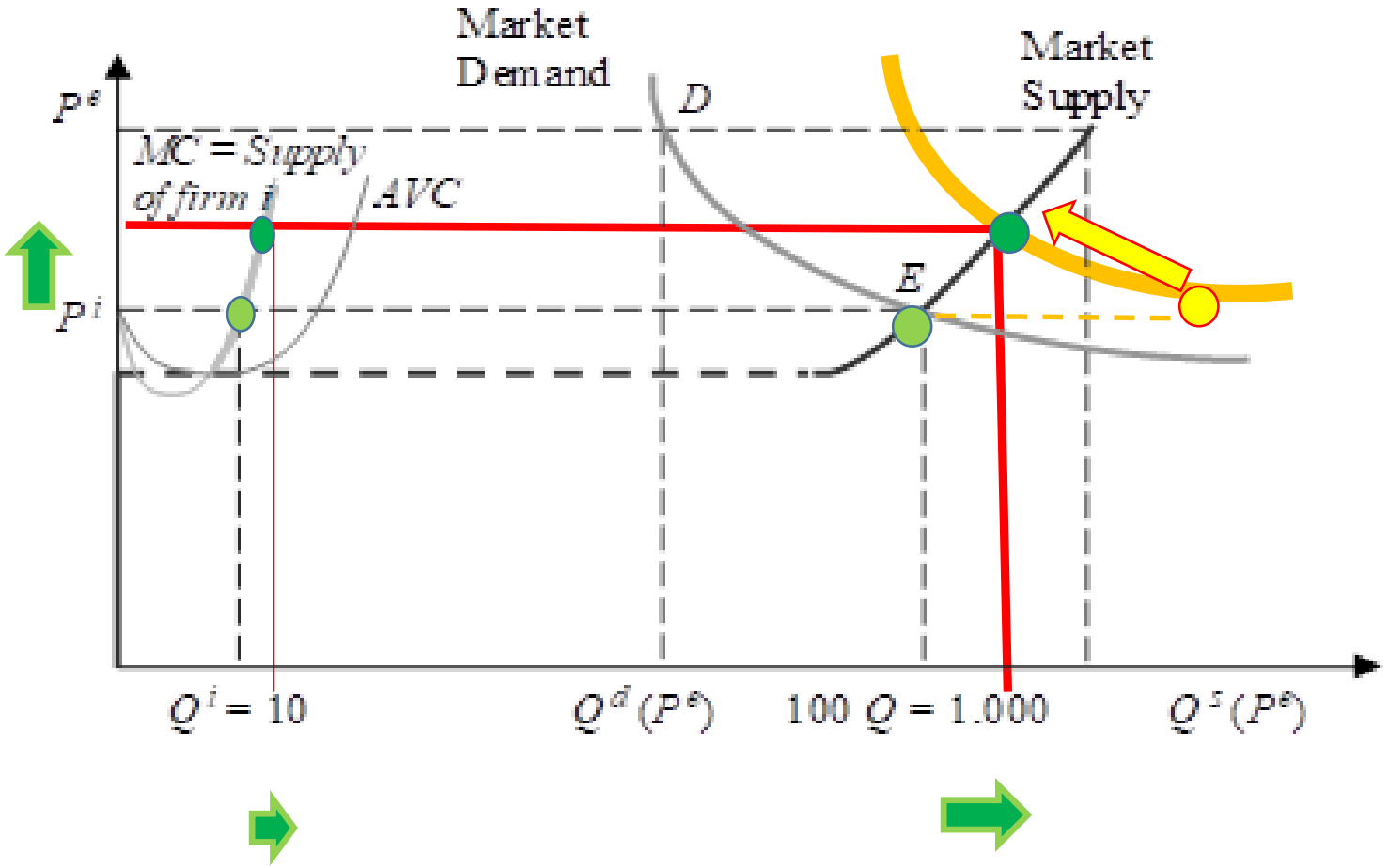


Masks and price – Case A

At P^i , an excess demand. How much are consumers willing to pay for quantities greater than 1000 that they do not find? Where do you see this info?
More than P^I!

Higher price leads each producer to raise production and accommodate the greater demand

What is the impact of an increase in demand on quantities sold and price?
Demand (and preferences) matter!

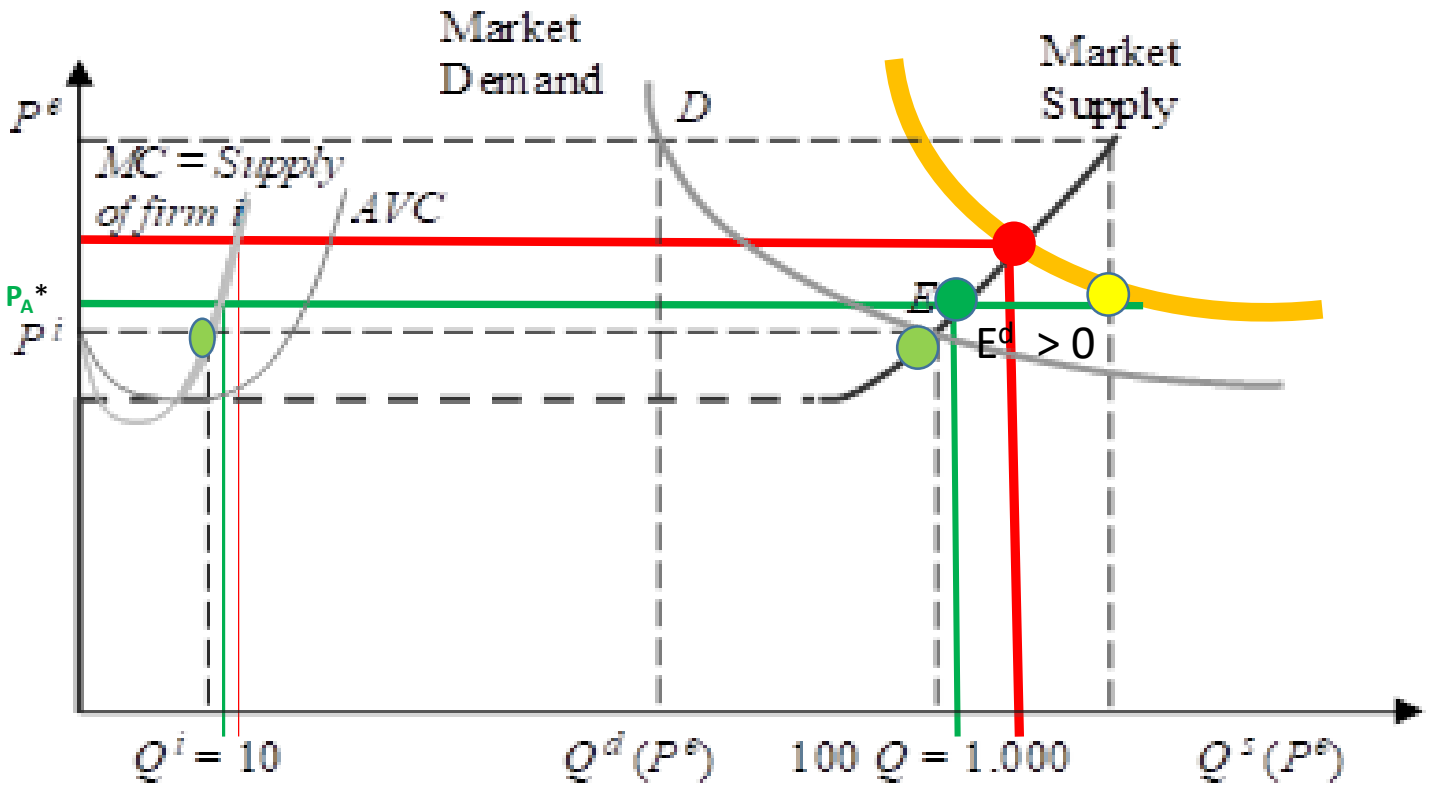


Masks and price – Case B: price ceiling

Introduction of a maximum price (dark green), rationing of demand. Protests by 100 firms demanding higher maximum price (red).

Prices of masks in the end were kept low and firms were «helped» to produce more (who paid?) (yellow)

Here too, demand (preferences) count!



Supply shocks

From w° to w1 > w°

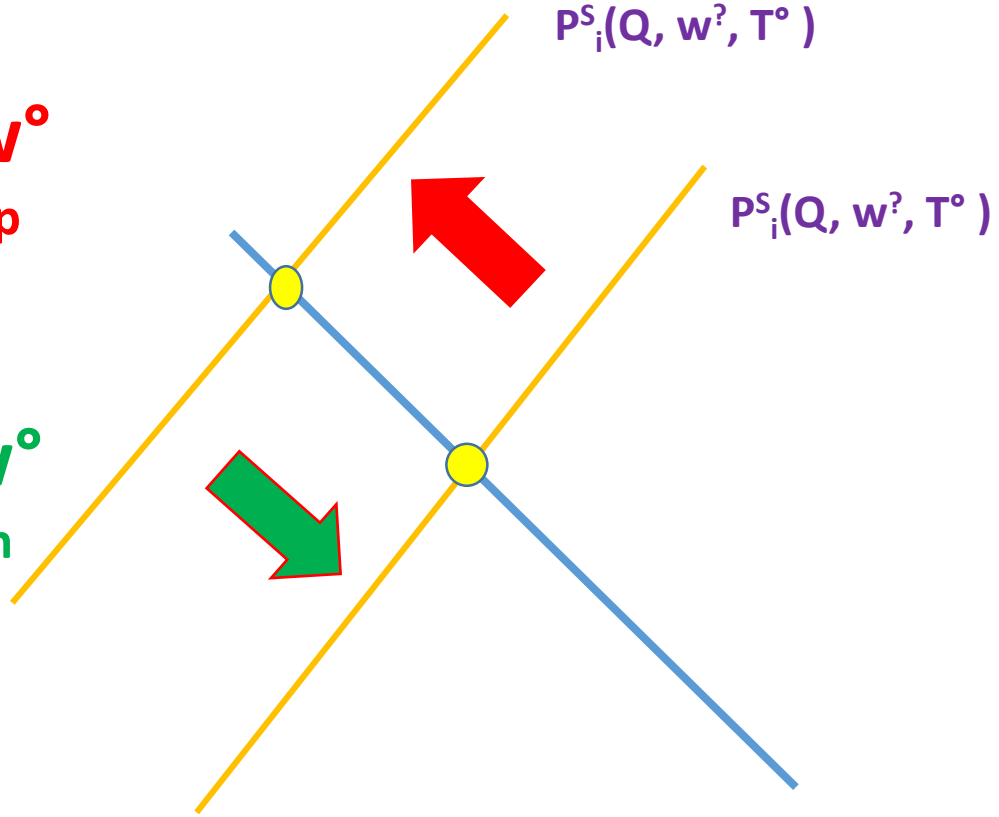
Quantities go down, prices up

Negative supply shock

From w° to w1 < w°

Quantities go up, prices down

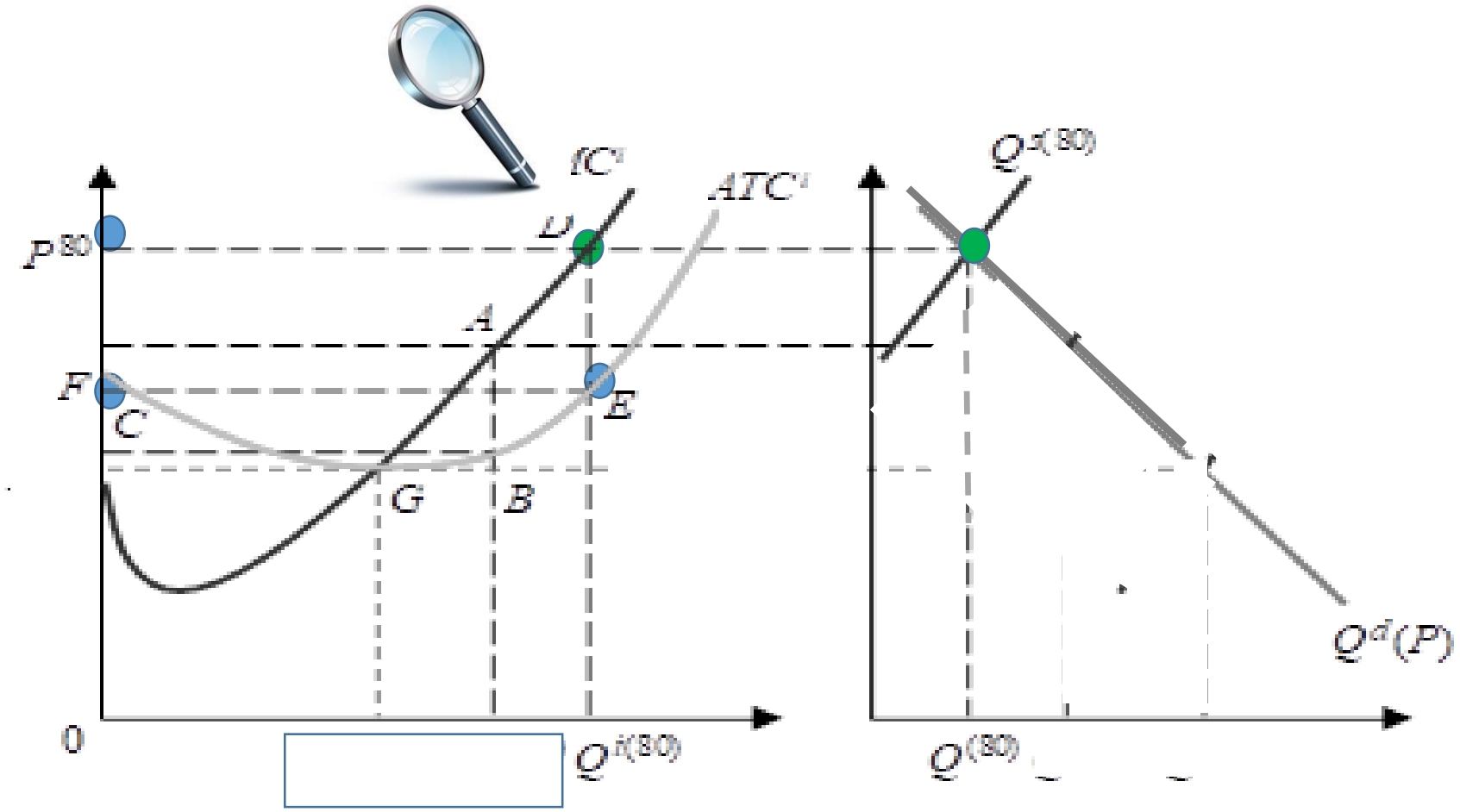
Positive supply shock



The effect of an **increase** (**decrease**) of the price of an input on the supply curve.

PC and ST Equilibrium with 80 firms: profits?

LT equilibrium with free entry: what changes?



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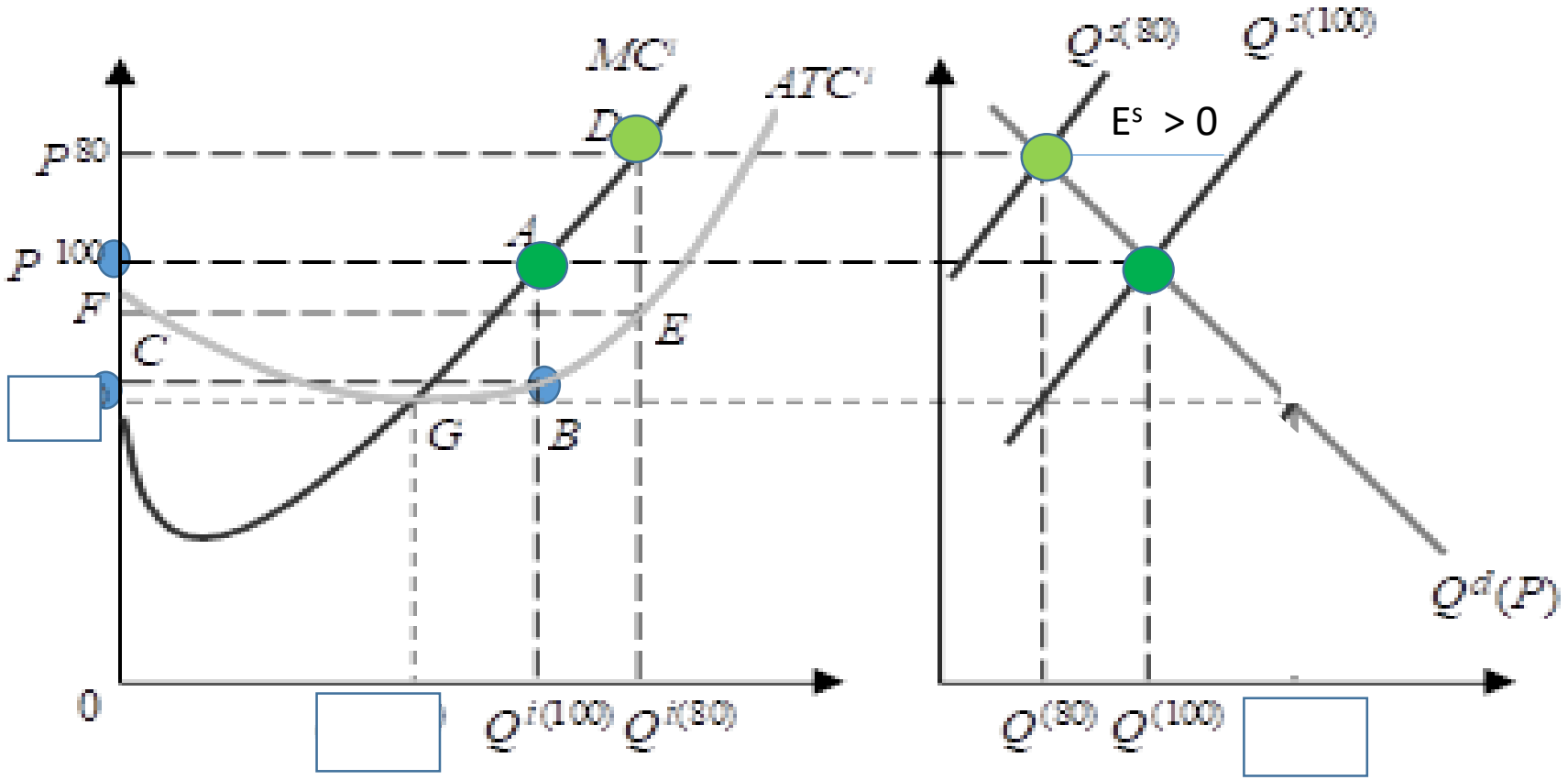
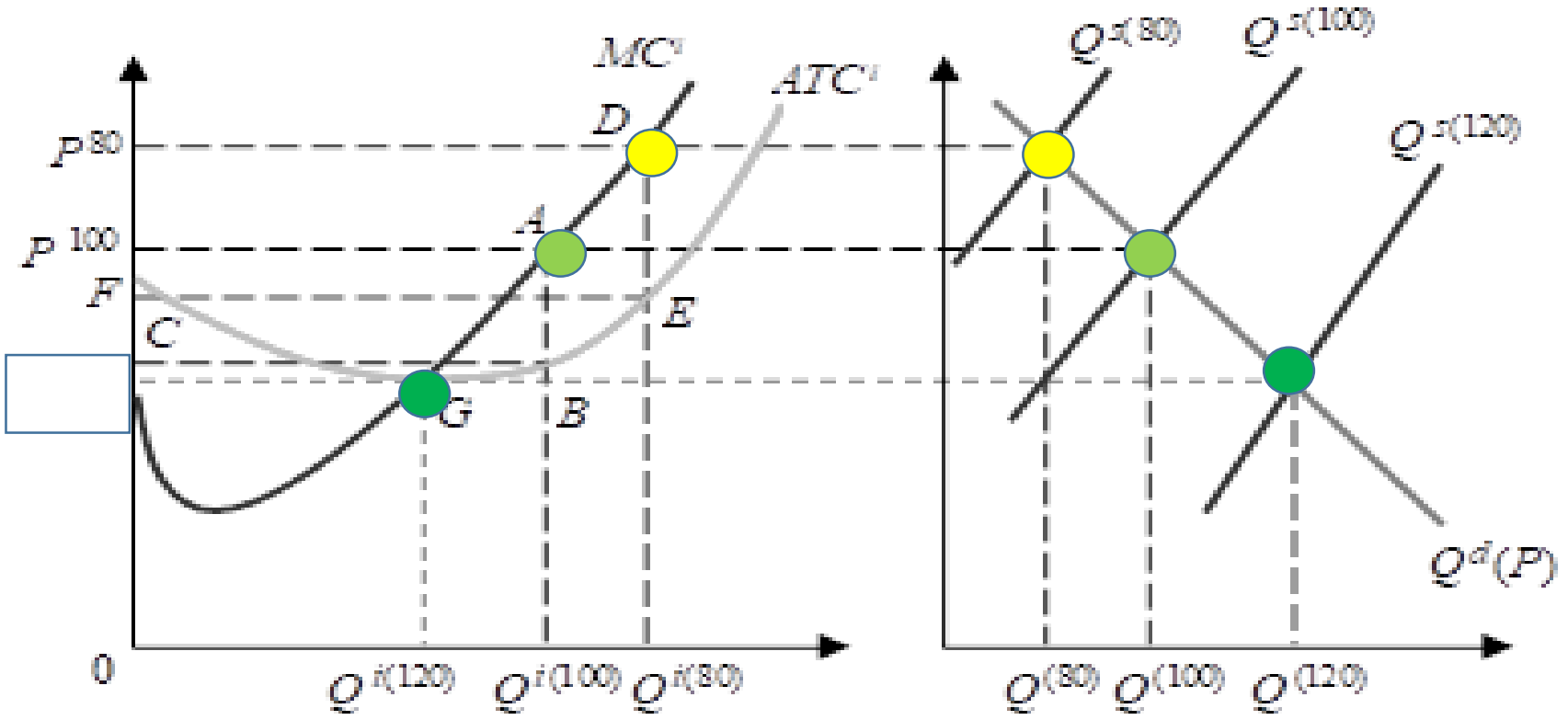
PC and LT with free entry – Equilibrium?

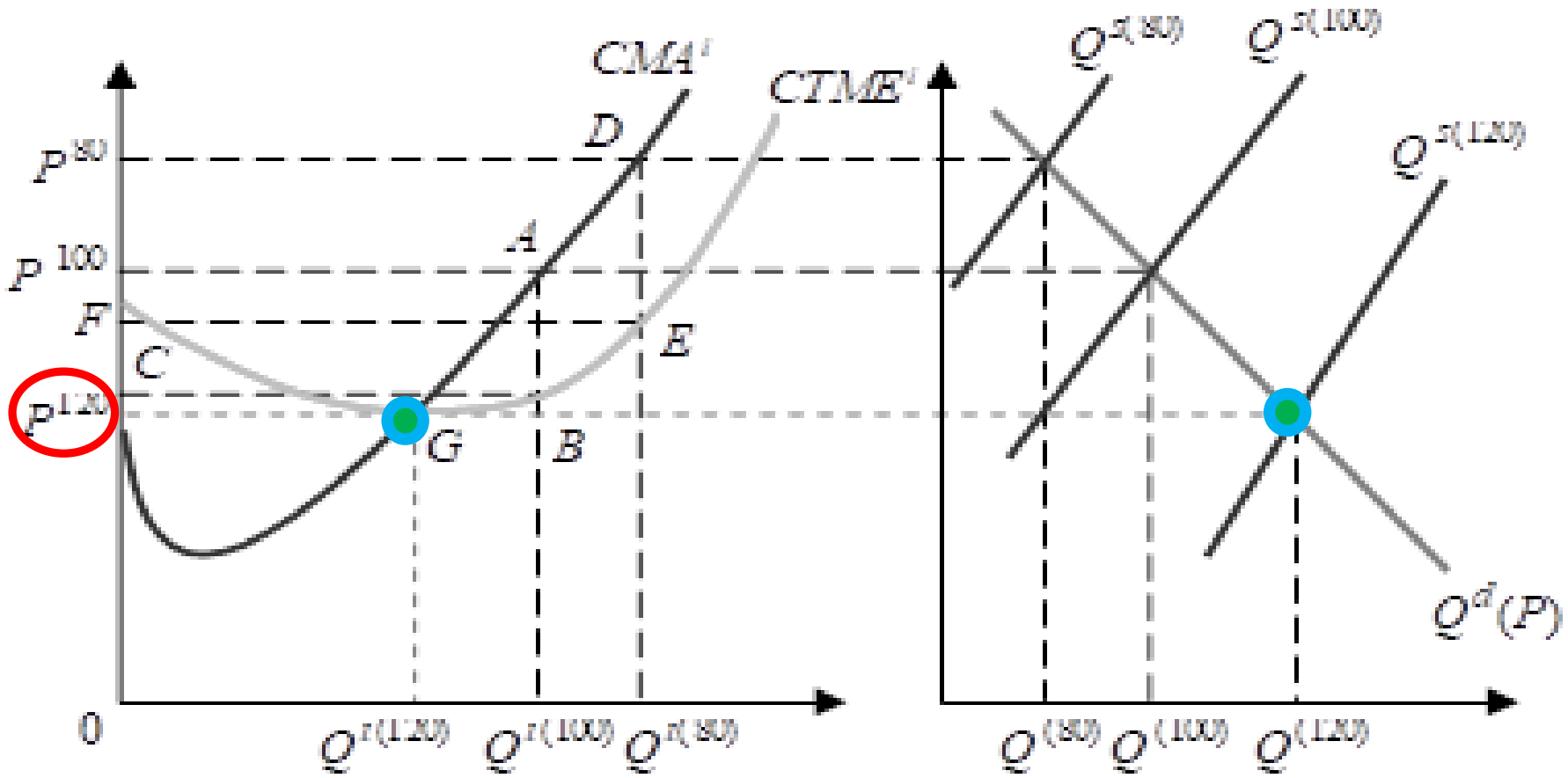


PC and LT – Equilibrium



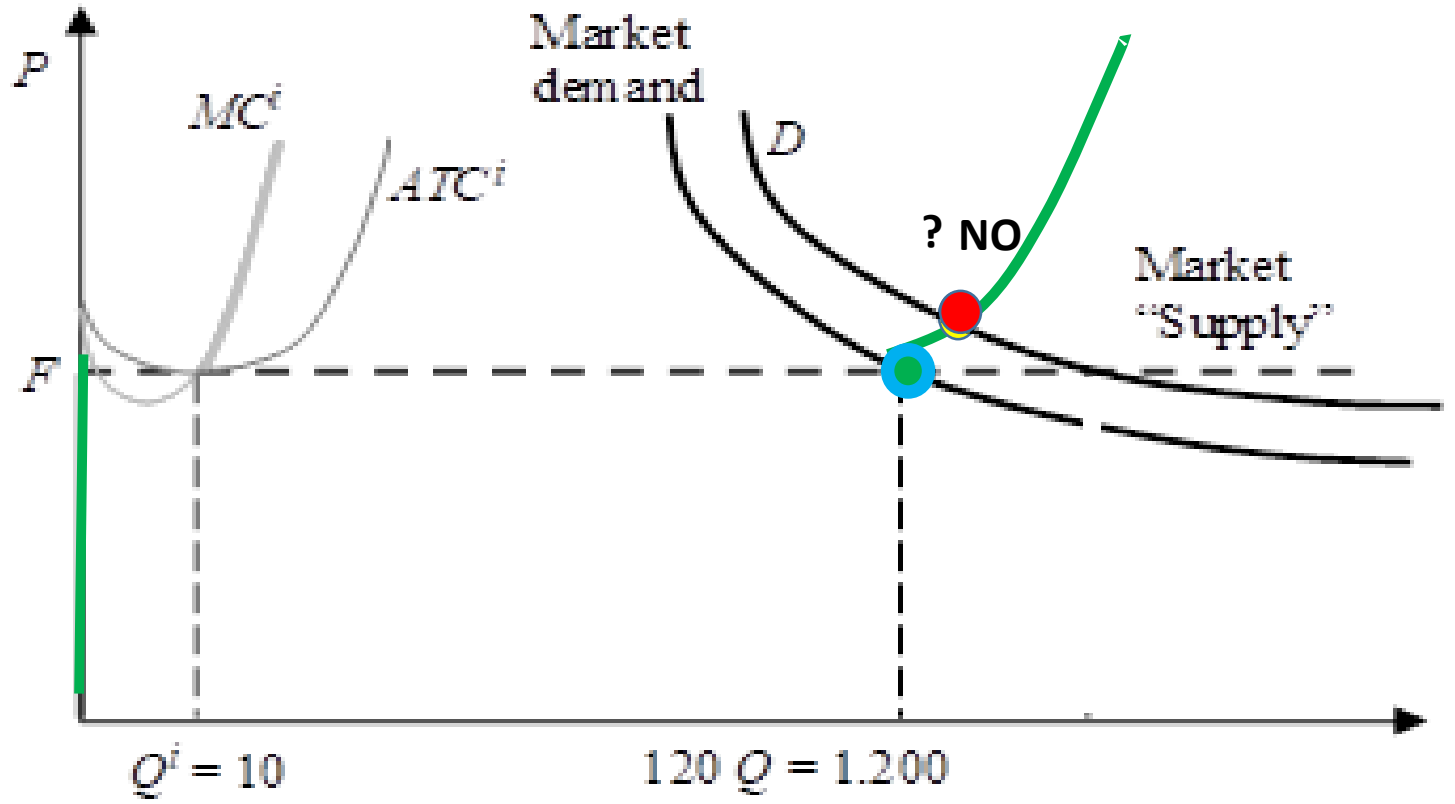
PC and LT – Constant Costs

Exit Point
Min AVC G

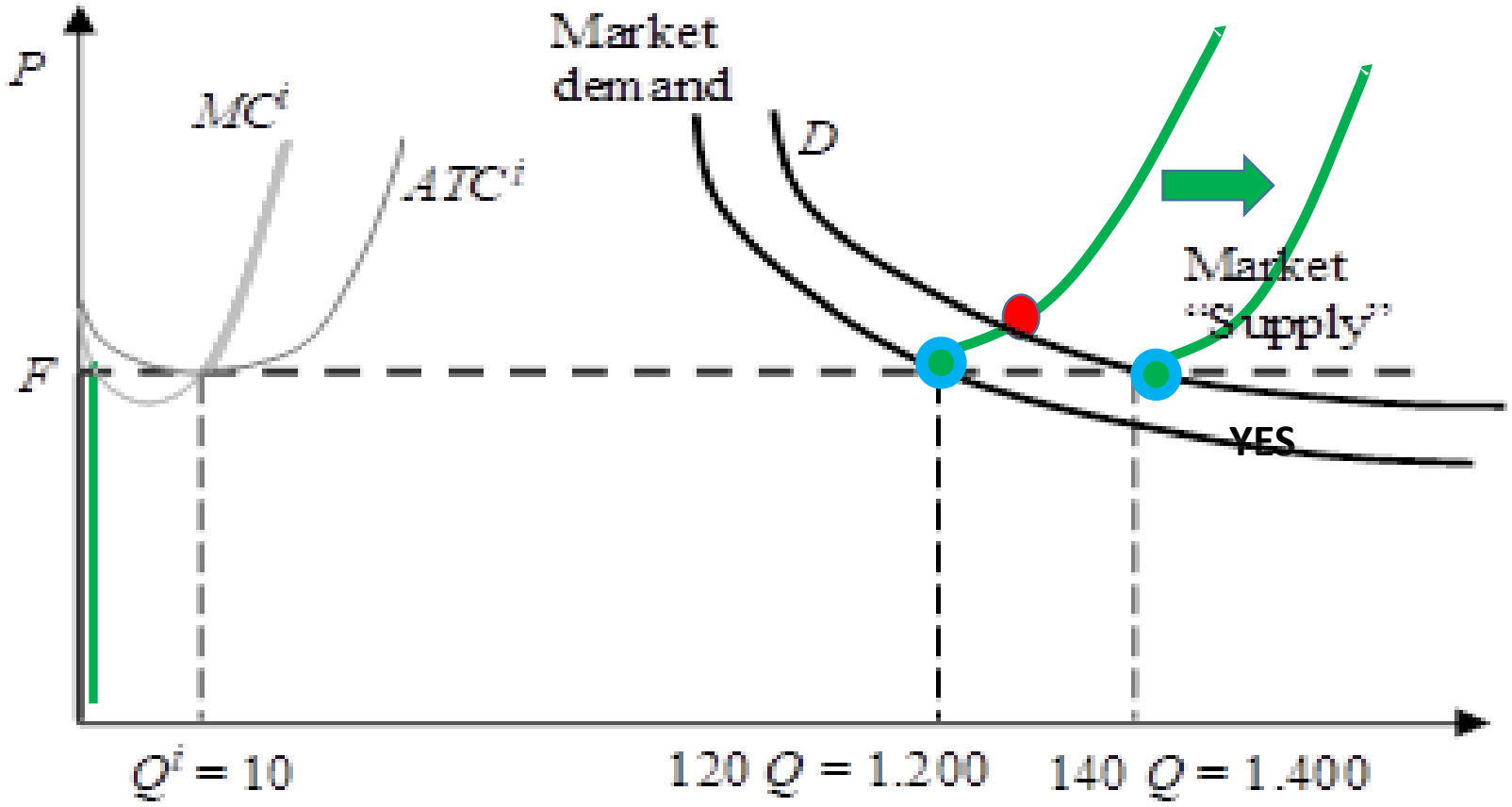


In the long term in perfect competition economic (extra) profits are zero.

PC, LT and Price: demand changes



PC, LT and Price



LT equilibrium with identical firms and constant costs

As in the short-term equilibrium, in the long-term equilibrium the prices of goods and the quantities produced P^{120} and Q^{120} are such as to ensure that profits and utility are **maximised** and that the quantities offered and demanded on the market are equal, subject to the following **additional conditions**:

(i) no company on the market wishes to change the size or quantity of the inputs;
(ii) no company on the market will wish to leave the market as it achieves exactly what it could achieve in other sectors;
(iii) no company outside the market will wish to enter the market, because it obtains exactly what it could obtain in other sectors. That is, there are **no extra profits**.

In the long-term competitive equilibrium companies produce at the lowest point of average costs, where average costs, marginal costs and price coincide, at the **efficient scale**.

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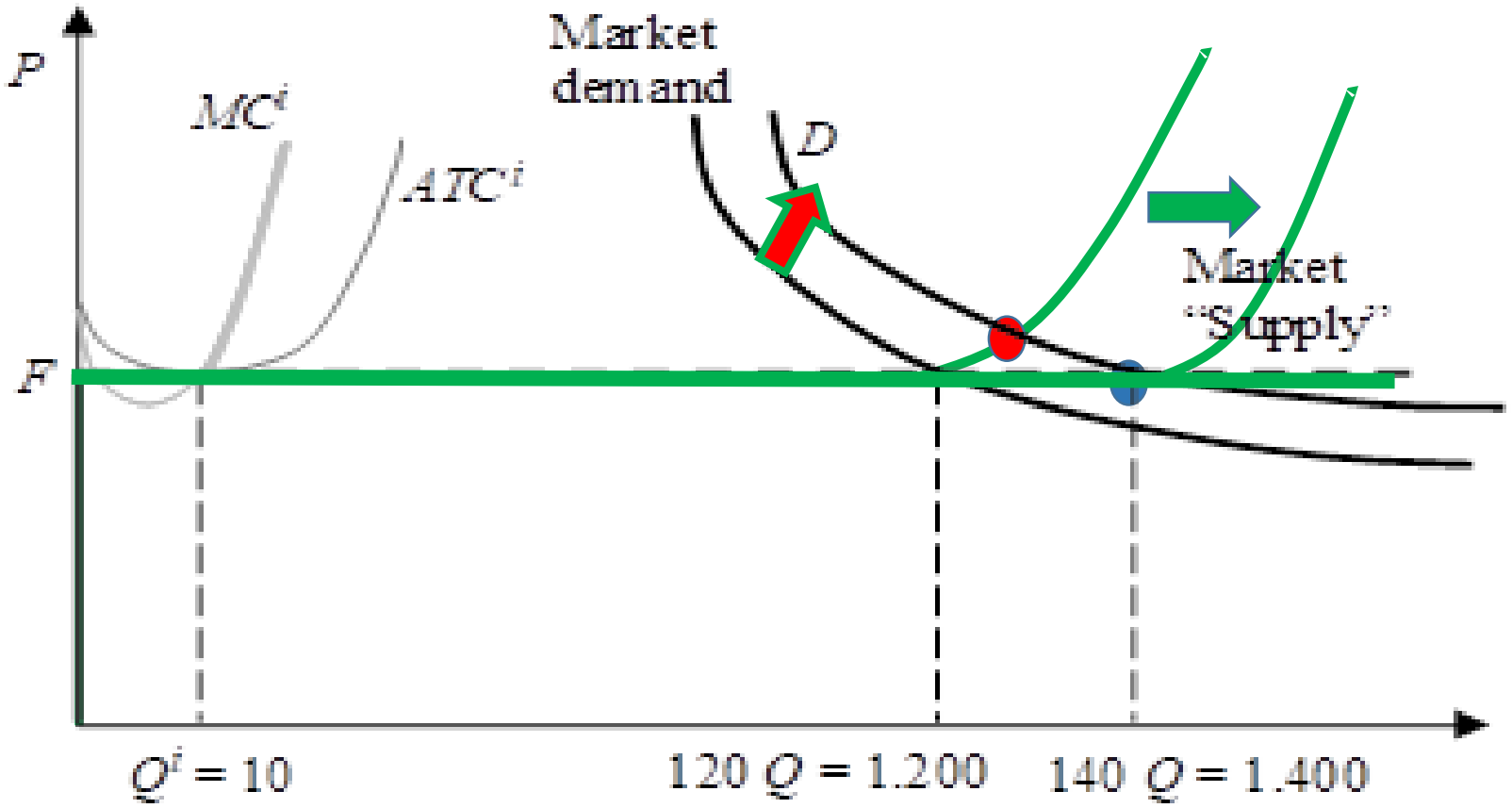
LT equilibrium with identical firms and constant costs

In the long run (as opposed to the short run in which an increase in the price made the production of each firm grow and therefore the market supply too) an increase in the price does not increase the supply of each individual firm present on the market but rather attracts new firms, until the price has fallen back to the point of minimum average costs.

In the long-term greater demand generates a rise in the number of firms and of quantities, not of price, which remains always equal to the exit price.

Price is NOT anymore explained by preferences or demand but only by TECHNOLOGY (min AVC)!

Where is the LT market supply?



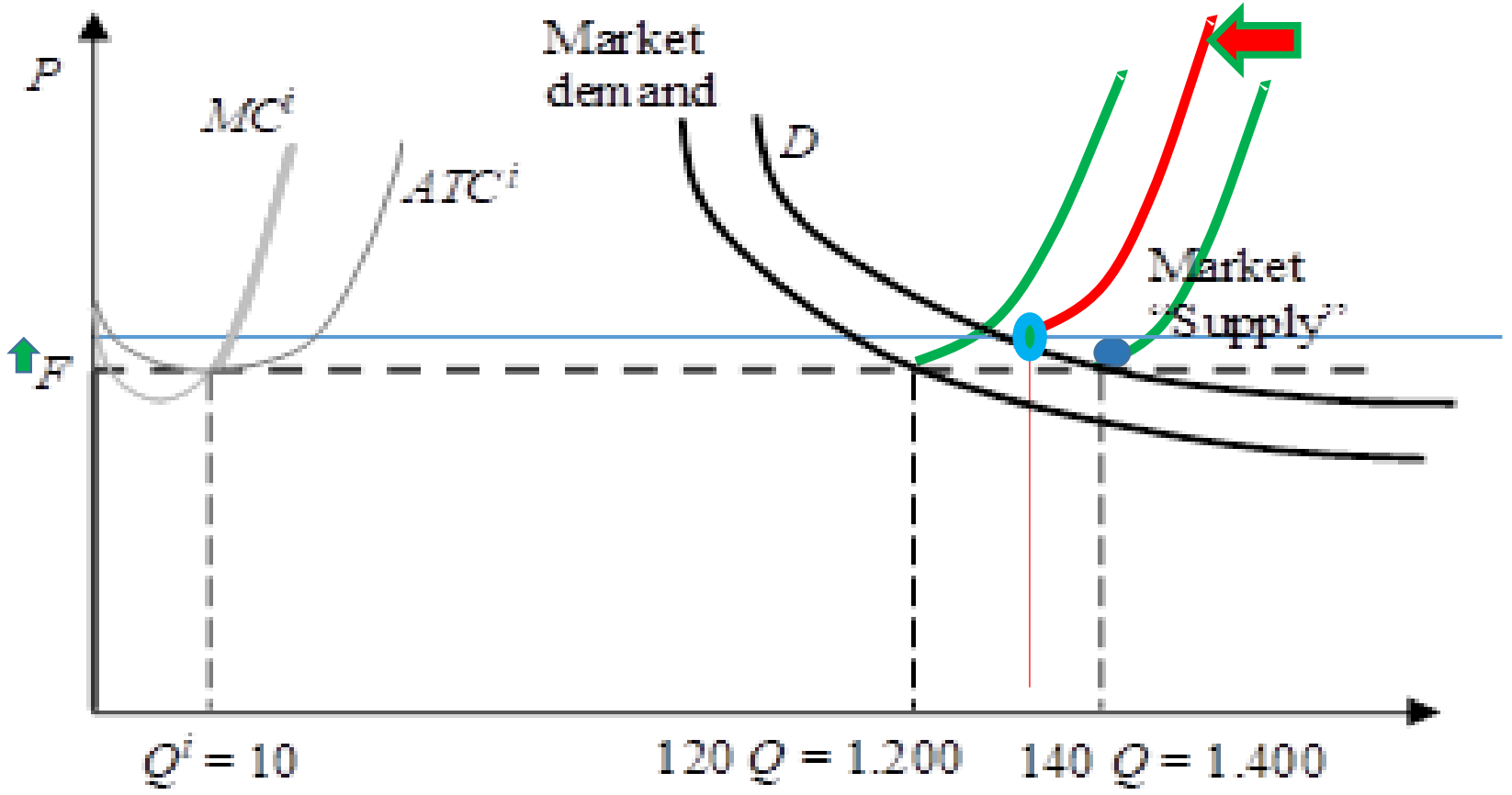
Any quantity demanded can be accommodated at Price F (min AVC) by the entry of new firms

Reminder

As we move along the supply curve with greater and greater quantities produced by the market we are keeping Technoloy and Input prices constant.

The toothpick industry! What happens to the price of wood when demand of toothpick doubles?
What about the wooden-house industry?

PC, LT and price at variable input prices



If input prices grow with the growth of production, if inputs are scarce, demand comes back to play a role in determining prices.

When demand increases for your product Q, your demand for inputs (workers, oil, land, pesticides, rare earths) increases too.

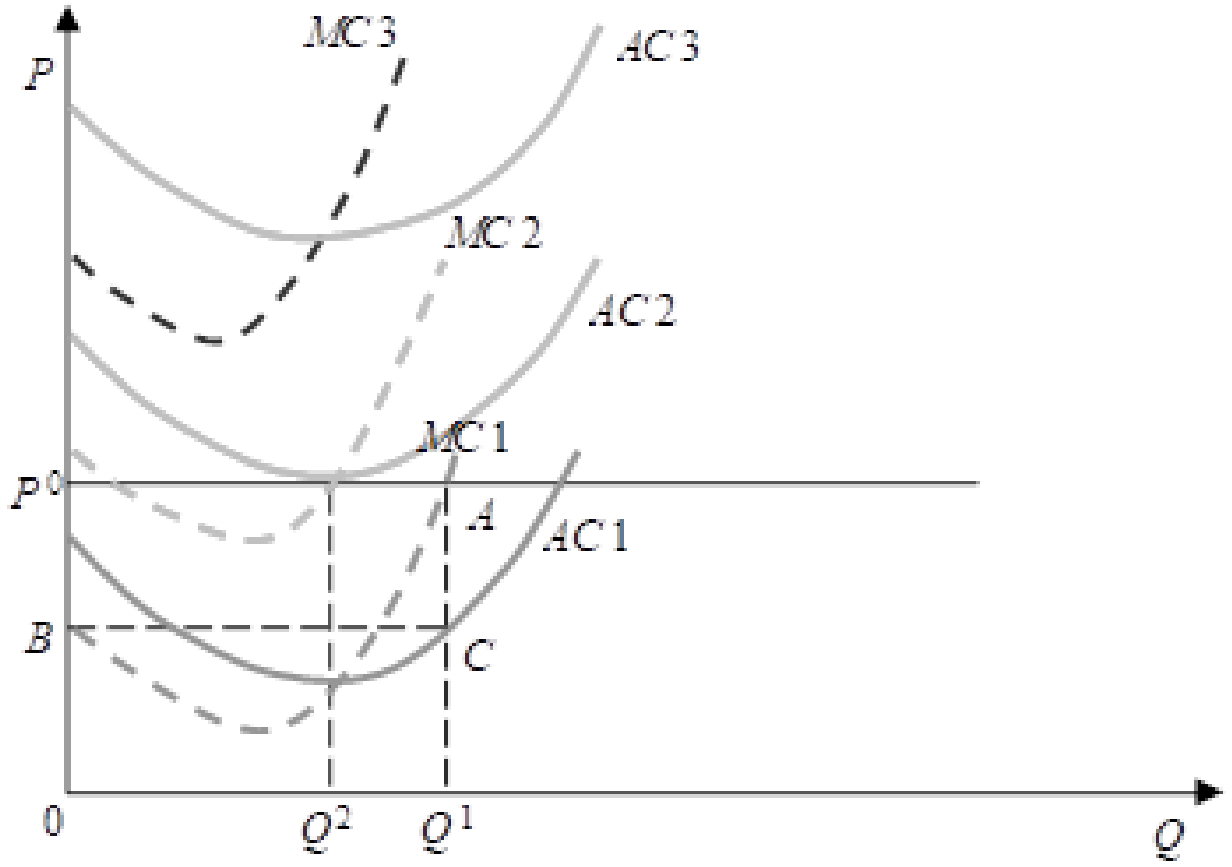
When demand for these inputs increases, if these inputs are scarce and the demand increase is large, their unit cost goes up, impacting the marginal cost curve of suppliers of Q and their supply curves, which shift NW.

LT Equilibrium and different firms

3 type 1 firms
4 type 2 firms
Millions of type 3 firms

Differentiated profit.

Positive long terms profits for…



LT Equilibrium and different firms

3 type 1 firms
4 type 2 firms
Millions of type 3 firms

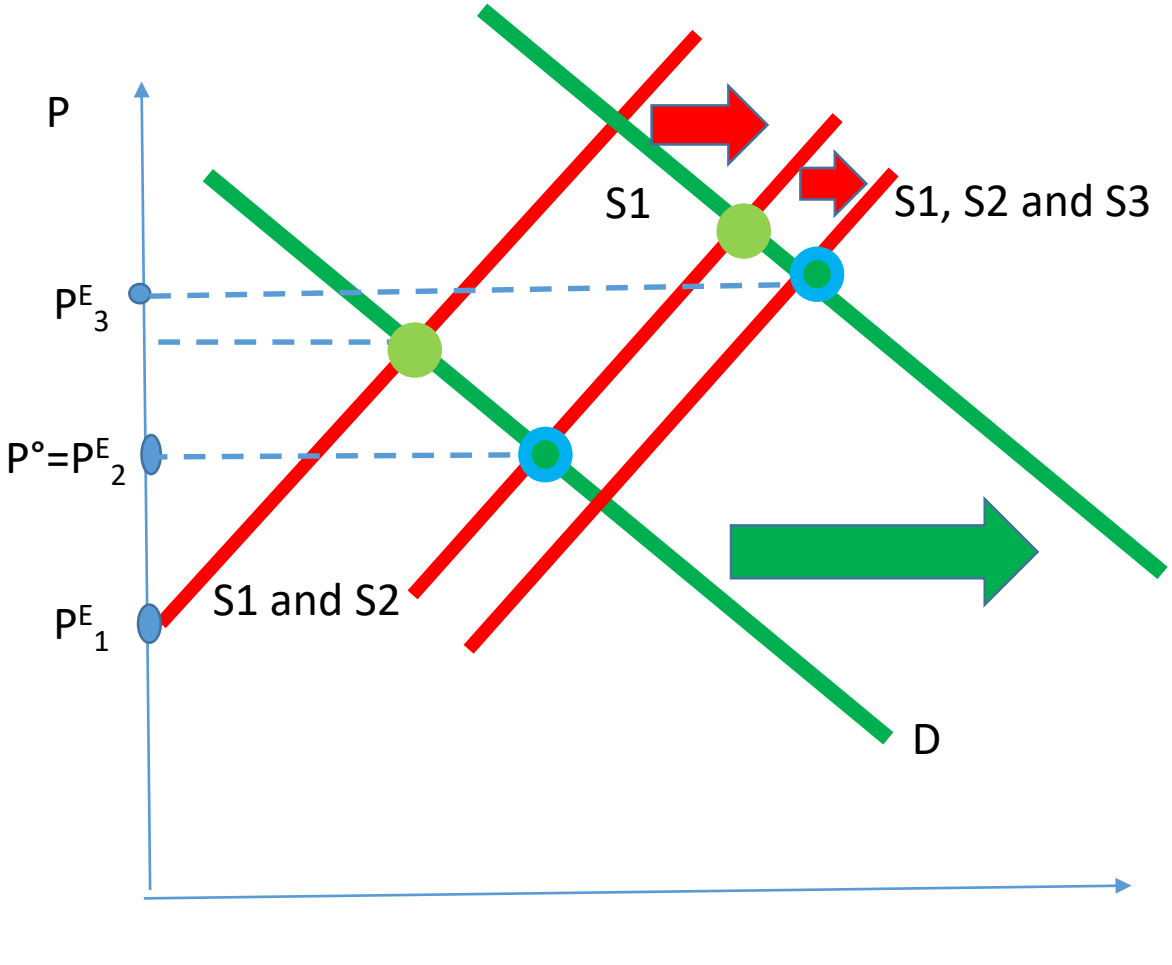
First LT equilibrium?

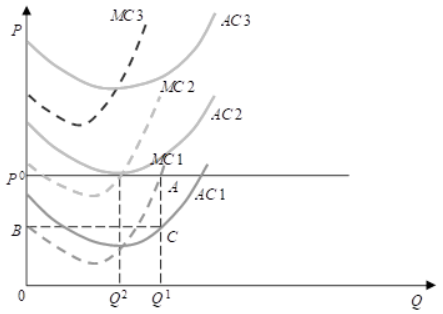
Second equilibrium with higher demand?

Demand and preferences matter in the LT again when inputs are scarce.

Extra profit? Differentiated! Why?

But are we sure that manager 1, so good…





The Monopoly

Analogies with PC

- They maximize profits
- They minimize production costs for any quantity
- They exit the market if it is not profitable
- They have no strategic interaction with rivals (because there are none; but beware of contestable monopolies where you have to defend yourself against the entry of rivals)
- Technology and the demand curve are constraints on action

Differences from PC

- They are not price takers but price makers: if they raise the price, they know they will not lose the entire market
- The elasticity of their demand curve is therefore not infinite and the marginal revenue is not equal to the price: every time they produce and sell more, they know they will have to sell all the quantities they previously sold at a higher price at a lower price.

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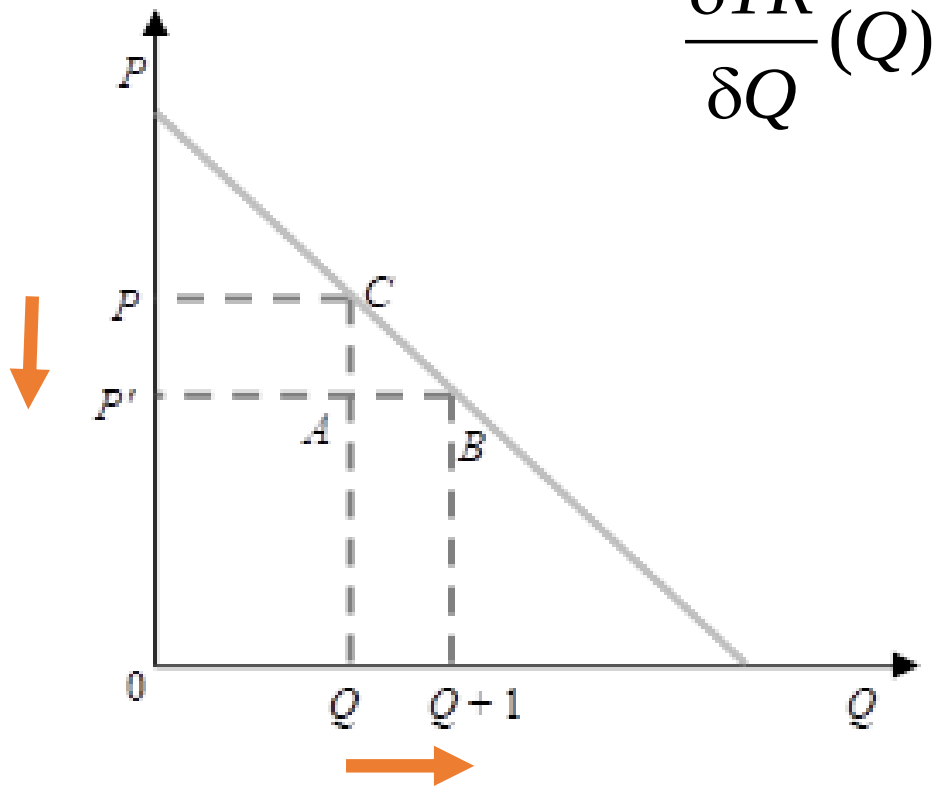
Monopolies existe because…

- Legal monopoly established by political decree for reasons of social equity (nationalization of electricity) or security (telephony until liberalization in the 1990s), etc.
- Natural monopoly linked to cost structure
- Strategic barrier to entry
- Gift from politicians to certain entrepreneurs
- To stimulate patents and innovation

Uniform pricing Monopolist (1 only price)

$$\frac{\delta RT}{\delta Q} = \frac{\delta[P(Q)Q]}{\delta Q} = \frac{\delta P}{\delta Q} P \frac{Q}{P} + P(Q)$$



$$\frac{\delta TR}{\delta Q}(Q) = P(Q)\left[1 - \left(\frac{1}{\varepsilon(Q)}\right)\right]$$

Monopoly pricing

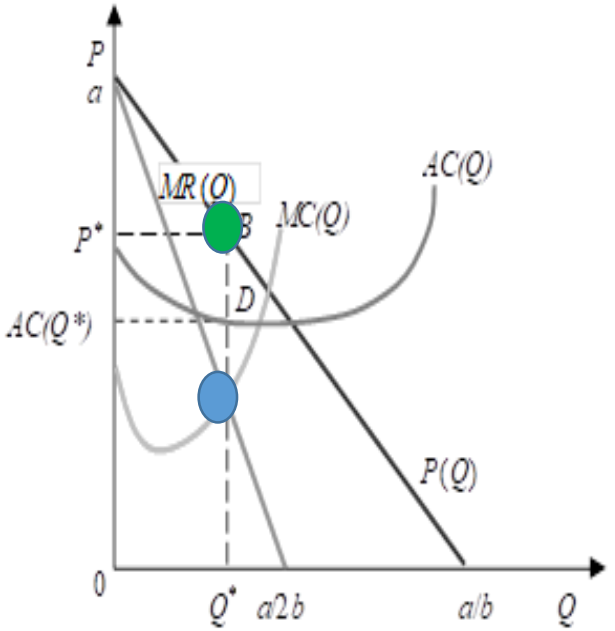
A well-known case is that of the linear inverse demand curve

$$P = a - b\,Q$$

thereby

$$TR(Q) = (a - bQ)\,x\,Q = a\,Q - bQ^2$$

$$MR(Q) = a - 2b\,Q$$



PS:
No supply curve!

Draw the marginal revenue curve.
PS: how is it in Perfect Competition?

$$MC(Q^*) = MR(Q^*) = P\left[1 - \frac{1}{\varepsilon}\right] = P\left[\frac{\varepsilon - 1}{\varepsilon}\right]$$

$P^M > MC$
$P^{CP} = MC$

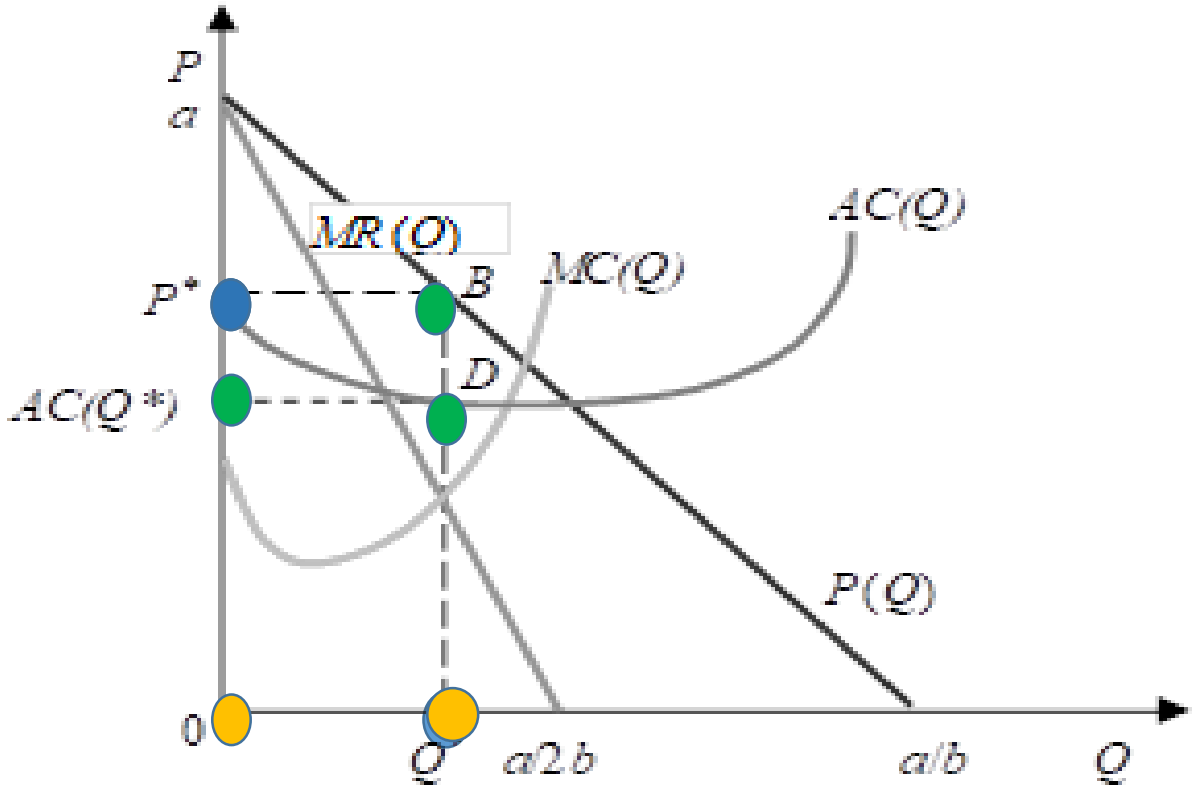
☺?

$Q^M < Q^{CP}$

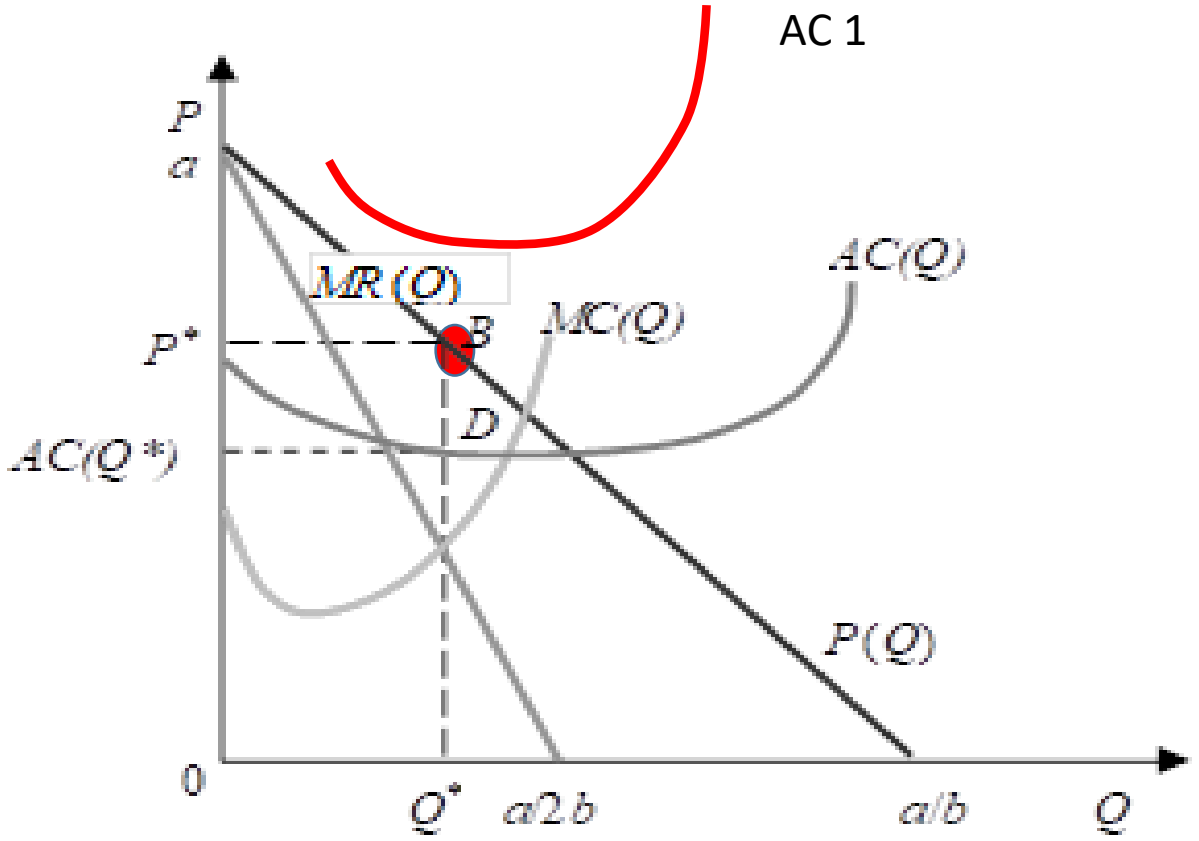
$P^M > P^{CP}$

$$P = \left[\frac{\varepsilon}{\varepsilon - 1}\right] MC(Q^*)$$

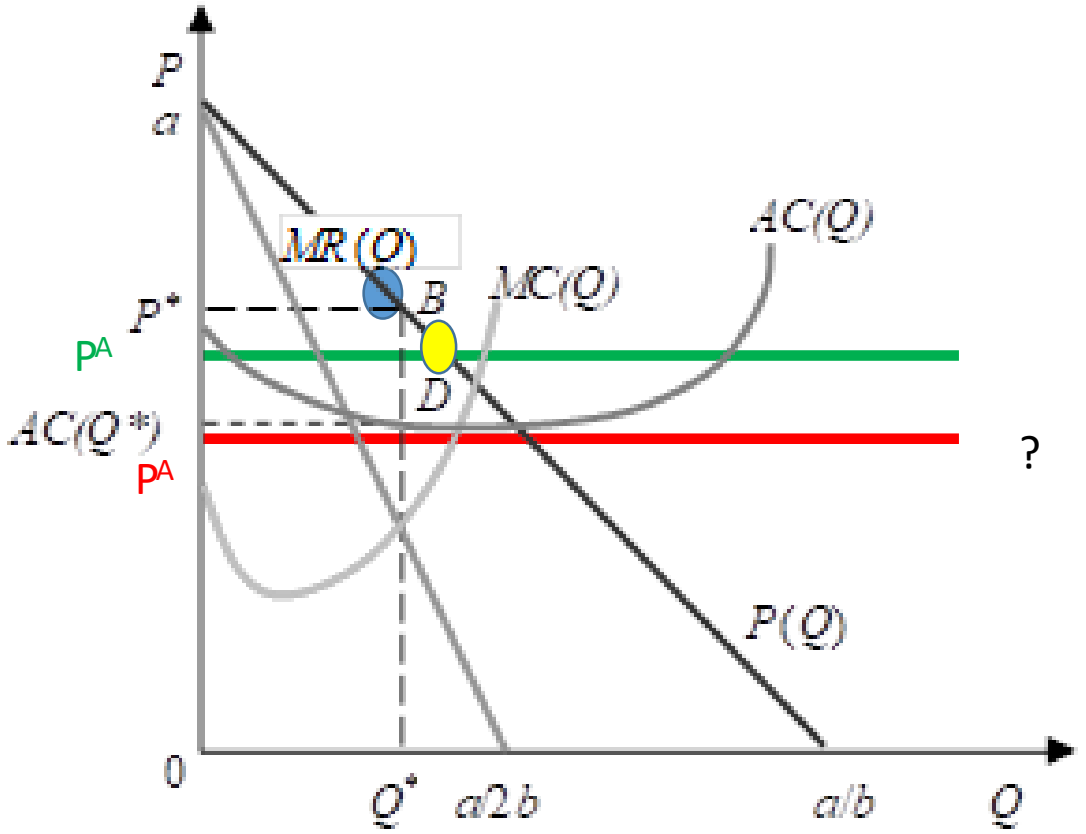
Monopoly profits



Monopoly



Masks and monopoly



What is best?

Monopoly or Perfect Competition?

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Efficiency

"How is the world": "positive" branch of the economics science;
"How the world should be": “normative” branch, (what is best? What is better?). **What do we mean by “better"?**

Improvement: a change (of production, of consumption, of situation) that is "desirable" starting from an initial situation, on the basis of a given, intuitive and not too controversial, criterion.

We will say that a situation B is **superior**, *according to the criterion adopted*, to a situation A, if passing from A to B represents an **improvement,** *according to the criterion adopted*. Instead, we will say that A is **efficient,** *according to this criterion*, if there is no way of obtaining an improvement by abandoning A.

One example of criterion: **output efficiency** in production. Given some input use, maximum output is obtained. Going from a situation in which we produce with **5 inputs** an amount equal to 3 output units [(5;3)] to the non maximum obtainable amount of 6 output units [(5;6)] represents an output improvement (“according to this criterion”), and therefore the production technique A (5; 6) is output-superior to technique B (5; 3). If C (5; 7) is the maximum output we can obtain with 5 inputs, C is an output-efficient technique in the sense that we cannot produce more than 7, given the use of 5 inputs, and therefore it cannot be improved given the use of 5 of the input. B and A are **output-inefficient** because both can be improved.

Similar arguments apply for example to "technologically efficient" production techniques that minimize the use of an input to reach a specific output. However, remember that there is no way to compare **various output or technologically efficient** points in production, as they are not improvements: just think of the decreasing trait of the isoquant.

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Efficiency in Consumption

«Let us make two counterparts meet».
The 2 only individuals populating the earth, Federica (f) and George (g).

They inherited from their parents the **endowments** of the only consumer goods available on earth, Apples and Mangos. In our case it will not be possible to expand these endowments through production (investment).

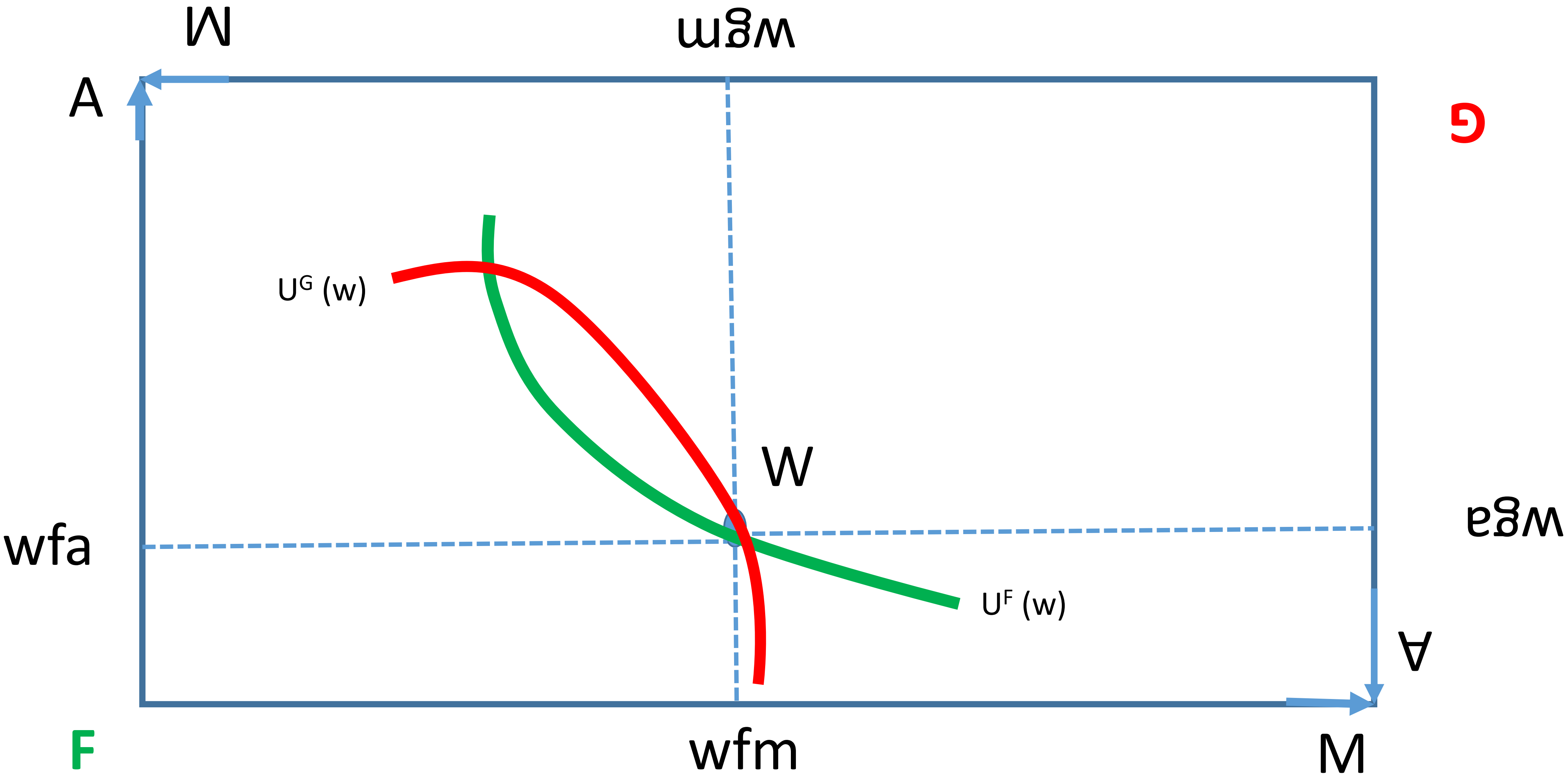
We will call Xf = (xfm; xfa) any **consumption basket** of Federica made of mangos (xfm) and apples (xfa) and we will call Xg = (xgm; xga) any consumption basket of George also made of mangos (xgm) and apples (xga).

A possible and specific basket that could be consumed by our two friends is the one they are endowed with, the so-called "**initial endowment**" noted as Wf = (wfm; wfa) for Federica and Wg = (wgm; wga) for George.

An **allocation** of goods, made of any couple of baskets (one for Federica and one for George), is said to be **feasible** when the total quantity consumed of a good by G and F is **lower or equal** to the total amount available for that good. Among the feasible allocations we will study (why?) only those that consume all available resources/endowments i.e. those such that:

$$xgm + xfm = wgm + wfm$$
$$xga + xfa = wga + wfa$$

The Edgeworth Box



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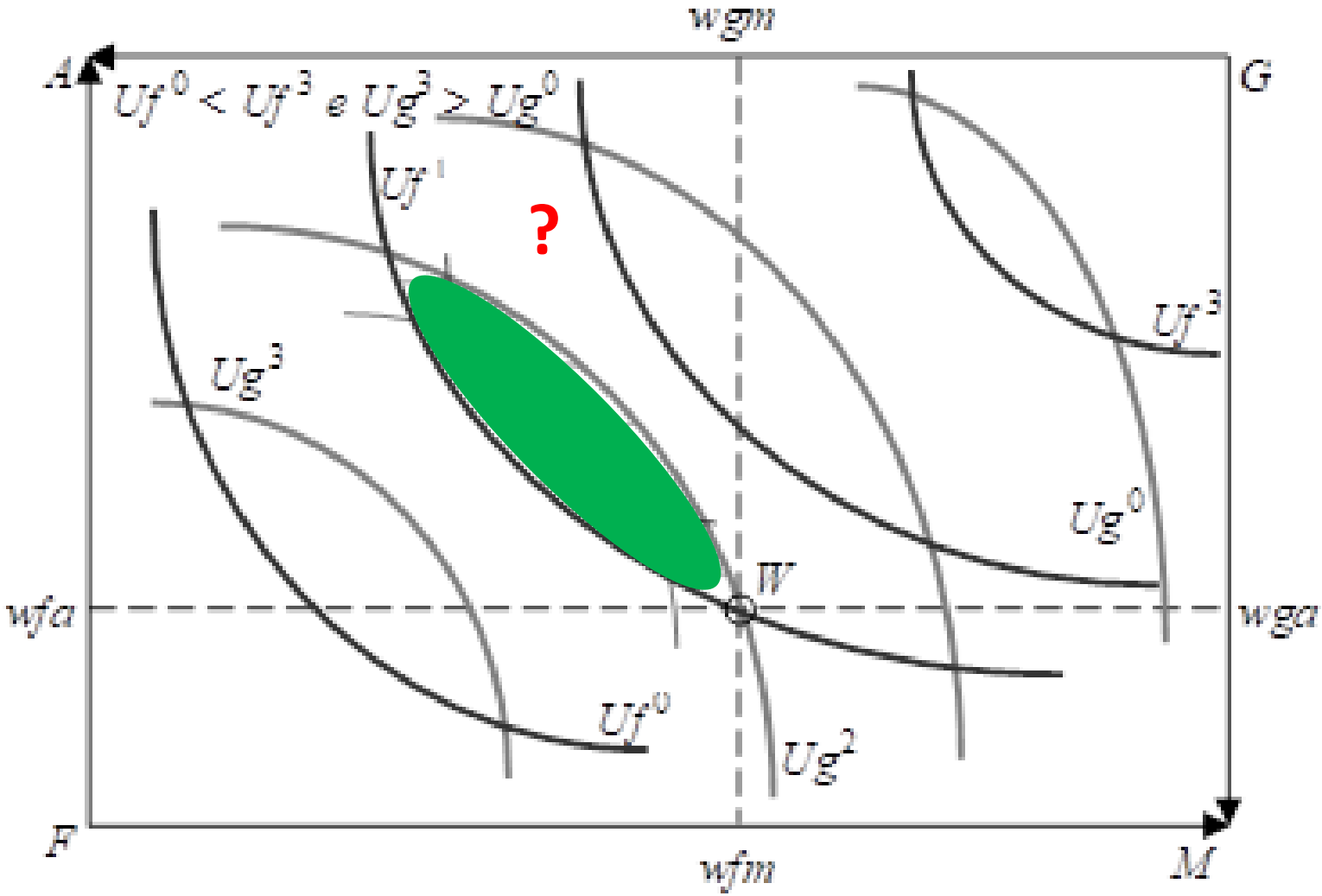
Voluntary Exchange and Improvement



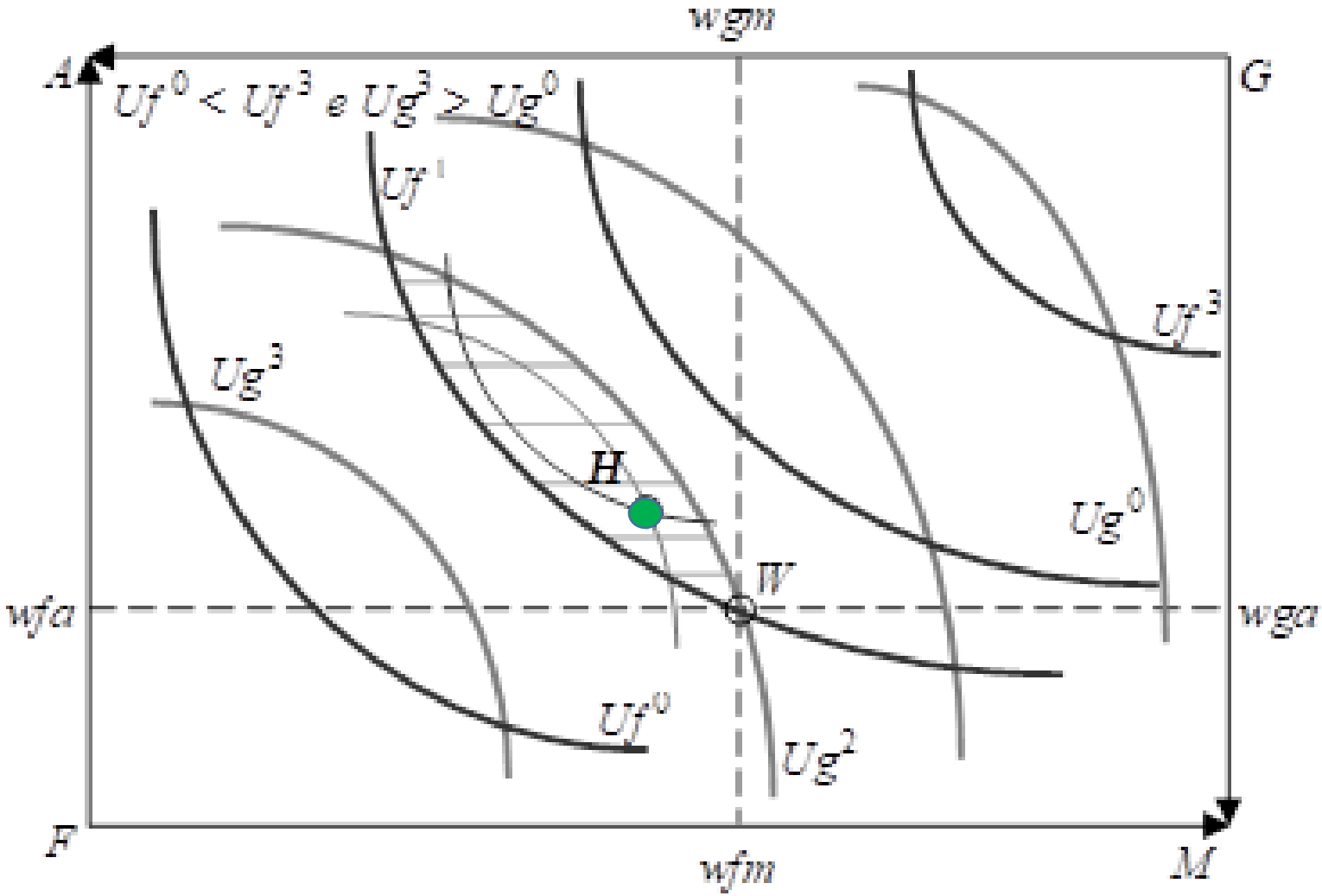
An improvement

H? A social improvement with respect to W.

Imagine being a Mayor of Rome.

Wouldn't you agree?

We will call **Pareto improvement** a movement to a situation where at least one person is better-off and none worse-off.



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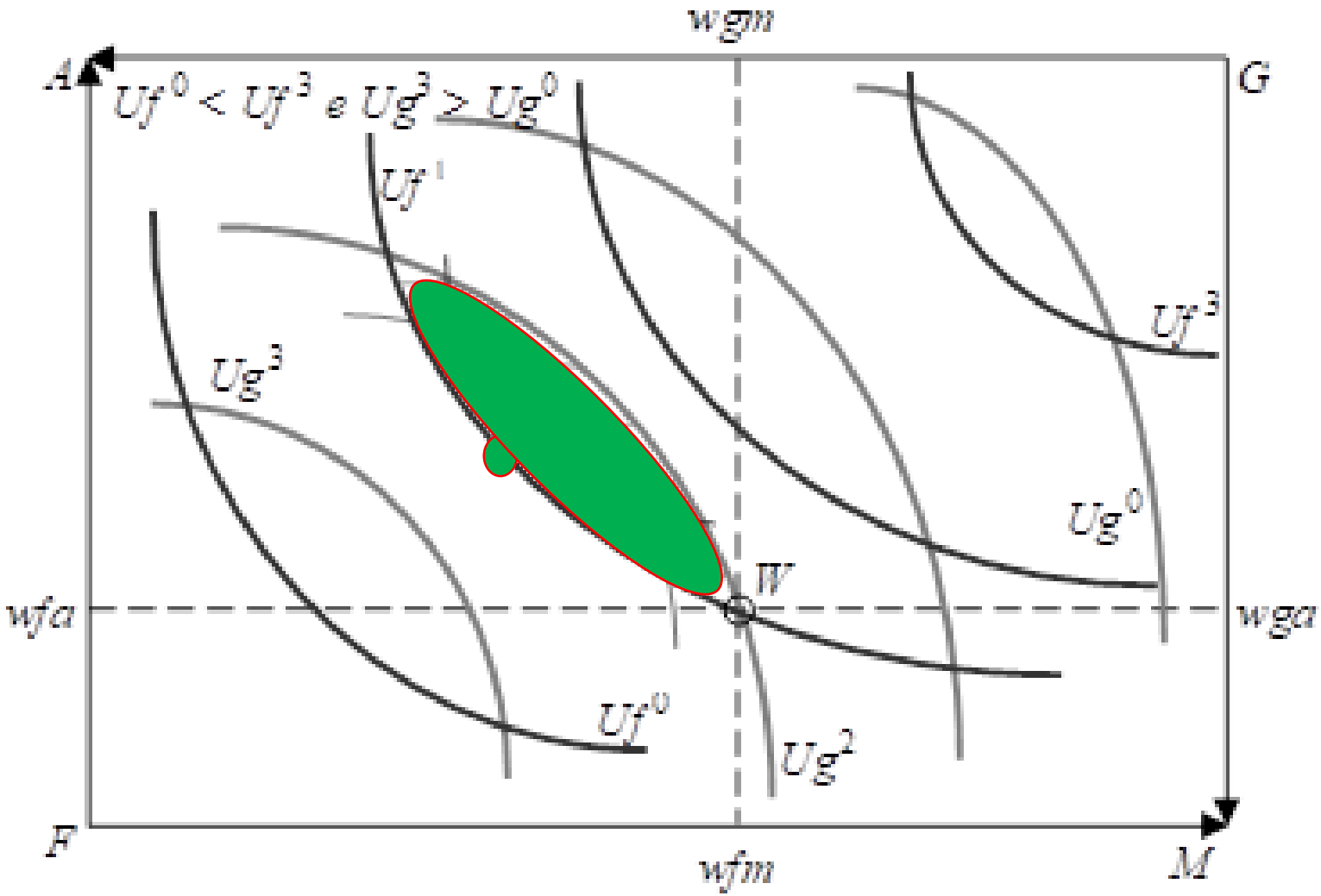
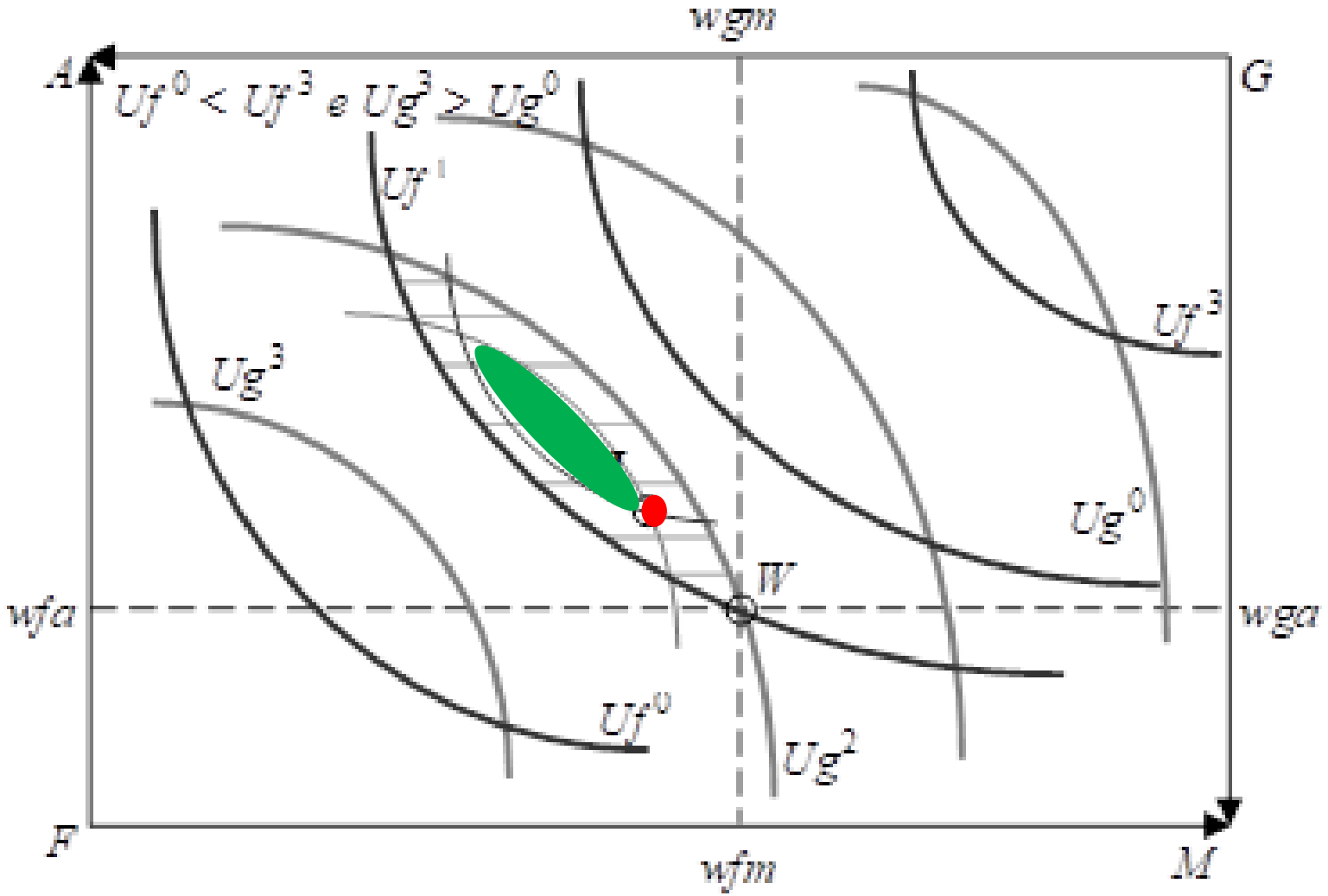
Bargaining Power of….?



Inefficiency



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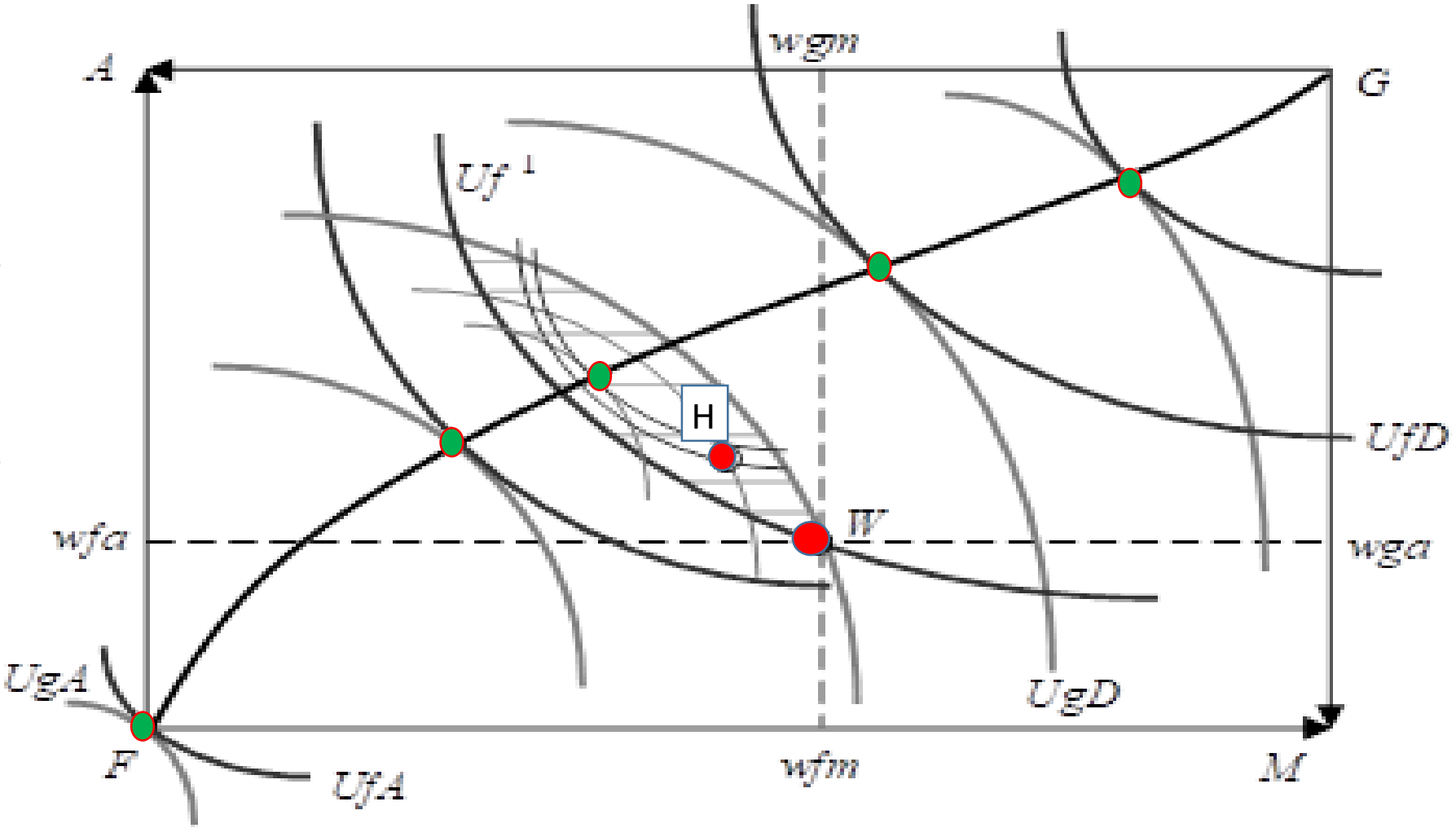
Efficiency and Pareto-optimum

We will call **Pareto improvement** a movement to a situation where at least one person is better-off and none worse-off.

So **Pareto-(in)efficiency** is …



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Pareto efficiency

A point that is **Pareto-inefficient** has a point **Pareto-superior** to it, i.e. it is a point from which you can move away with a Pareto improvement.

A **Pareto-efficient** consumption allocation answers (partially) our need to find a criterion to judge as to whether a social (2-people) situation is to be preferred to another one.

A consumption allocation (and, more generally, a situation) is **Pareto-efficient** if:

– given the utility reached by one individual, the other one maximizes her utility, or
– it is not possible to make mutually advantageous exchanges, i.e. so called **Pareto improvements**.

The set of all Pareto-efficient points in the Edgeworth box is named the "**contract curve**"

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Efficiency and Pareto optima: the contract curve

From W to G?
A Pareto improvement.

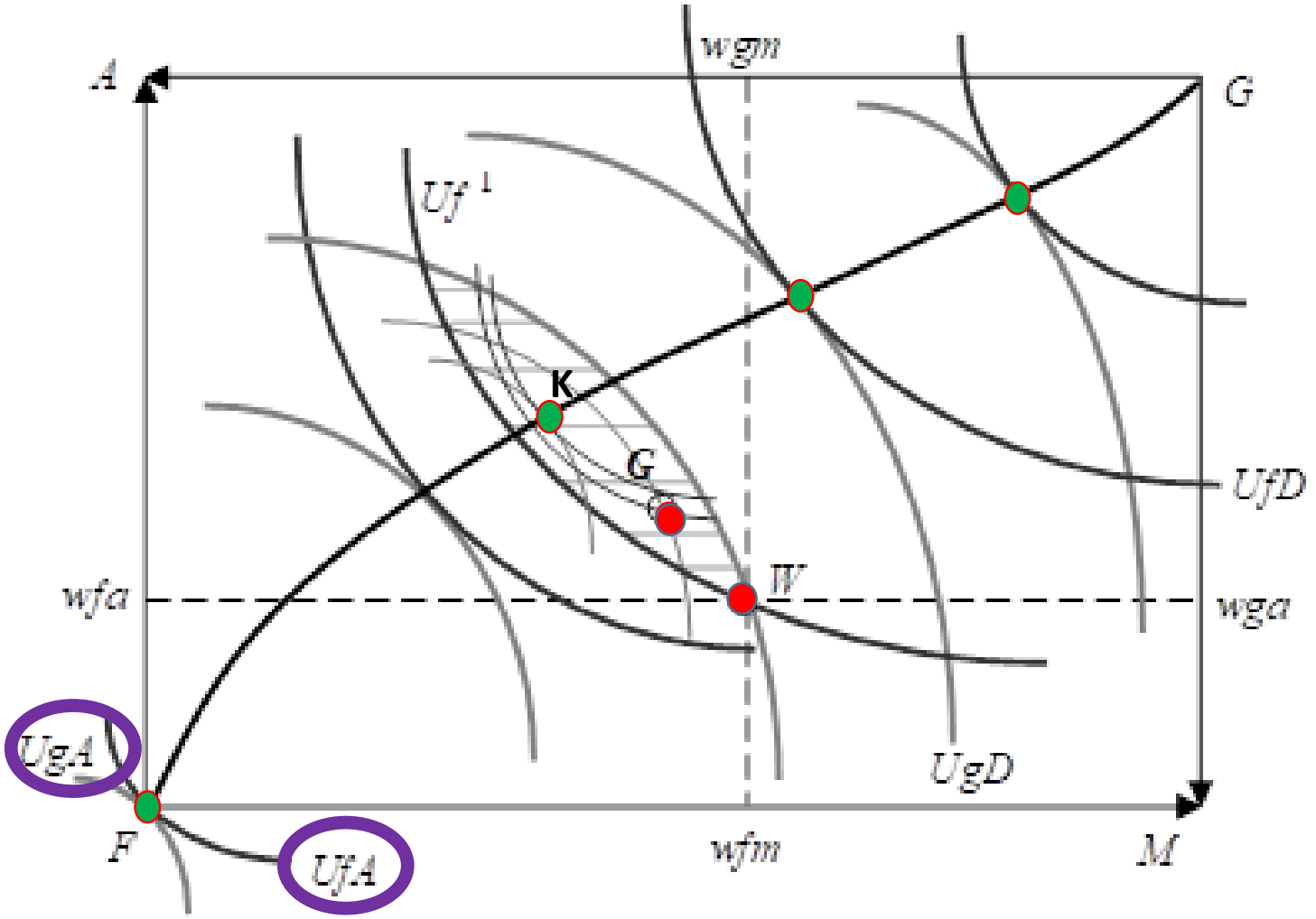
W is …

Pareto-inefficient.

like…

G, since …
from G to K we have a Pareto improvement.

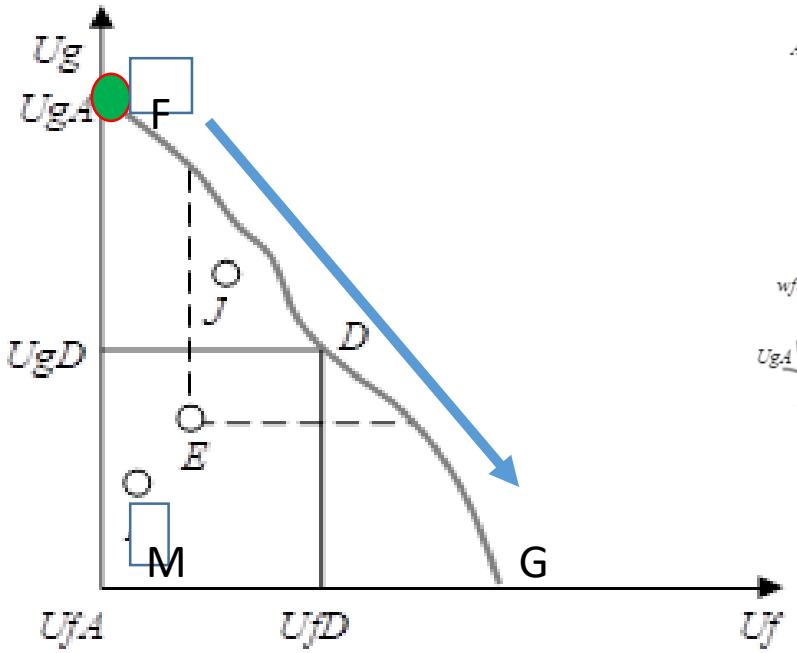
K is …
Pareto-efficient,
like …
F!

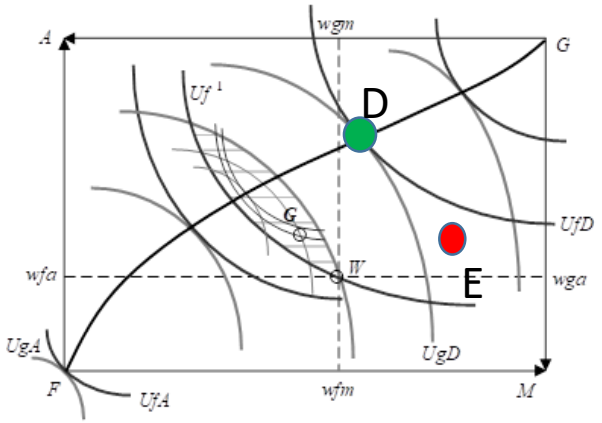


Utility–possibility set and frontier

From E to D?
A Pareto improvement.
D is Pareto superior to …
E.
From M to E?
Idem. E is Pareto superior to M.
A movement from E to F?
Not a Pareto-improvement even if F is Pareto-efficient.
Is F Pareto-superior to E?
No.

The frontier that separates feasible utilities from non-realizable ones is called the utility–possibility frontier. On it we read, given a certain amount of goods available overall in the economy, the utilities related to Pareto-efficient points.

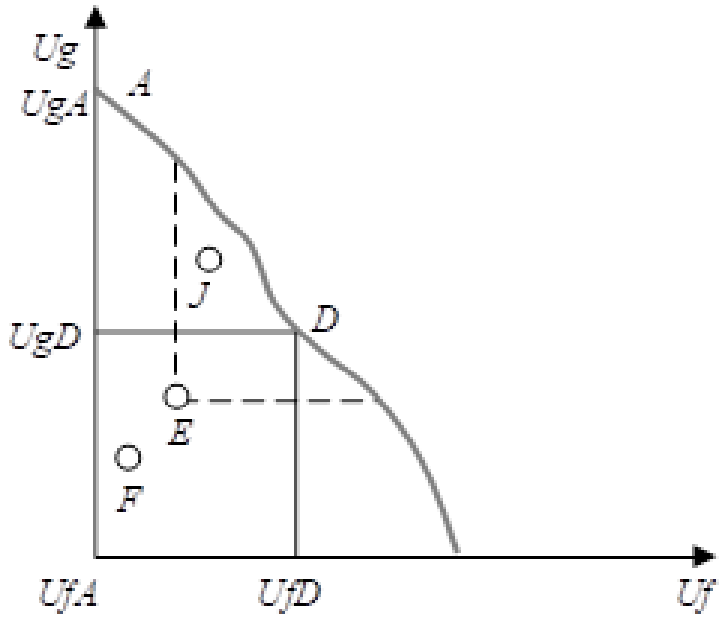




If a point is not Pareto-efficient it does not mean that it is Pareto-inferior to all Pareto-efficient points. It simply means that there will be at least one allocation Pareto-superior to it. For example, all achievable allocations lying **north-east of E** constitute Pareto-superior allocations to E: note that F is not part of these allocations (F is not Pareto-superior to E), while there are inefficient allocations (in the sense of Pareto), such as J, that Pareto dominate E.

The problem of the Pareto criterion

It tells us nothing regarding those changes which do not represent a Pareto improvement, such as moving for example from A to E or from J to D or, more importantly, from A to D.
Mayor of Rome?



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The Marshall criterion

Pareto criterion? Excellent, but of limited use! Why, Pareto?

Now examine changes in the allocations in society, such that these dissatisfy some and make other individuals happier: **not** an improvement in the sense of Pareto. How to choose?

Ask those who are made **worse off** after the change "what amount of money would they need to feel as well off as they were before the change in the social situation" and those who are made **better off** by the change "what amount of money would they be willing to give up in order to remain in the new social situation ".

After that, Marshall said, add up losses needed to recuperate (- sign) and gains willing to be given up (+ sign) and call the total balance the **net sum**, which will be positive (negative) if the sum that those who are better off are willing to pay to remain in the new situation is higher (lower) than that those who are worse overall require to accept the new situation.