FUNCTIONAL AREAS:
The Function of Production

Topic 4. The function of production

- The function of production. Concept and objectives

- Types of production systems

    - Rigid production

    - Flexible production

    - Just in Time production

- Production planning and control

    - Planning tools: GANTT graphs and PERT method
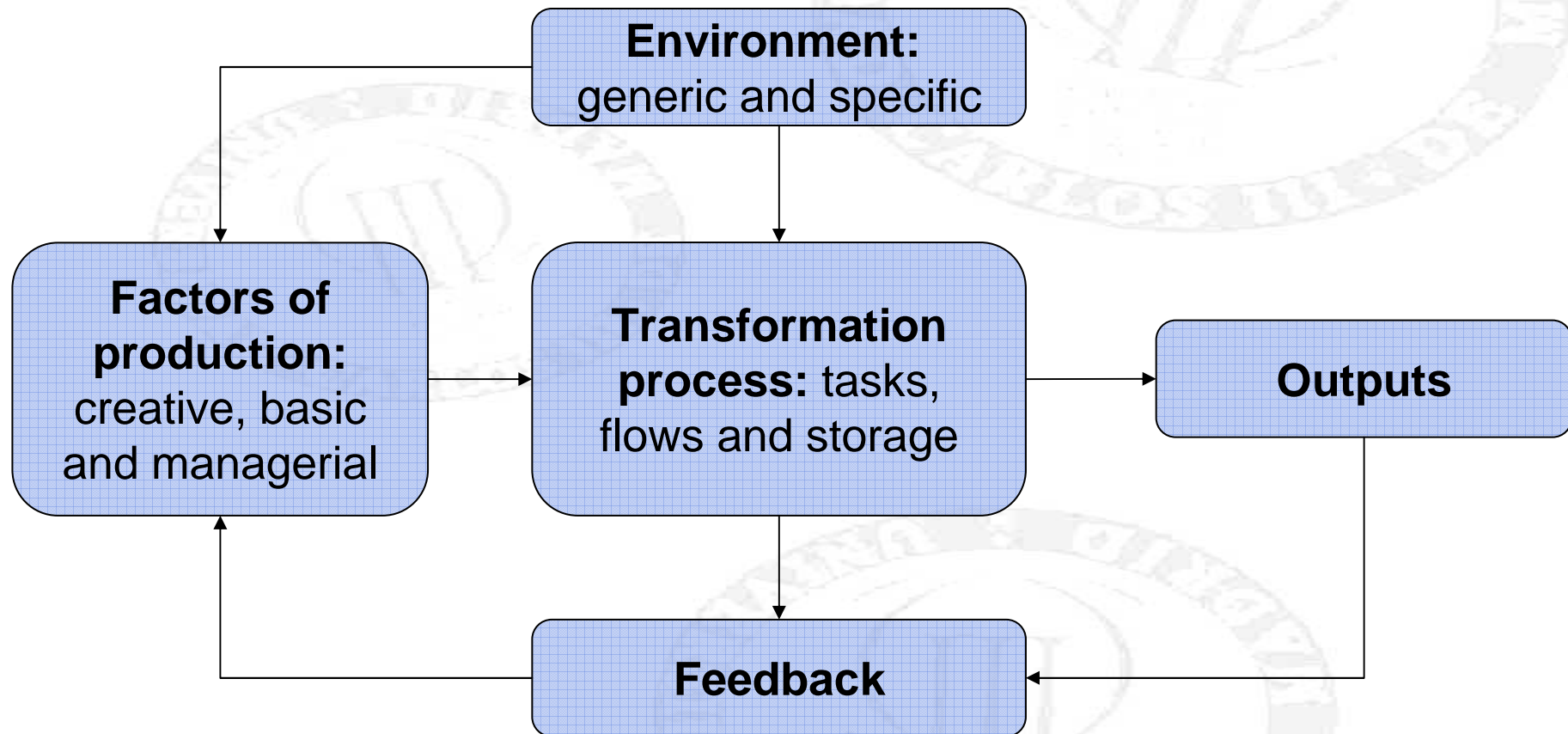
    - Control of efficiency

A **production system** is a method for converting inputs into outputs

Production management (operations management) is the set of activities aimed at planning, designing, staffing and controlling a firm's production system

Environment: generic and specific

Factors of production: creative, basic and managerial

Transformation process: tasks, flows and storage

Outputs

Feedback

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Objectives of the function of production

COST

QUALITY

TIME OF DELIVERY

FLEXIBILITY

Potential contradictions between the objectives

COST - QUALITY

FLEXIBILITY - COST

TIME OF DELIVERY - COST
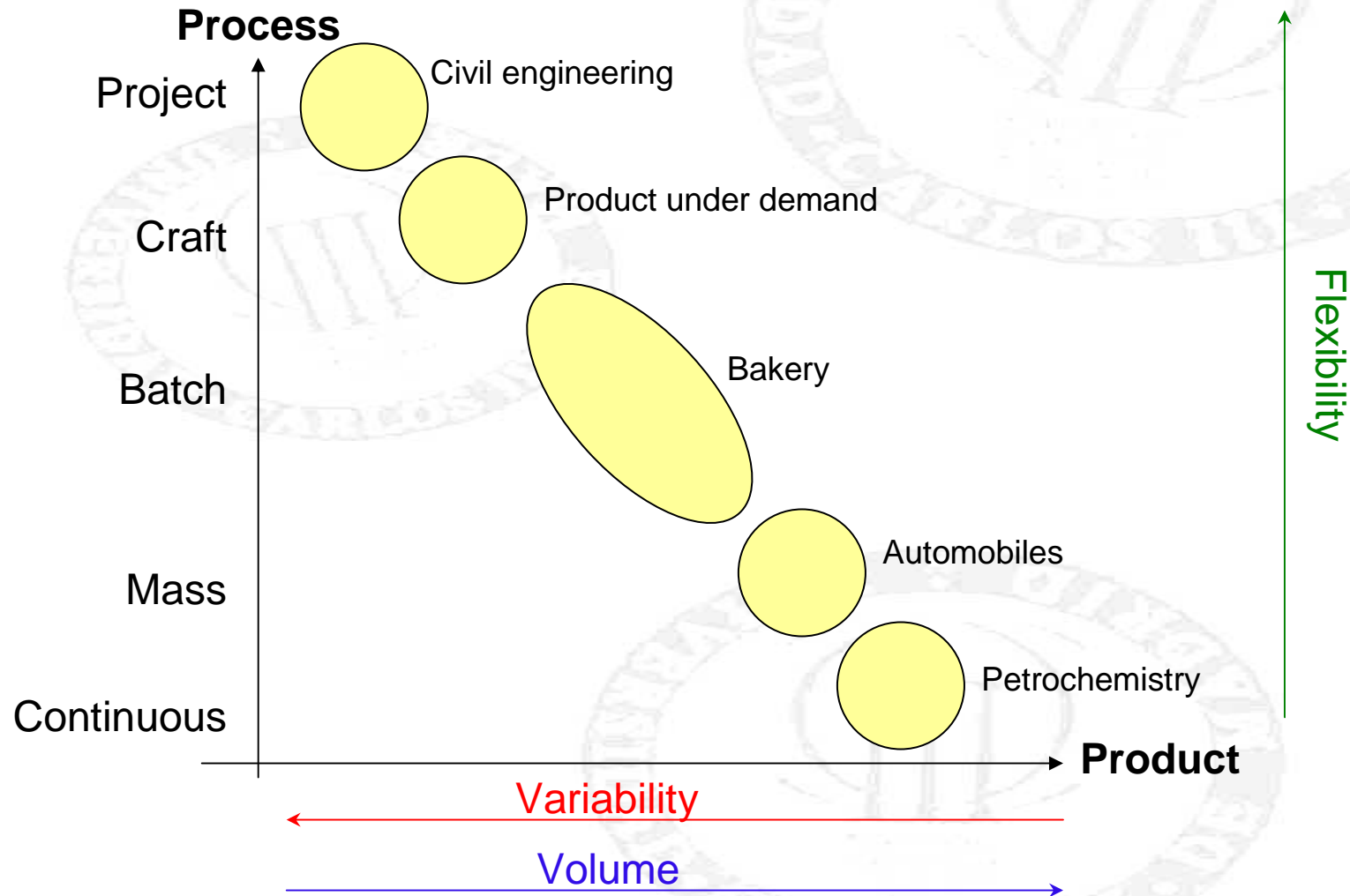
Matrix product-process

Process

Project — Civil engineering

Craft — Product under demand

Batch — Bakery

Mass — Automobiles

Continuous — Petrochemistry

Product

Variability

Volume

Flexibility

5 generic types grouped in 3 categories:

RIGID or CONTINUOUS

FLEXIBLE or INTERMITTENT

JUST IN TIME

Characteristics

Big volumes of production

Low price commercialization

Standard products

Capital intensive

Advantages of the job specialization

Less time to learn a task

The simplicity of the task makes the learning process cheaper

Time elimination for changing from one task to another

The worker acquires expertise in performing the task

Better adecuacy worker–job position

Easy replacement of workers (and mechanization)

Organization of the factory

Division of labour creating different **job positions**

Assignment criteria: **Seniority**

BUREAUCRATIZATION OF THE COMPANY

Mass production

Continuous or process production

Characteristics

Flexible volumes of production

More complex and differentiated products

Higher qualified workers

Equipment for general use

Organization

Plant layout based on teamwork

Workers have more responsibility

Less hierarchical levels (layers)

Employee rotation

Remuneration depends on qualification

Craft production

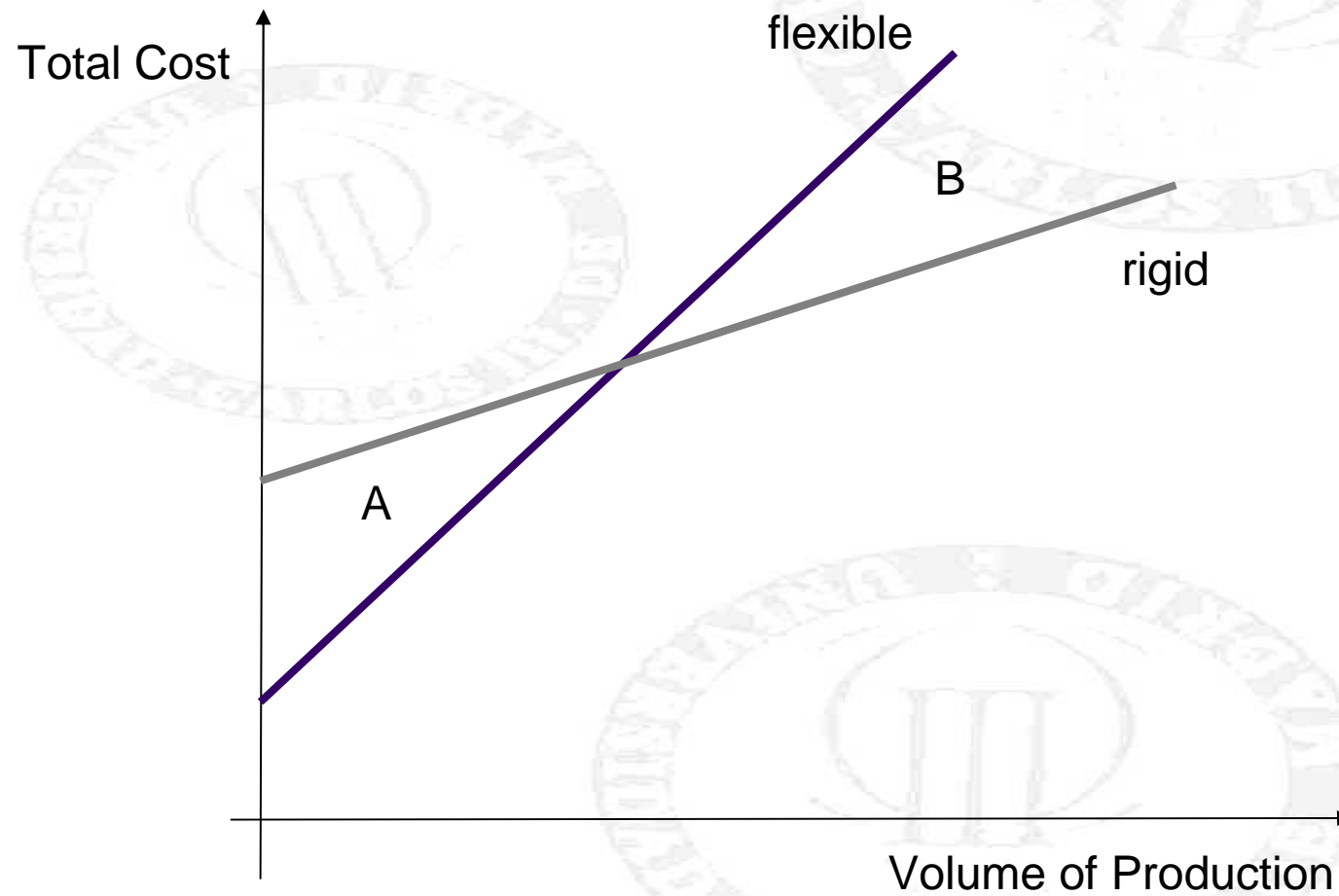Batch production

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It arises from the need for manufacturing many types of automobiles, in small batches but under the same production process.

It is based on requests and eliminates inventories

Competitive advantages

Manufacture high quality products

Reduce the whole production cycle

Internal organization

Job cells

Plant distribution

U shape

Mechanisms to support quality

JIDOKA

POKA YOKE

Mechanisms of visual control

ANDON

CONTROL PANNELS

WORK SHEETS

KANBAN

Plant layout

Functional or process layout

Product layout

Fixed layout

5 generic types:

Project

Individualized products: high cost, qualified workers, equipment for general use, difficult planning and control

Plant layout: **"fixed"**

Craft

Batches

Low quantity of a great variety of products:

• Craft: more adaptability, less quantity

• Batches: more uniformity, more quantity (batch size)

Plant layout: **"functional"**

Mass

Continuous

Standard products for mass markets, division of labour:

• Mass: more dependant on workers than machines

• Continuous: more dependant on machines than workers

Plant layout: **"product"**

Functional or process layout

Advantages

- High use of the machines

- Machines can be easily replaced

- If similar machines are close, operators can train and supervise themselves easily.

- Specific incentive system for each worker

Disadvantages

- Distance between functions

- Handling wastes when transporting the materials

- Flow of materials and operator's work is difficult to standardize

- Flow of materials is difficult to plan

- Activities are difficult to plan

- Lines are not balanced: some are saturated and others free

Product layout

Advantages

- Few workload in process

- It requires less space for transport and for the temporal storage of the products

- Planning and control systems are simplified

- Operators need low preparation

- Flow of materials is easy to anticipate

Disadvantages

- Inflexible

- Time is determined by the slowest machine. "Bottlenecks" should be avoided

- Problems in one machine affects the rest of the process

- High investment is needed

- Difficult to define incentive programmes for each employee

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Fixed layout

A **fixed layout** is a plant layout in which the product stays in one place and the machinery, materials and labour are brought to that one place

- *A posteriori*

    PRODUCTIVITY

- *A priori*

    COST ANALYSIS

Total Productivity Indexes:

$$\text{Total Productivity} = \frac{\text{Goods and services}}{\text{Labour} + \text{Capital} + \text{Raw materials} + \text{Energy}}$$

Partial Productivity Indexes:

$$\text{Labour Productivity} = \frac{\text{Goods and services}}{\text{Labour}}$$
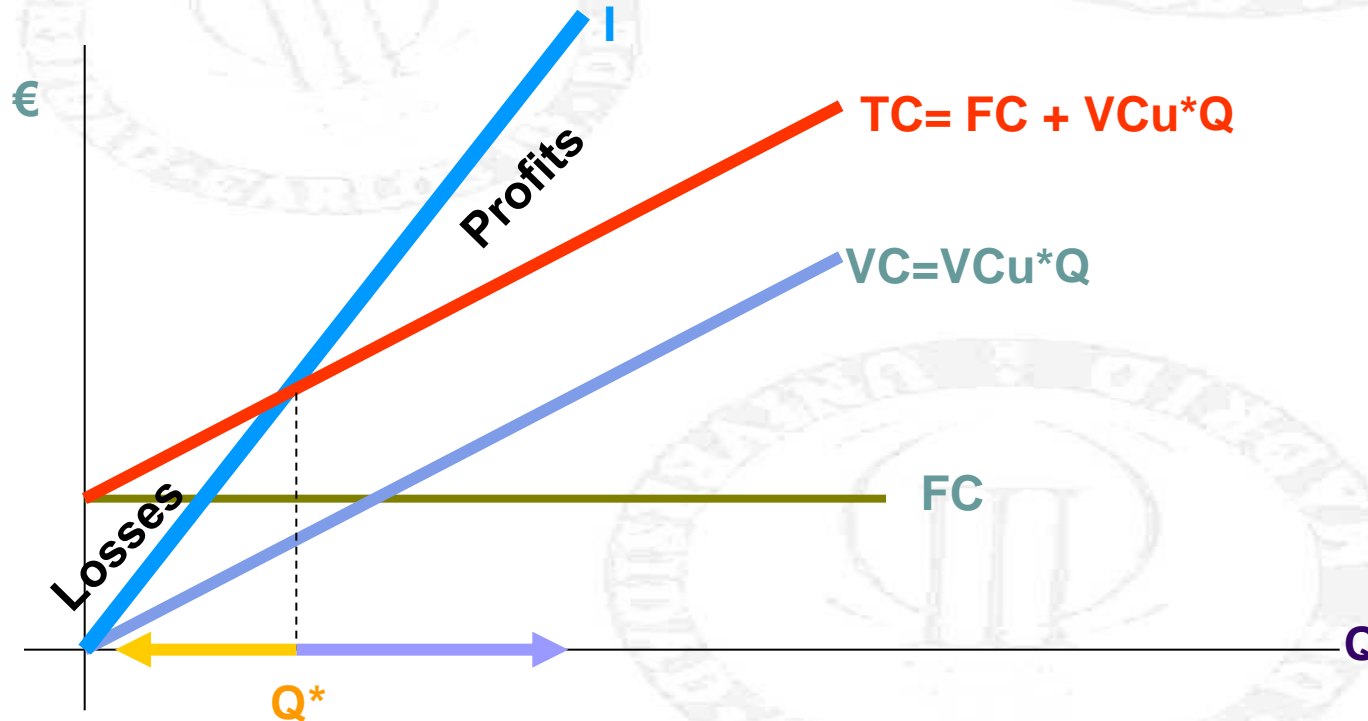
BREAK-EVEN POINT ANALYSIS

Volume of sales/production at which the company covers its total costs.

Volume of sales/production from which the company starts to get profits.

Depends on costs structure

$$Q_0 = \frac{FC}{P - VC_u} = \frac{FC}{m}$$

€

I

Profits

TC= FC + VCu*Q

VC=VCu*Q

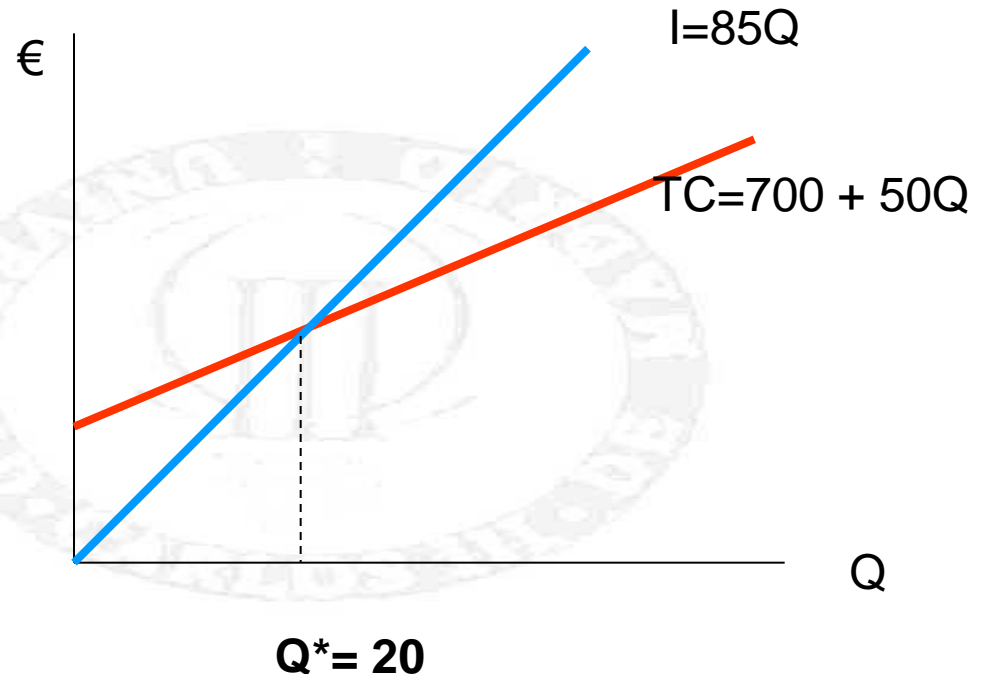**Losses**

FC

Q*

Q

m = Gross margin

SALES: 60 u

- P = 85mu/u

Expenses

- Depreciation = 400 mu
- Advertising = 300 mu
- Fabric = 12mu/u
- Thread = 1umu/u
- Buttons = 5 mu/u
- Labour = 32mu/u

SOLUTION
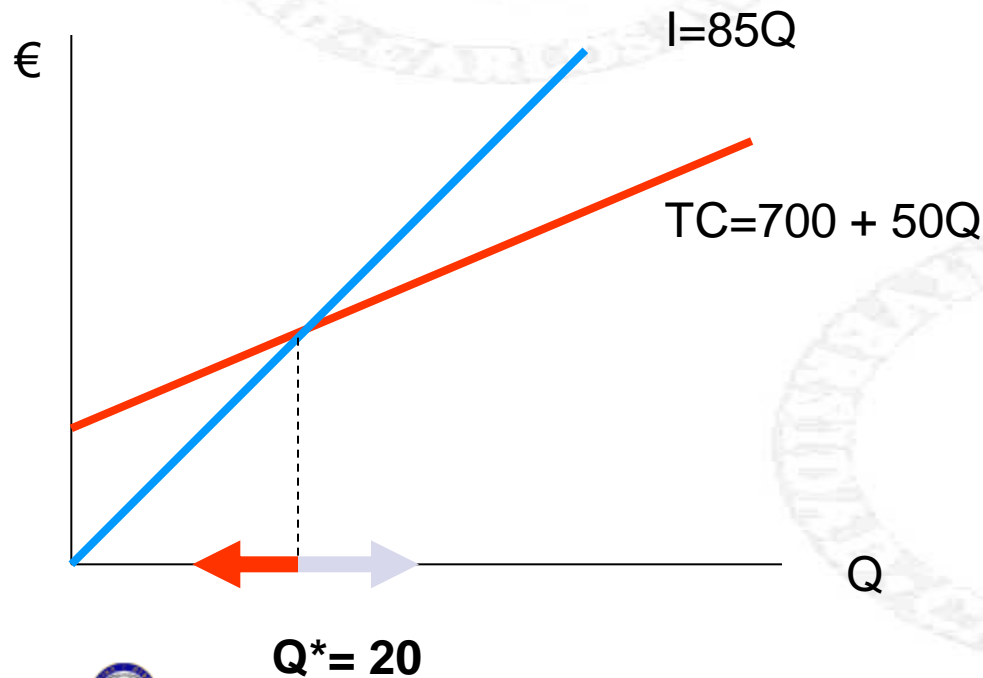
- **FC= 700**
- **VCu (cv) = 50 mU/u**
- **Q*=Qo= 20uf**

€

I=85Q

TC=700 + 50Q

Q

Q*= 20

a) If Q = 22 ---- Profit?

b) If Q = 18 ---- Profit?

2nd way:

Profit = (Q – Q*)*m

€

I=85Q

TC=700 + 50Q

Solution
a)2*35=+70 profits
b)(-2)*35= -70 losses

Q

Q*= 20

Represents the strength of the business.

It enables a business to know that what is the exact amount it has gained or lost over or below BEP
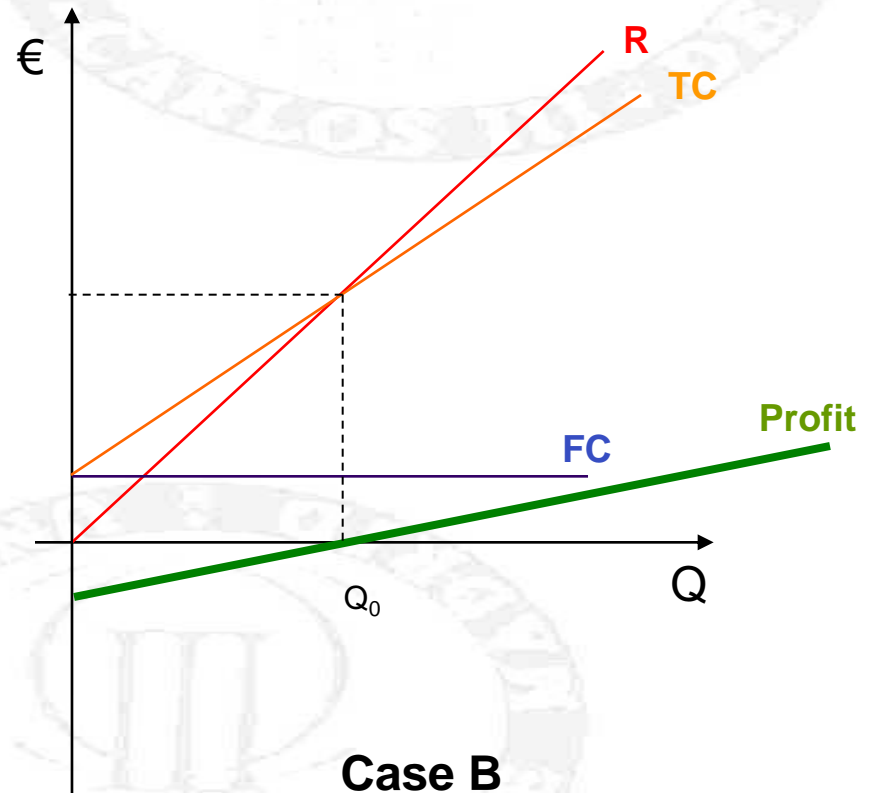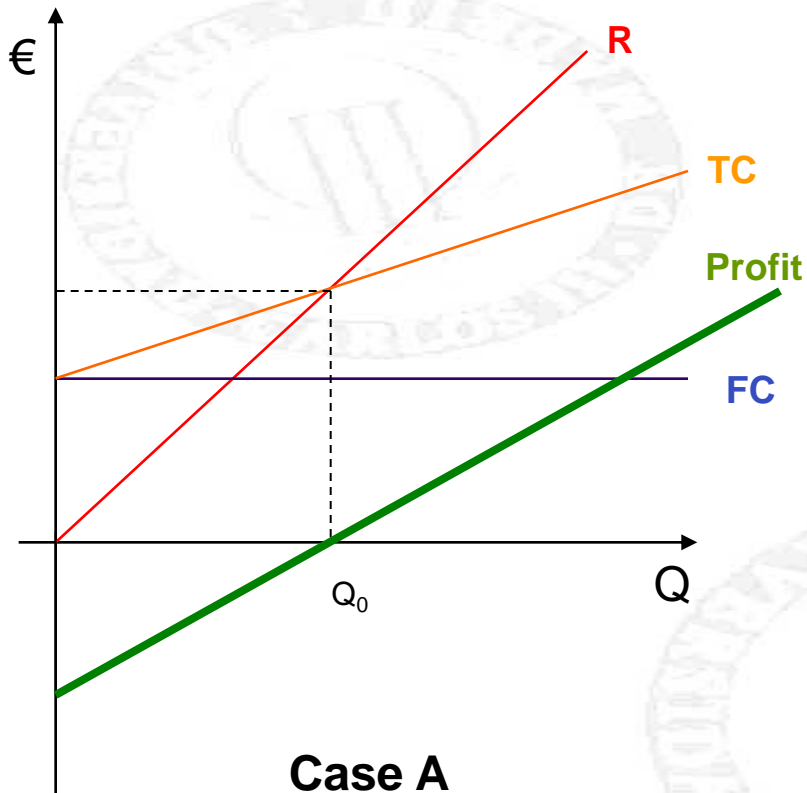
in u: MS = (Q-Q*)
in mu: MS = (Q –Q*)*m
in %: MS = (Q-Q*) /Q*

EXAMPLE:

if Q = 30 ⟶ (MS= 10 u; 350 mu: 50%)

Case A

Case B

it measures how a change in sales translates into a change in operating income (profit or loss).

$$OL = \dfrac{\dfrac{\Delta Profit}{Profit}}{\dfrac{\Delta Q}{Q}}$$

$$OP = \dfrac{Q^*m}{Q^*m - FC}$$

INTERPRETATION

OL = 3 . An increase on sales of 1% makes the profits to increase by a 3%. An increase on sales in a10% generates a decrease on profits by a 30%
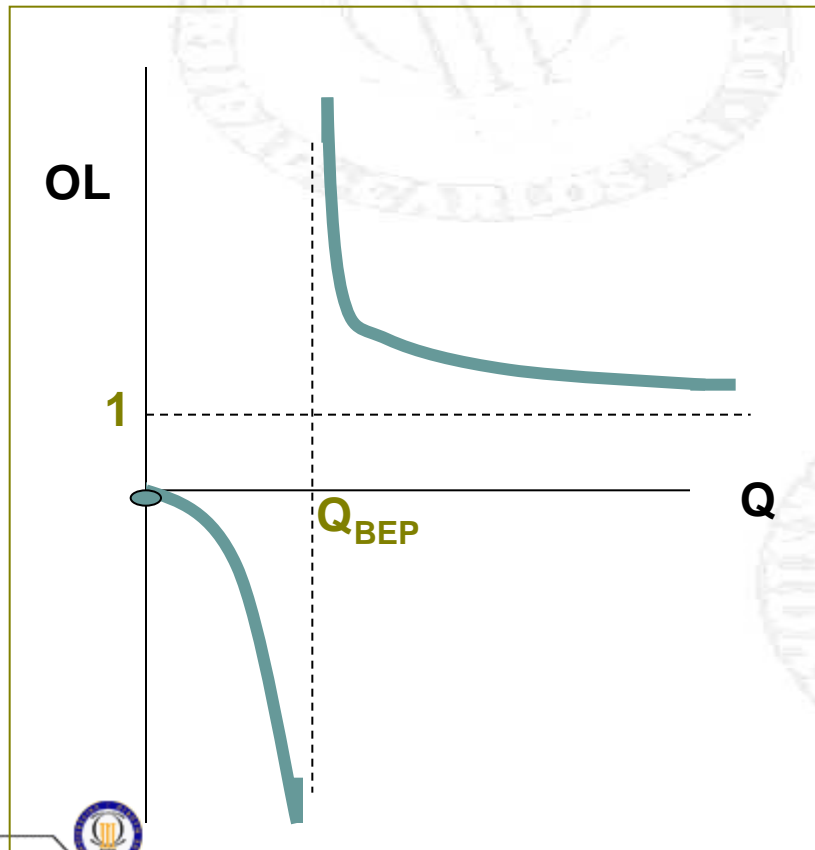
- It captures the income sensitivity, change in operating income for a given change in sales (revenue)

- Index of ECONOMIC RISK (operating risk)

- To compare business in the same sector

- *Ceteris paribus*, higher CF, higher OL

$$OL = \frac{Q*m}{Q*m - FC}$$

Profits

- If $Q > Q^*$: OL>1
  - More than proportional

Losses

- If $Q < Q^*$: OL<=0
  - Amplifier effect or more than proportional:
    - OL<-1
  - Less than proportional effect:
    - -1<OL<0

How to compute the Operating leverage

Operating Leverage Calculation:

$$OL = \frac{\dfrac{\Delta Profit}{Profit}}{\dfrac{\Delta Q}{Q}}$$

Considering that: $\quad Profit = P*Q - (VC*Q + FC) = Q*(P-VC) - FC$

Where: $\quad \Delta Profit = \Delta Q*(P-VC)$

Substituting:

$$OL = \frac{\dfrac{\Delta Q*(P-VC)}{Q*(P-VC)-FC}}{\dfrac{\Delta Q}{Q}} = \frac{Q*(P-VC)}{Q*(P-VC)-FC} = \frac{Q*m}{Q*m-FC} = \frac{Q*m}{Profit}$$

Negative OL example

Sales, TR (Total Revenue) = P*Q	Degree of Operating Leverage, DOL
$500,000	-0.25
1,000,000	-0.67
1,500,000	-1.50
2,000,000	-4.00
2,500,000 (Breakeven sales level)	(Undefined)
3,000,000	+6.00
3,500,000	+3.50
4,000,000	+2.67
4,500,000	+2.25
5,000,000	+2.00
5,500,000	+1.83
6,000,000	+1.71
	DOL indicates the percentage *reduction* in operating *losses* that occurs at the result of a 1 percent increase in output. For example, the DOL of -1.50 at a sales level of $1,500,000 indicates that, from a base sales level of $1,500,000, the firm's operating losses are *reduced* by 1.5 percent for each 1 percent *increase* in output.