

ECONOMICS AND MANAGEMENT OF TECHNOLOGY

PROF. TIZIANA D'ALFONSO



SAPIENZA
UNIVERSITÀ DI ROMA

ECONOMICS AND MANAGEMENT OF TECHNOLOGY
MASTER DEGREE IN MECHANICAL ENGINEERING AND CHEMICAL ENGINEERING

Basic information



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On the teacher

- **Teacher:** Prof. Tiziana D'Alfonso
- **Website:** [Click here](#)
- **Contacts:**
tiziana.dalfonso@uniroma1.it
Via Ariosto 25, Roma
Office A120
- **Office hours:** Monday, 3pm-5pm (see *AVVISI* for possible changes). On zoom. Please send an email to fix your own office hour



Schedules

- **ZOOM Link:**

<https://uniroma1.zoom.us/j/84790545272?pwd=ZHBSVDZMR0xQaTRsOGRKWZxdzVBdz09>

- Monday 12am-2pm
- Tuesday 2pm-5pm
- Thursday 11am-2pm
- Lessons will start normally **after 15 minutes**
- Festivities
 - 1/04/2021, 5/04/2021, 6/04/2021: due to **Easter**
 - and any other date (**eventually**) indicated on the website and by the teacher

| | 11 am-12am | 12am-1 pm | 1pm-2pm | 2-3pm | 3-4pm | 4-5pm |
|-----------------|------------|-----------|---------|-------|-------|-------|
| MONDAY | | | | | | |
| TUESDAY | | | | | | |
| THURSDAY | | | | | | |



Who are we in the class?

- **Master students**
- **Mechanical Engineering**
 - **6 cfu (attend 60 hours)**
 - **9 cfu (attend 90 hours)**
- **Chemical Engineering**
 - **9 cfu (attend 90 hours)**



Class organization

| Part I | Part II | Part III |
|---|--|---|
| MICROECONOMICS | ACCOUNTING | MICROECONOMICS |
| <ul style="list-style-type: none"> • Introduction to microeconomics • Production and cost theory • Perfectly competitive markets | <ul style="list-style-type: none"> • Accounting methods • Investment decisions | <ul style="list-style-type: none"> • Advancements <ul style="list-style-type: none"> ○ Monopoly ○ Price discrimination ○ Innovation |

6 CFU (60 hours)

For 6 cfu students

6 CFU (60 hours)

3 CFU (30 hours)

For 9 cfu students

Exam simulation

Exam simulation



Contents



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Program

Part I: Introduction to microeconomics, Production and cost theory, Perfectly competitive markets

Textbook: Microeconomics | 4th Edition, Ronald R Braeutigam, David Besanko

1. Prerequisites: Analyzing Economic Problems; Demand and Supply Analysis

- Chapter 1
- Chapter 2 (only sections 2.1, 2.2 and 2.3)

2. Technology

Technological sets and production function. Total, average and marginal productivity. Isoquants and marginal rate of technical substitution. Elasticity of substitution and types of technology. Long run vs short run. Returns to scale and returns to varying proportions. Elasticity of scale. Technological Progress. High tech labour vs low tech labour.

- Chapter 6, including Appendix



Program

3. Costs

The cost function and isocosts. Conditional input demands. Price and output elasticity of input demands. Expansion path. Short run vs long run cost functions. Total costs. Variable, fixed and quasi-fixed costs. Sunk costs. Average and marginal costs. Economies of scale and the minimum efficient scale. Economies of scope and learning curves

- Chapter 7, including pag 283-284 of the Appendix
- Chapter 8 (excluding section 8.4 at pag 315,316 and 317), including Appendix

4. Competitive markets

Economic profits and opportunity costs. Profit maximization in the long run. Duality of production, cost and profit functions. Short run profit maximization. Profit maximization and return to scales. Supply curves and producer's surplus. Short run vs long run supply curves.

Market demand. Individual supply and market supply. Perfect competition. Short run and long run market equilibrium. Meaning of 0-profits. Pareto efficiency

- Chapter 9, including Appendix
- Suggested reading: Chapter 10



Program

Part II: Accounting methods and investment decisions - Accounting methods

Material provided by the teacher

1. Financial statements

The Balance Sheet and Account Categories: Assets, Liabilities, Owners 'Equity. The Income Statement: Revenues, Cost of Sales, Gross Margin, Expenses, Net Income. Relation between Balance Sheet and Income Statement. The Statement of Cash Flows. Misconceptions about Depreciation. Sources and Uses of Cash. Working capital flows. Analysis of the Cash Flow Statement.



Program

Part II: Accounting methods and investment decisions - Investment decisions

Textbook: Brealey, R. A., Myers, S. C., Allen, F., Principles of corporate finance (12th Edition). Mc Graw Hill.

1. Value

Future Values and Present Values. Net Present Value. Risk and Present Value. Present Values and Rates of Return. Calculating Present Values When There Are Multiple Cash Flows. The Opportunity Cost of Capital. Perpetuities and Annuities. Continuous Compounding. Real and Nominal Rates of Interest. Calculating the Present Value of an Investment.

- Chapter 2

2. Investment Decisions

Net Present Value and Other Investment Criteria. Discounted Payback. Internal Rate of Return. Pitfalls of IRR. Making Investment Decisions with the Net Present Value. Relevance of Cash Flow. Estimation of Cash Flows on an Incremental Basis. Treating of Inflation. Investment Timing. Equivalent Annual Cash Flows and Inflation. Equivalent Annual Cash Flow and Technological Change

- Chapter 5
- Chapter 6



Program

Part III: Advancements

Textbook: Microeconomics | 4th Edition, Ronald R Braeutigam, David Besanko

5. Monopoly

Demand elasticity. Elasticity and revenues. The monopolist maximization problem. Inefficiency of monopoly and deadweight loss. Causes of monopoly. Subadditivity of costs and economies of scale. Natural monopoly. Price discrimination (first degree, second degree, third degree).

- Chapter 11 (excluding section 11.7)
- Chapter 12 (excluding sections 12.5 and 12.6)

6. Innovation

Product innovation vs process innovation. Drastic innovation. Willingness to pay for innovation. Innovation and market structure.

- Material provided by the teacher



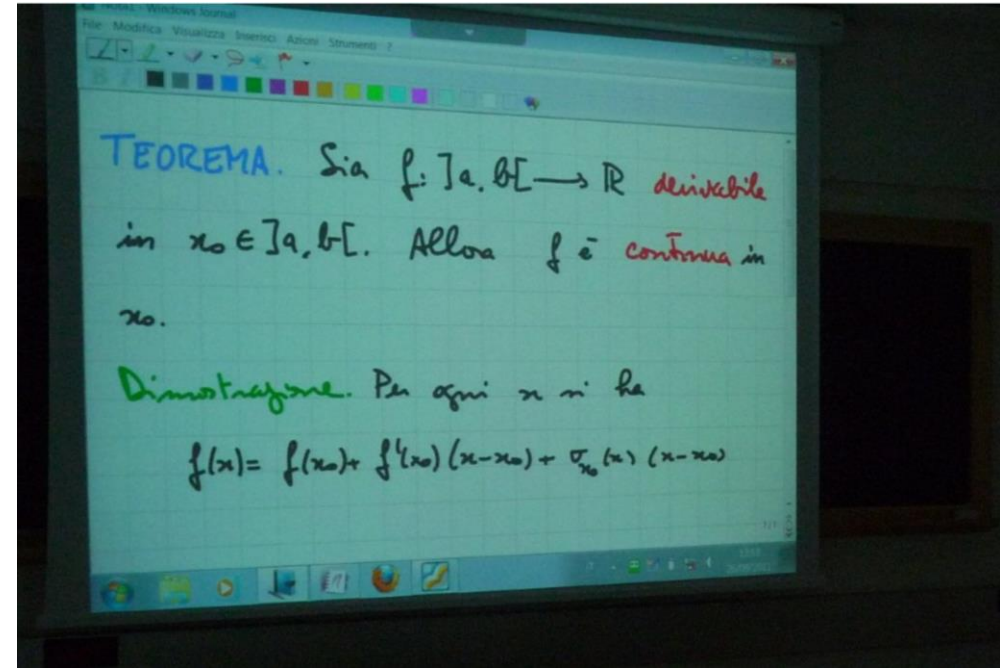
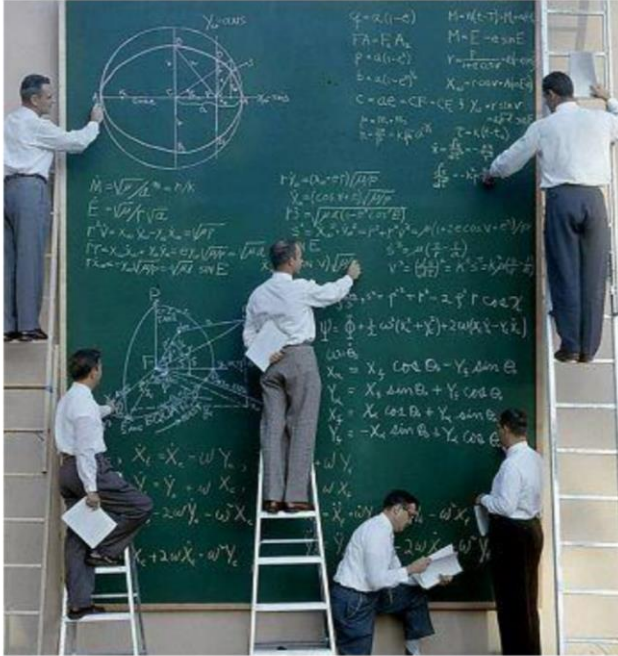
Teaching method



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Blackboard



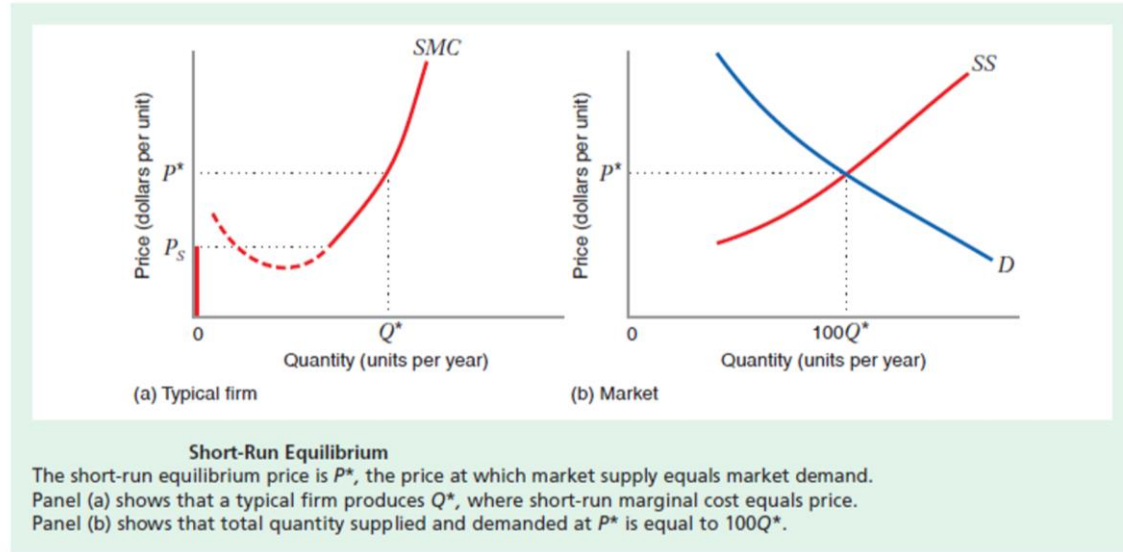
Technological progress...



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Use of some slides



Mainly to fix ideas with some graphs
based on your textbook



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Exercises

Economics of Technology and Management

Master Degree in Mechanical Engineering – Sapienza University of Rome

Settore scientifico-disciplinare: ING-IND/35 Ingegneria Economico-Gestionale

Teacher: Tiziana D'Alfonso

Day: 04/03/2019

Problem 1

Consider the production function COBB DOUGLAS, $Q = AL^aK^b$, $A > 0, a > 0, b > 0$. What is the elasticity of substitution between capital and labour?

Consider the production function (CES production function) whose equation is given by the formula, where $\beta > 0, \rho > 0, \rho < 1$:

$$Q = (\rho L^\beta + (1 - \rho)K^\beta)^{1/\beta}$$

- (a) What is the elasticity of substitution between capital and labour?
- (b) Is it a constant number or not?
- (c) What if $\beta \rightarrow 0$? Indicate which production function describes the CES in this situation

Problem 2

Determine returns to scale in the following production functions:

- (a) $Q = 2\sqrt{K^2 + L^2}$
- (b) $Q = K^{1/4}L^{3/4}$
- (c) $Q = \frac{4}{5}(K + L)$

Problem 3

Suppose that the production function for microchips is given by $Q = KL^2 - L^3$, where Q is the number of microchips produced per year, K is machine-hours of capital, and L is man-hours of labor.

- Problem set on each argument
- Solutions will be provided for each set after 2-3 weeks
- At the end of each argument students will practice in class



Exam and evaluation



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Evaluation

- **Written test**

- Minimum grade: 18/30; Maximum grade: 30 cum lauda
- **Lauda is attributed to grade 32 and 33**
- **Registration on *INFOSTUD* is mandatory.**
- The use of any material is forbidden (hardcopy or softcopy). Students may make use of calculators (not programmable).
- Exhibition of a valid ID is mandatory;

- **There is no oral test**

- It is not possible to reach sufficiency by means of oral test
- It is not possible to increase the mark of the written test by means of the oral test
- **DON'T ASK FOR THE ORAL TEST!!**



Registration of marks

- During written test you can leave the room. In this case, “**Rinuncia**” will be registered on INFOSTUD
- If your written test is not sufficient, “**Bocciato**” (Rejected) will be registered on INFOSTUD
- If your written test is sufficient but you do not want to accept the mark, “**Rinuncia**” will be registered on INFOSTUD **together with the mark**
- Generally, marks can be registered up to 1 month (the deadline will be indicated by the teacher). After that date, **if no communication has arrived from the student:**
 - marks greater than 18 will be registered on INFOSTUD and it will not be possible anymore to take the exam



Written Tests - Dates

- The following dates are accessible to any student
 - 4 June 2021
 - 1 July 2021
 - 15 September 2021
 - January 2022 (To be defined)
 - February 2022 (To be defined)

- The following dates are accessible to part time students, out-of-course students, repeating students, students who have accrued 30 cfu (maximum), students who have completed attendace (in order to see your rights [Click here](#))
 - March or April 2021 (To be defined)
 - October or November 2021 (To be defined)



What about the written test

6 CFU

- **4 applied exercises**
 - Production and cost theory
 - Perfectly competitive markets
 - Accounting
 - Investment decisions
- **1 open question on theory (6 CFU program)**
- **1 hour 50 minutes**

9 CFU

- **6 CFU exam**
- **+**
- **1 applied exercises**
 - Monopoly/price discrimination/innovation
- **1 open question on theory (additional 3 CFU program)**
- **2 hours and 20 minutes**



What happened last year

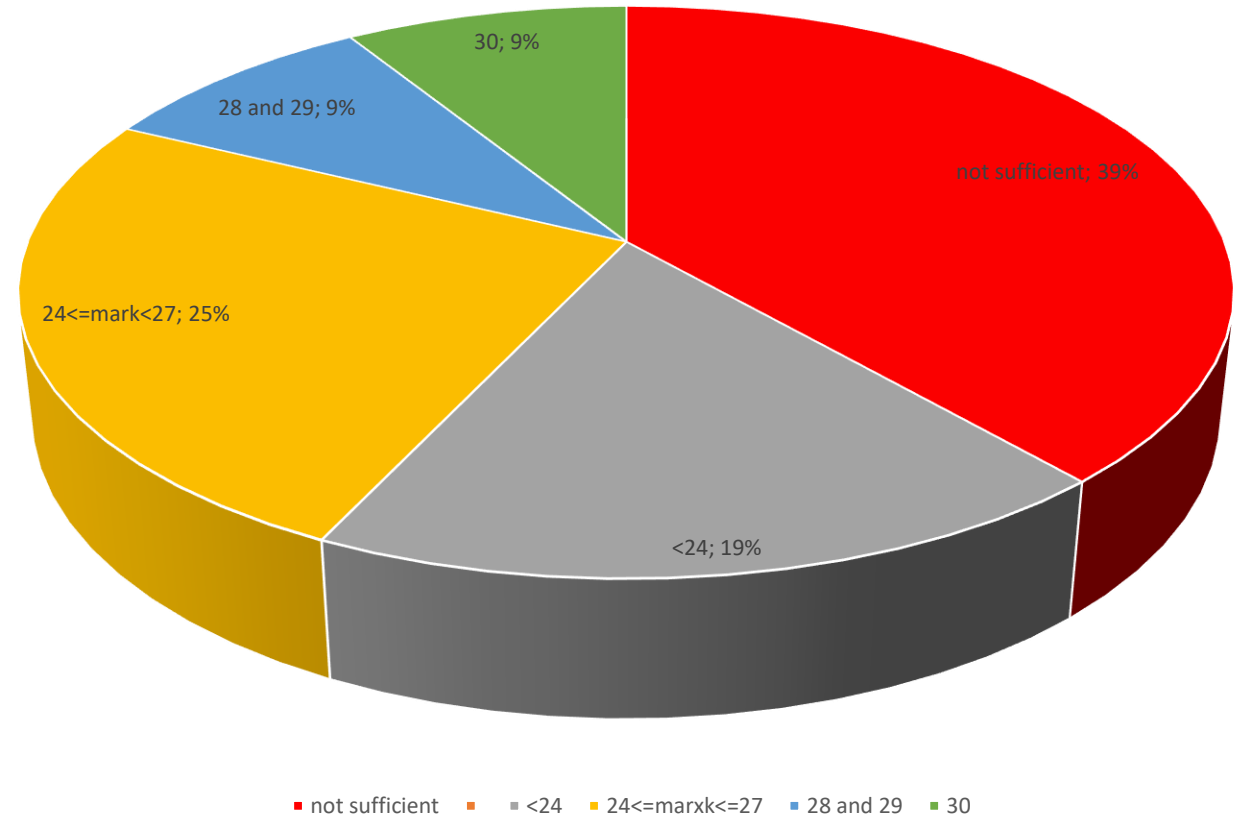
The following data refer to

- Mechanical Engineering students
- 9 cfu program
- Same arguments as in this year



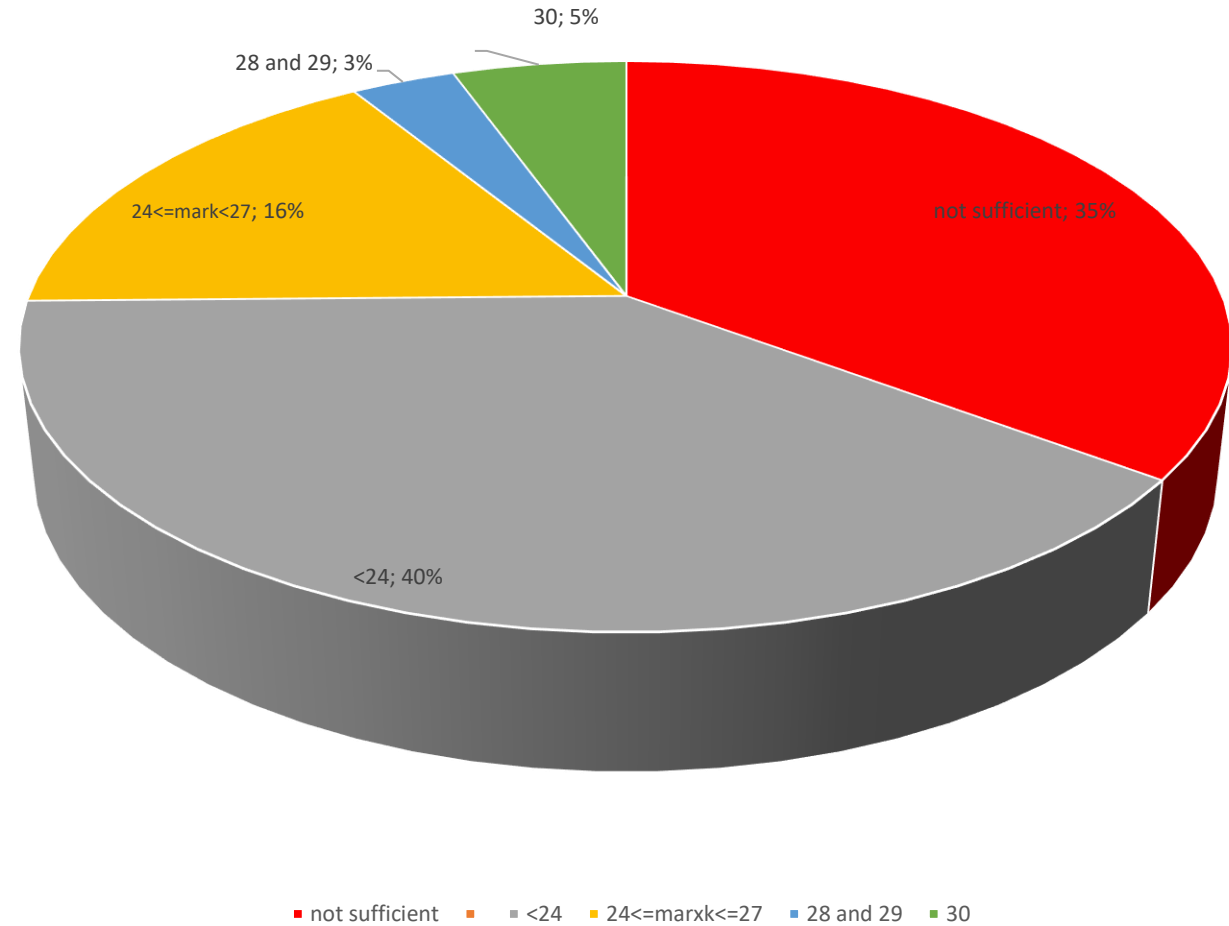
June 2019

- 198 students booked the exam
- 135 students submitted their papers for correction
- 63 students did not show or did not submit their paper
- Average mark: **24,84**



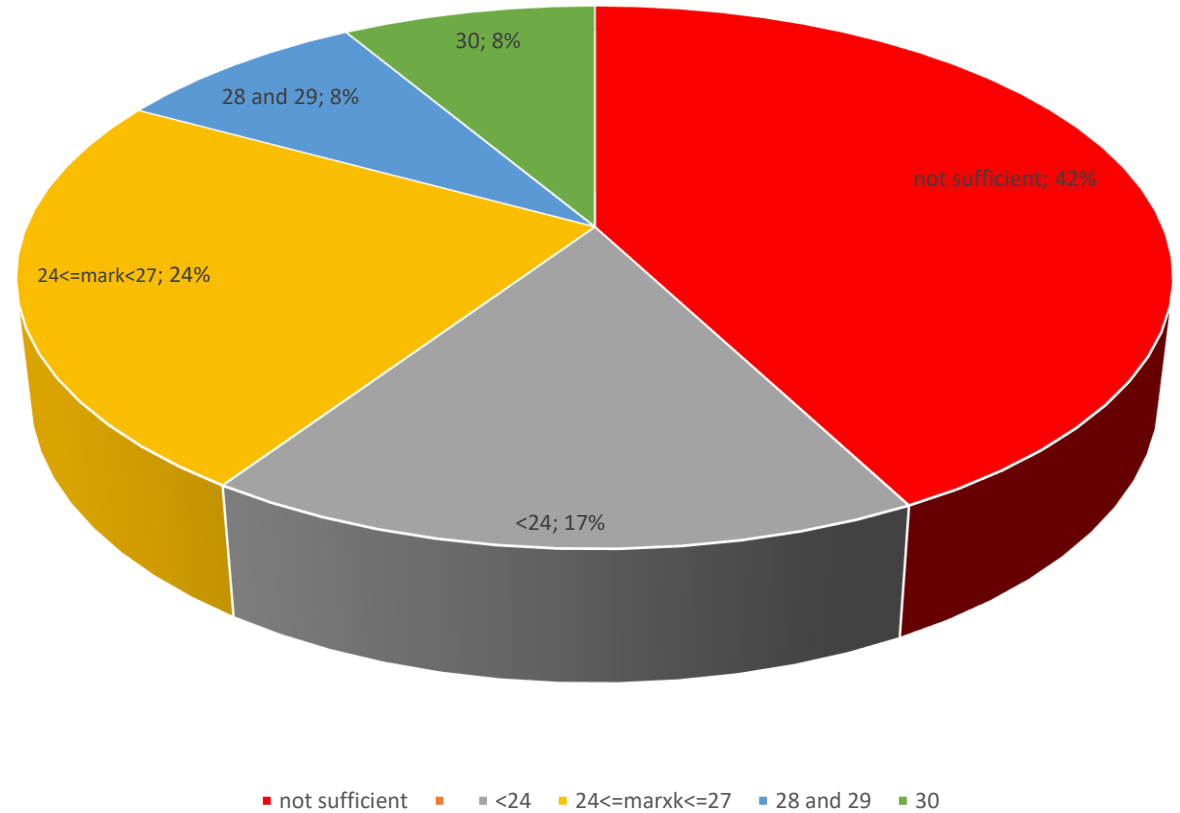
July 2019

- 149 students booked the exam
- 91 students submitted their papers for correction
- 58 students did not show or did not submit their paper
- Average mark: **22,44**



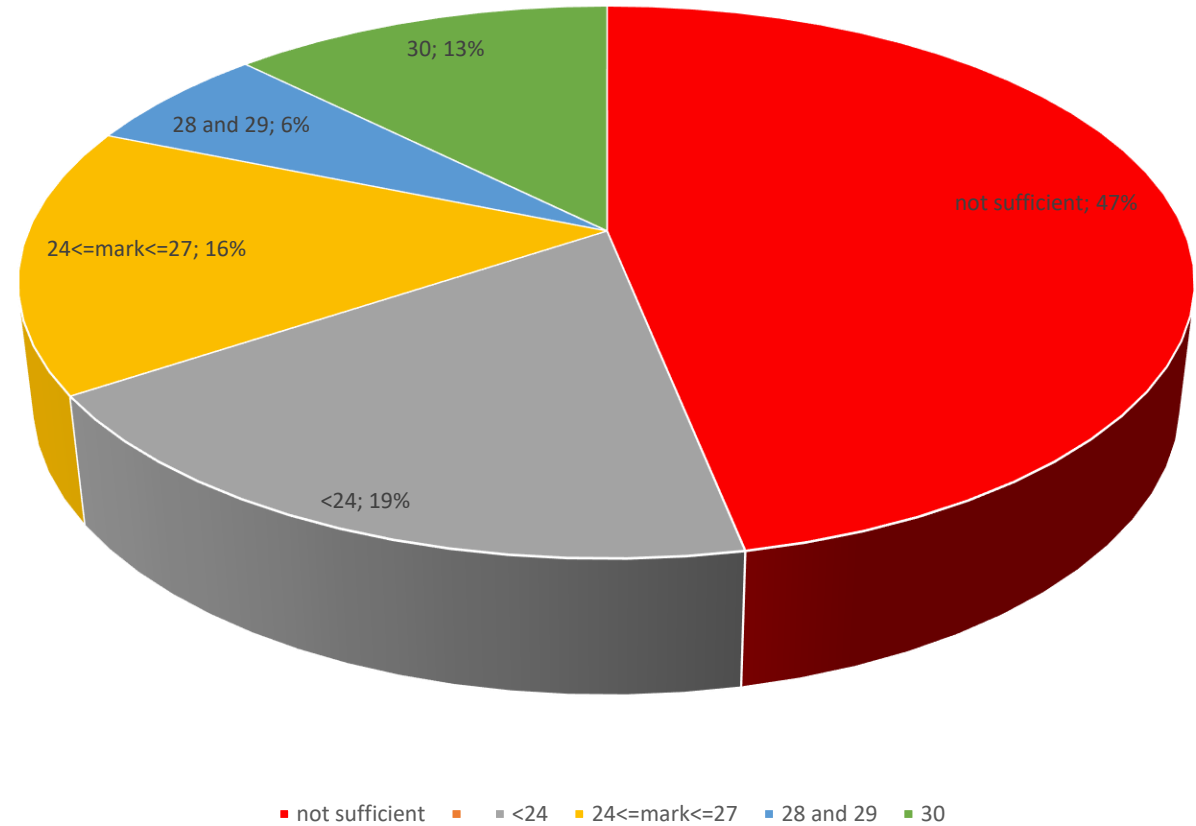
September 2019

- 105 students booked the exam
- 59 students submitted their papers for correction
- 46 students did not show or did not submit their paper
- Average mark: **24,73**



January 2020

- 65 students booked the exam
- 32 students submitted their papers for correction
- 33 students did not show or did not submit their paper
- Average mark: **25,05**



Introduction to the course contents

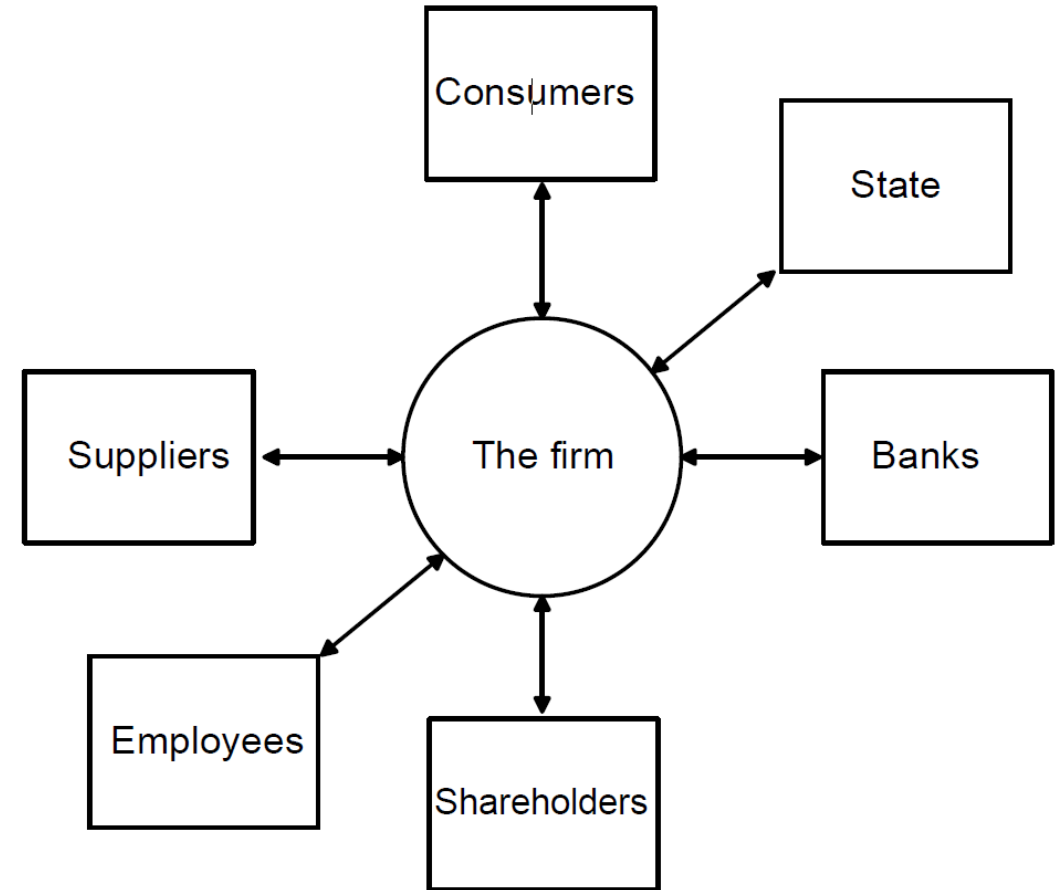


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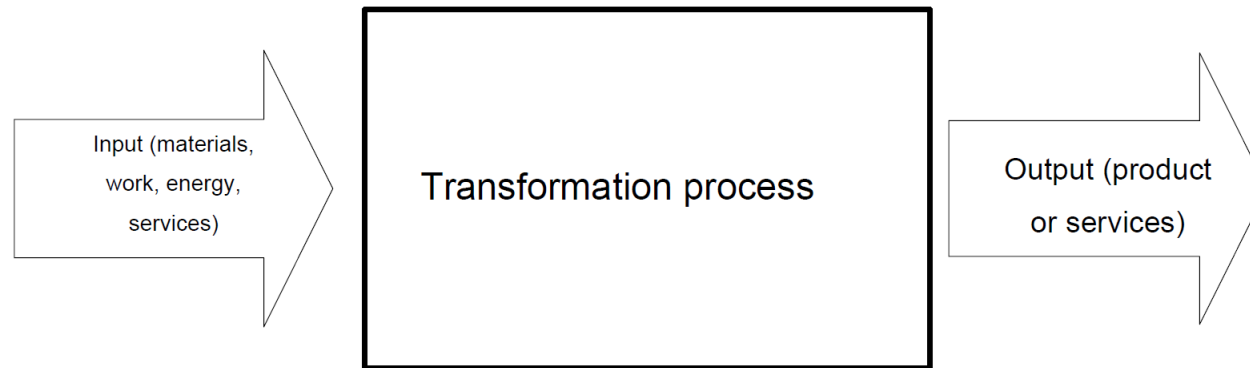
The firm

- The firm can be seen as a **system that exchanges resources with a multiplicity of subjects**
- There are at least **6 categories of subjects** that exchange flows of resources with the firm



The firm

- The firm can be modeled as an **Input / output system**
- Dynamic
- That transforms a multiplicity of **productive factors (input flow)**
 - Materials, Work, Energy, Services, ...
- In a multiplicity of **products / services (output flow)**



Our goals

- Analyze the **decision-making processes of firms**
 - *Typical question:* What is the optimal level of **output** that maximizes firm **profit**?
 - *Typical question:* Which **price structure** maximizes firm profit?
 - *Typical question:* Should the firm pursue such **investment**?
- Analyze the **functioning of the markets** on which firms exchange goods and services
- Analyze the role of the **State** in ensuring that the **markets give results efficient and fair in the distribution of resources**



The decision process

- **Economics is the study of how societies use scarce resources to produce valuable commodities and distribute them among different people** (*Samuelson, P.A., 1948. Economics*)
- Behind this definition are two key ideas **in economics**: that **goods** are **scarce** and that society must use its resources **efficiently**.



The decision process

- The firm evaluates decisions based on the **measurement and comparison of all costs and benefits directly and indirectly attributable to these costs.**

Benefits > Costs



Cost concepts for decision making

- **Managers** are most experienced with cost presented as **monetary expenses** in an profit-loss statement.
- **Politicians and policy analysts** are more familiar with costs as an expense item in a budget statement.
- **Consumers** think of costs as their monthly bills and other expenses.



Cost concepts for decision making

Suppose that you own and manage your own construction business and that you are contemplating whether you should continue to operate over the next year or go out of business.

- If you remain in business, you will need to spend \$100,000 to hire the services of workers and \$80,000 to purchase supplies; if you go out of business, you will not need to incur these expenses.
- In addition, the business will require 80 hours of your time every week. Your best alternative to managing your own business is to work the same number of hours in a corporation for an income of \$75,000 per year.
- In this example, the opportunity cost of continuing in business over the next year is \$255,000.
 - This amount includes an **explicit cost** of \$180,000—the required cash outlays for labor and materials; it also includes an **implicit cost** of \$75,000—the income that you forgo by continuing to manage your own firm as opposed to choosing your best available alternative.



Cost concepts for decision making

The **opportunity cost** of an alternative includes all of the explicit and implicit costs associated with that alternative

- **explicit costs** Costs that involve a direct monetary outlay.
- **implicit costs** Costs that do not involve outlays of cash.

From the firm's perspective, the **opportunity cost of using the productive services of an input is the current market price of the input. Such cost is what the firm's owners would save or gain by not using those services.**



Cost concepts for decision making

Economic costs are synonymous with **opportunity costs** and, as such, are the **sum of all decision-relevant explicit and implicit costs**.

Accounting costs—the costs that would appear on **accounting statements**—are **explicit costs that have been incurred in the past**.

Accounting statements are designed to serve an audience outside the firm, such as lenders and equity investors, so accounting costs must be objectively verifiable. That's why accounting statements typically include historical expenses only—that is, explicit cash outlays already made (e.g., the amounts the firm actually spent on labor and materials in the past year). An accounting statement would *not* include implicit costs such as the opportunity costs associated with the use of the firm's factories because such costs are often hard to measure in an objectively verifiable way.



Back to class organization

| Part I | Part II | Part III |
|---|--|--|
| MICROECONOMICS | ACCOUNTING | MICROECONOMICS |
| <ul style="list-style-type: none"> • Introduction to microeconomics • Production and cost theory • Perfectly competitive markets | <ul style="list-style-type: none"> • Accounting methods • Investment decisions | <ul style="list-style-type: none"> • Advancements <ul style="list-style-type: none"> ○ Monopoly ○ Price discrimination ○ Innovation |

Point of view of the economist

Economic costs

Point of view of the accountant

Accounting costs

Point of view of the economist

Economic costs




What you will learn

Source:

Radio Canada International



 Radio Canada International



Disappearing cashiers: self check-out replacing people



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What you will learn

The average weekly salary for a...



Source:

Global Sports Salaries Survey



What you will learn



Source:

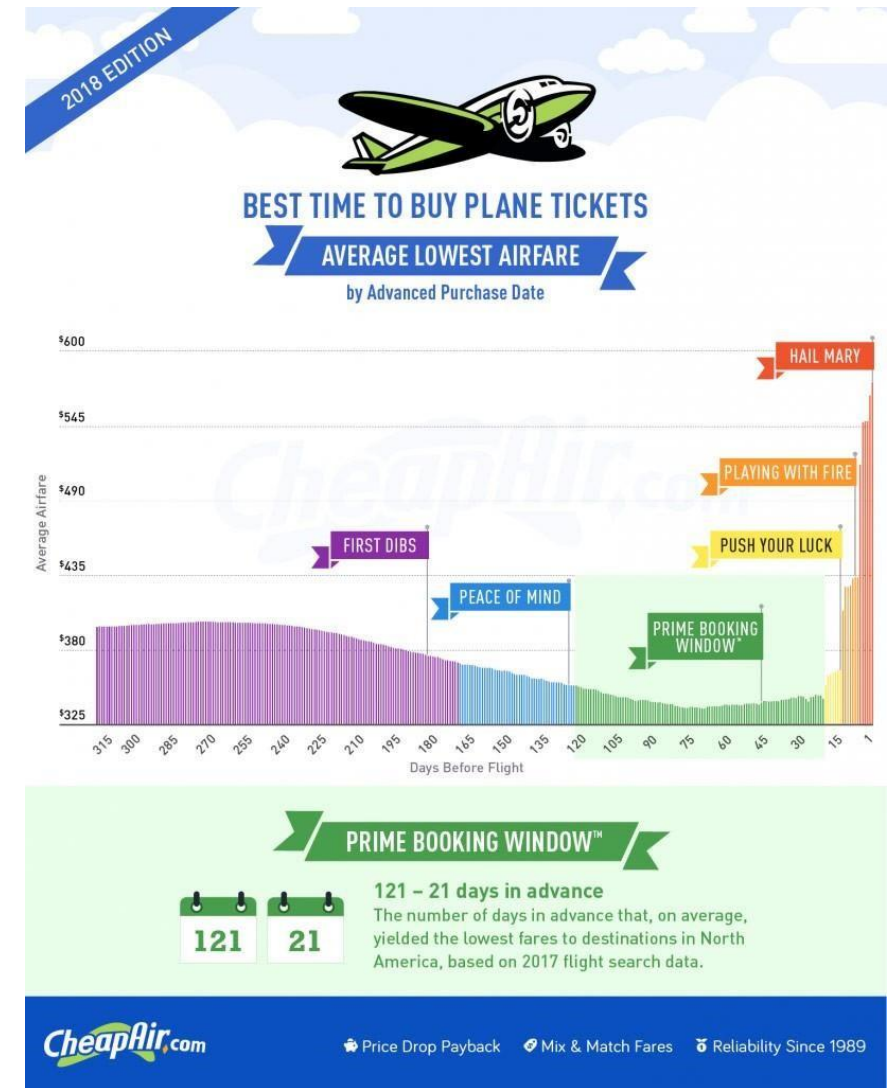
New York City
Department of Consumer
Affairs



What you will learn

Source:

Volo-in-ritardo.it



What you will learn



CF CALCIO FINANZA **WALTER SABATINI RE DI PLUSVALENZA** PREMIUM SPORT L'ESPRESSO DIRETTA

| BILANCIO | CALCIATORE | CEDUTO A | CESSIONE A | PLUSVALENZA |
|----------|------------|---------------|------------|-------------|
| 2015/16 | PJANIC | Juventus | 32000 | 28272 |
| 2013/14 | MARQUINHOS | PSG | 31451 | 27470 |
| 2015/16 | ROMAGNOLI | Milan | 25000 | 23864 |
| 2013/14 | LAMELA | Tottenham | 27175 | 15284 |
| 2014/15 | BENATIA | Bayern Monaco | 24700 | 14261 |
| 2015/16 | GERVINHO | HB CFFC | 17550 | 12506 |
| 2011/12 | VUCINIC | Juventus | 15000 | 10076 |
| 2012/13 | BORINI | Liverpool | 13265 | 9117 |
| 2014/15 | DODÒ | Inter | 8849 | 7995 |
| 2012/13 | KRKIC | Barcellona | 13000 | 6621 |

Source:

90Min

