PRINCIPLES OF ECONOMICS
for non-economists

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and Decisions in Economics

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PRINCIPLES OF ECONOMICS

1. **Economics. What is this?**
2. **The agents of the economy**
   2.1 Demand: consumers, patients, elasticity
   2.2 Supply: firms, hospitals physicians;
   Efficiency, Efficacy, Effectiveness, Equity,
   Opportunity cost
3. **The market**
   3.1 Definition
   3.2 Market structures
   3.3 Perfectly competitive markets
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6. **Externalities**
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8. **Uncertainty, risk and insurance**
   8.1 Attitudes towards risk
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PRINCIPLES OF ECONOMICS

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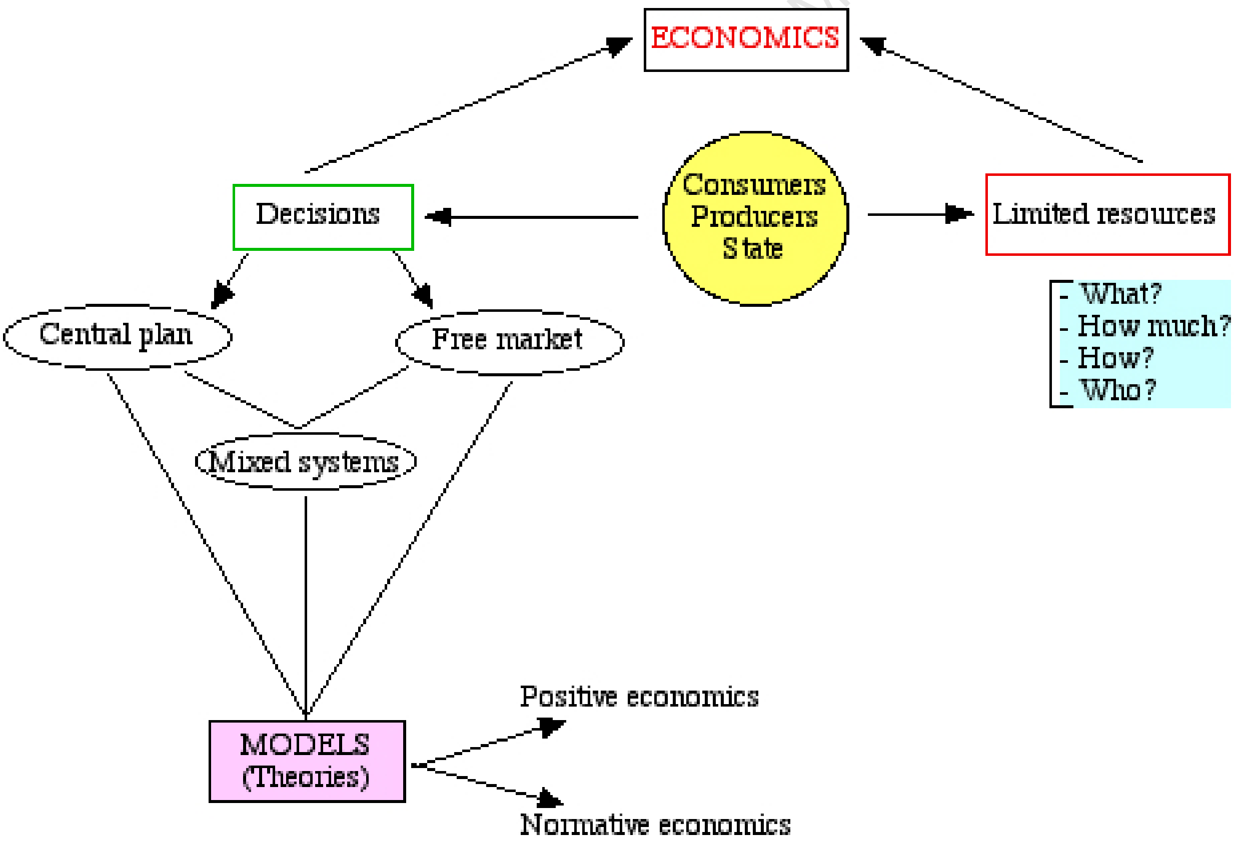


Economics: Study of the way in which economic agents take their decisions regarding the use (allocation) of *scarce* resources.

Economic agents: Decision makers in the economy. Individuals, households, enterprises (for profit, non-profit; production, distribution), State.

Decisions:

- what to produce/consume?

- how much to produce/consume?

- How to produce/consume?

- Who produces/consumes?

Answers to these questions depend on the organization of the economy: central plan, free market, mixed systems.

Reality too complex. Study of an economy by means of models (theories): set of assumptions providing a simplified representation of reality capturing the fundamental relationships among economic agents [$\rightarrow$ road map vs. road network].

Two (complementary) uses of models:

- description of decision making process $\rightarrow$ positive economics

- policy design (control and improvement of decision making) $\rightarrow$ normative economics

★ Resources: inputs, factors of production.
- land (physical resources of the planet)
- labor (human resources)
- capital (resources created by human to aid in production: tools, machinery, factories, ...)

enterprise: organization of resources to produce goods and services.

★ Main concepts related with scarcity:

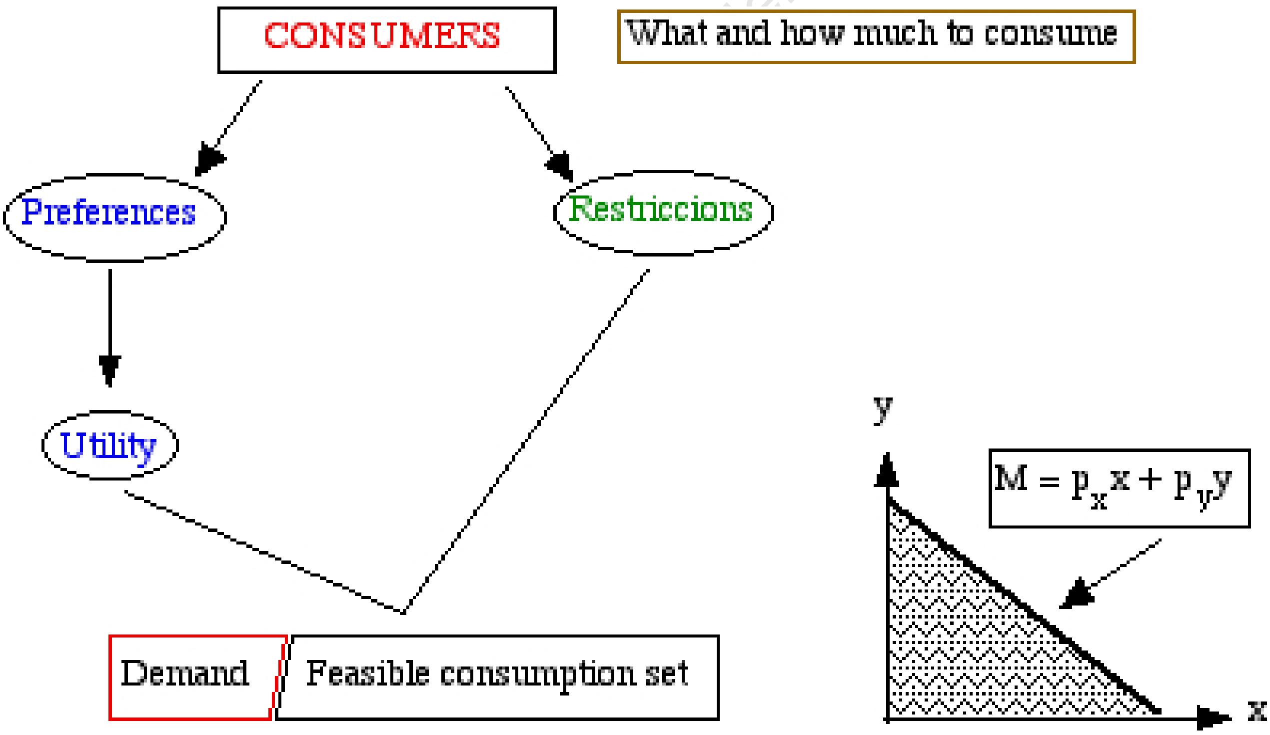
Efficiency

Opportunity cost

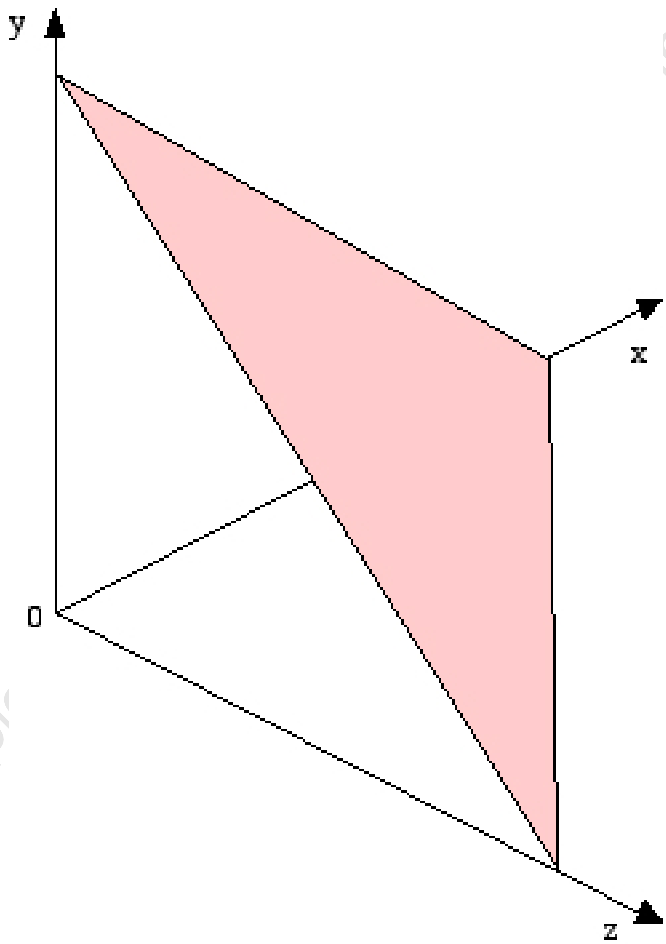
Production Possibility Frontier

2. The agents of the economy

Population (Demand)



3D consumption set

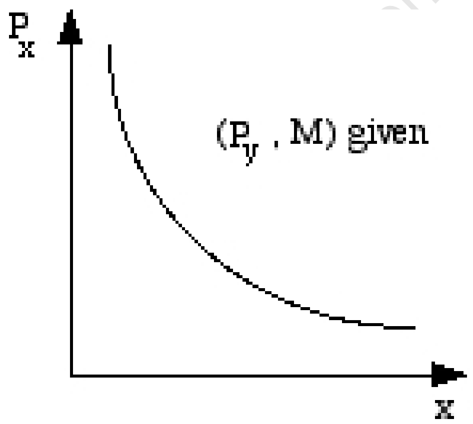


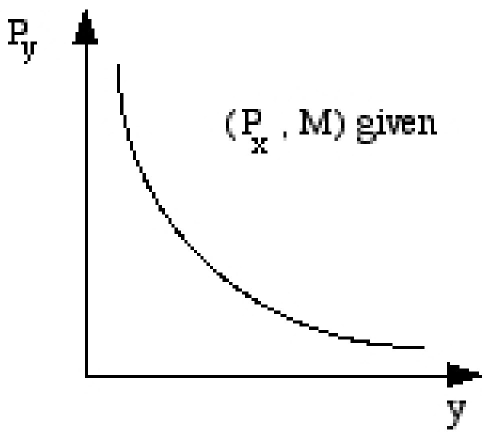
Individual vs. aggregate demand

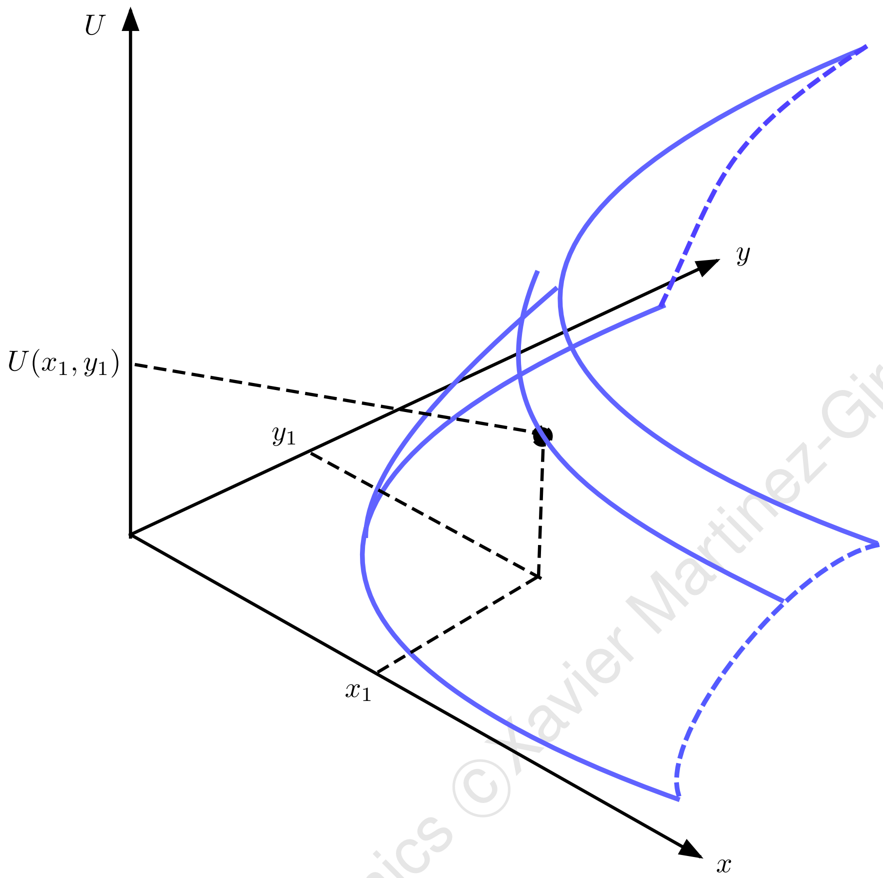
Individual demand $\rightarrow$ solution of

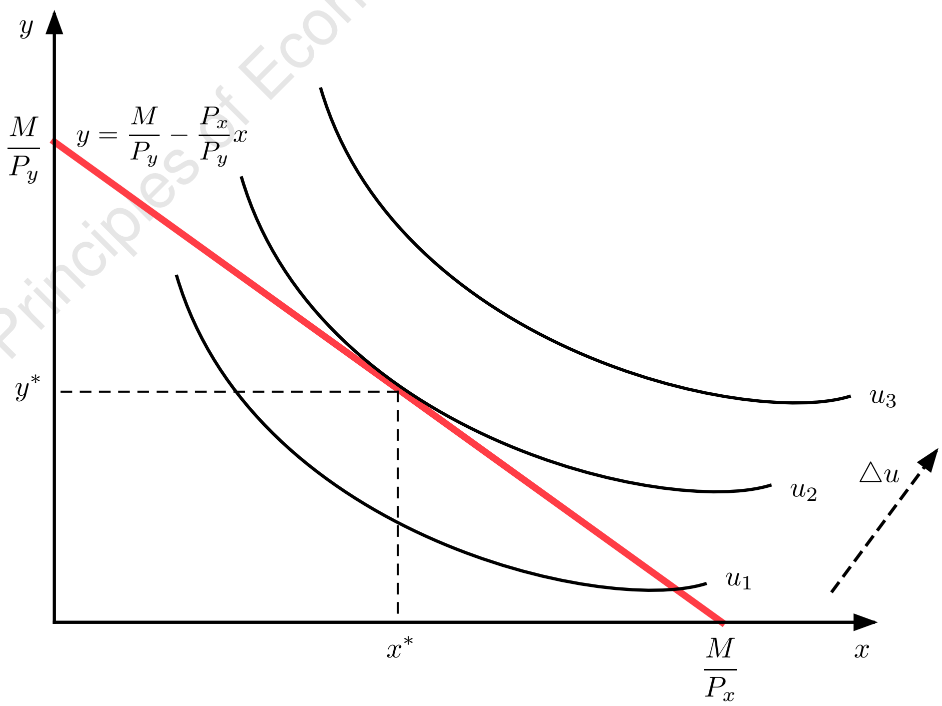
$$\max_{x,y} U(x,y) \text{ s.t. } M = P_x x + P_y y$$

$$x^*(P_x, P_y, M)$$
$$y^*(P_x, P_y, M)$$



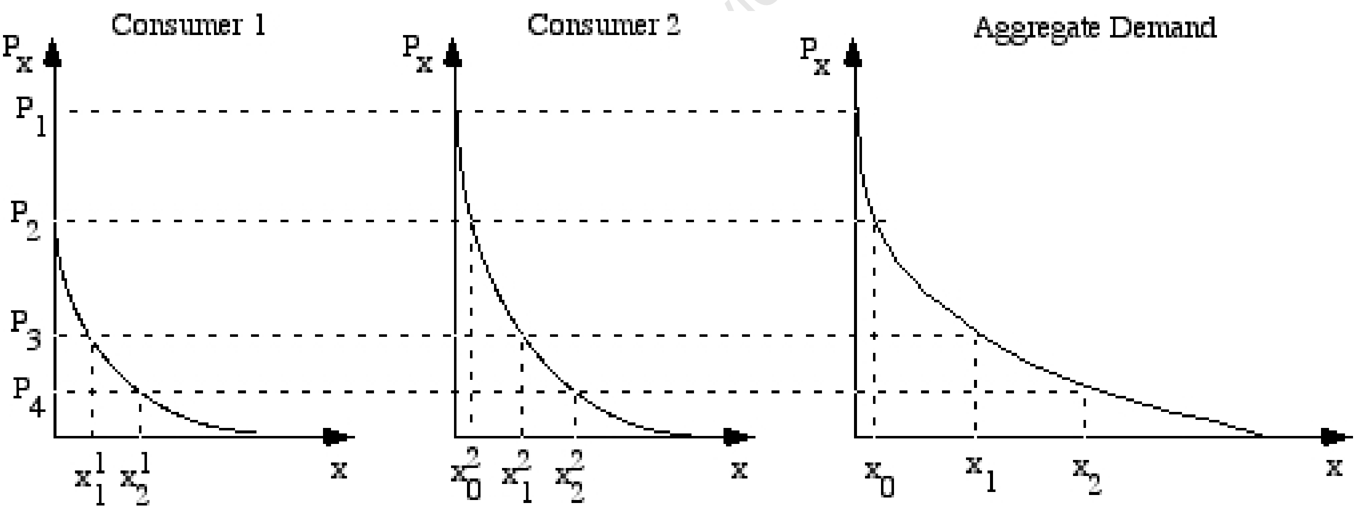



U
U(x1, y1)
y1
y
x1
x


y
M/Py
y = M/Py − Px/Py x
y*
u3
u2
△u
u1
x*
M/Px
x

Consider 2 individuals $x_1(P_x, P_y, M_1)$ and $x_2(P_x, P_y, M_2)$.

The aggregate (market) demand for good x is the horizontal sum of individual demands.



$x_0 = x_0^2$

$x_1 = x_1^1 + x_1^2$

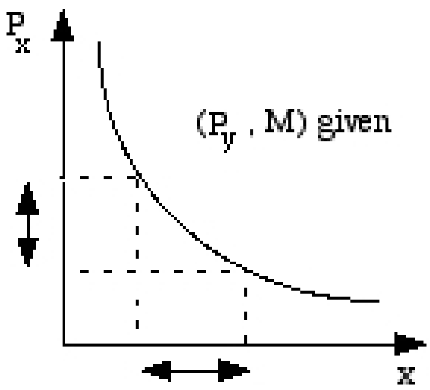
$x_2 = x_2^1 + x_2^2$

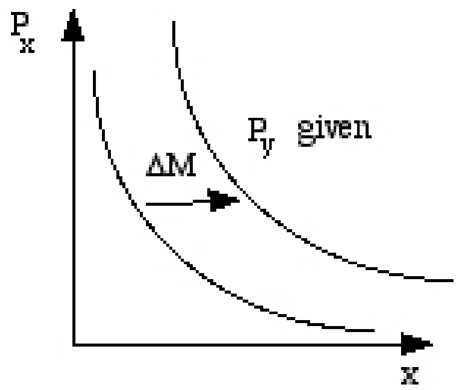
Effects on (aggregate) demand

Changes along the demand curve $[(P_y, M)$ given]

- $\uparrow P_x,\ x \downarrow$: some consumers buy less and some others leave the market.

- $\downarrow P_x,\ x \uparrow$: some consumers buy more and some others enter the market.





Shifting the demand curve $[(P_x, P_y)$ given]

- $\uparrow M \longrightarrow$ increase demand x and y: demand curve moves outwards.

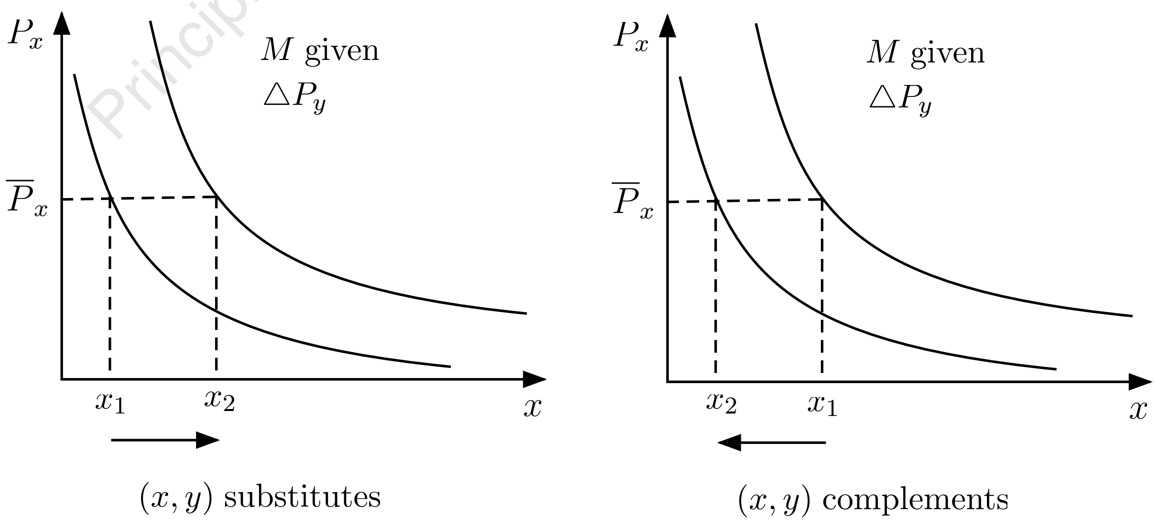
Crossed effects [(P_x, M) given]

Impact of $\uparrow P_y$ (M constant) on x, three possibilities:

(i) x and y independent, e.g. (x,y)= (coffee, gasoline):
$\uparrow P_y \rightarrow \downarrow y \rightarrow$ demand of x unaffected

(ii) x and y substitutes: satisfy similar needs, e.g. (x,y) = (butter, margarine):
$\uparrow P_y \rightarrow \downarrow$ demand of $y \rightarrow \uparrow$ demand of x.

(iii) x and y complements: joint consumption, e.g. (x,y) = (coffe, sugar):
$\uparrow P_y \rightarrow \downarrow$ demand of $y \rightarrow \downarrow$ demand of x.



Elasticity

How to measure the impact of ΔP_x on x?

Method 1: Direct and simple

$$\frac{\Delta x}{\Delta P_x}$$

Problem: dependent on units

EURO		Peseta	
P_x	x	P_x	x
6	10	1000	10
12	5	2000	5

$$\left.\frac{\Delta x}{\Delta P_x}\right|_{EUR} = \frac{-5}{6} = -0.83$$

$$\left.\frac{\Delta x}{\Delta P_x}\right|_{Pts} = \frac{-5}{1000} = -0.005$$

Method 2: Index invariant to units $\longrightarrow$

Elasticity

Own-price elasticity

$$\left|\varepsilon_x\right| = \left|\frac{\%\Delta x}{\%\Delta P_x}\right| = \left|\frac{\frac{\Delta x}{x}}{\frac{\Delta P_x}{P_x}}\right| = \left|\frac{\Delta x P_x}{\Delta P_x x}\right|$$

$\left|\varepsilon_x\right| > 1$ elastic (overreaction)

$\left|\varepsilon_x\right| < 1$ inelastic (underreaction)

Example: $\left|\varepsilon_x\right| = \frac{1}{2}$

Cross-price elasticity

$$\varepsilon_{xy} = \frac{\%\Delta x}{\%\Delta P_y} = \frac{\frac{\Delta x}{x}}{\frac{\Delta P_y}{P_y}} = \frac{\Delta x P_y}{\Delta P_y x}$$

Income elasticity

$$\eta_x = \frac{\%\Delta x}{\%\Delta M} = \frac{\frac{\Delta x}{x}}{\frac{\Delta M}{M}} = \frac{\Delta x M}{\Delta M x}$$

Ilustration

Derivation of the demand function

- Consider a two-good economy: a composite consumption good (y) and health care (x).
- (Representative) individual's utility function:

$$U(x,y) = x^{\alpha}y^{\beta},\ \alpha,\beta > 0$$

- Individual's income m.
- Individual's budget constraint:

$$m \geq xP_x + yP_y$$

where P_x y P_y denote prices of x and y respectively.

- Individual's problem:
Select a bundle (x,y) to maximize utility given $(P_x, P_y; m)$:

$$\max_{x,y} x^{\alpha}y^{\beta} \text{ s.t. } m \geq xP_x + yP_y$$

Solution:

$$\max_{x,y} L(x,y) = x^{\alpha}y^{\beta} + \lambda(m - xP_x - yP_y)$$

First order conditions,

$$\frac{\partial L}{\partial x} = \alpha x^{\alpha-1}y^{\beta} - \lambda P_x = 0 \qquad (1)$$

$$\frac{\partial L}{\partial y} = \beta y^{\beta-1}x^{\alpha} - \lambda P_y = 0 \qquad (2)$$

$$\frac{\partial L}{\partial \lambda} = m - xP_x + yP_y = 0 \qquad (3)$$

From (1) and (2),

$$\frac{\alpha y}{\beta x} = \frac{P_x}{P_y}$$

That is,

$$y = \frac{\beta x}{\alpha}\frac{P_x}{P_y} \qquad (4)$$

Substituting (4) in (3) yields

$$x(P_x, m) = \frac{\alpha m}{P_x(\alpha + \beta)} \qquad (5)$$

Substituting (5) in (4) yields

$$y(P_y, m) = \frac{\beta m}{P_y(\alpha + \beta)} \qquad (6)$$

Example Society with two consumers a and b and two goods x and y.

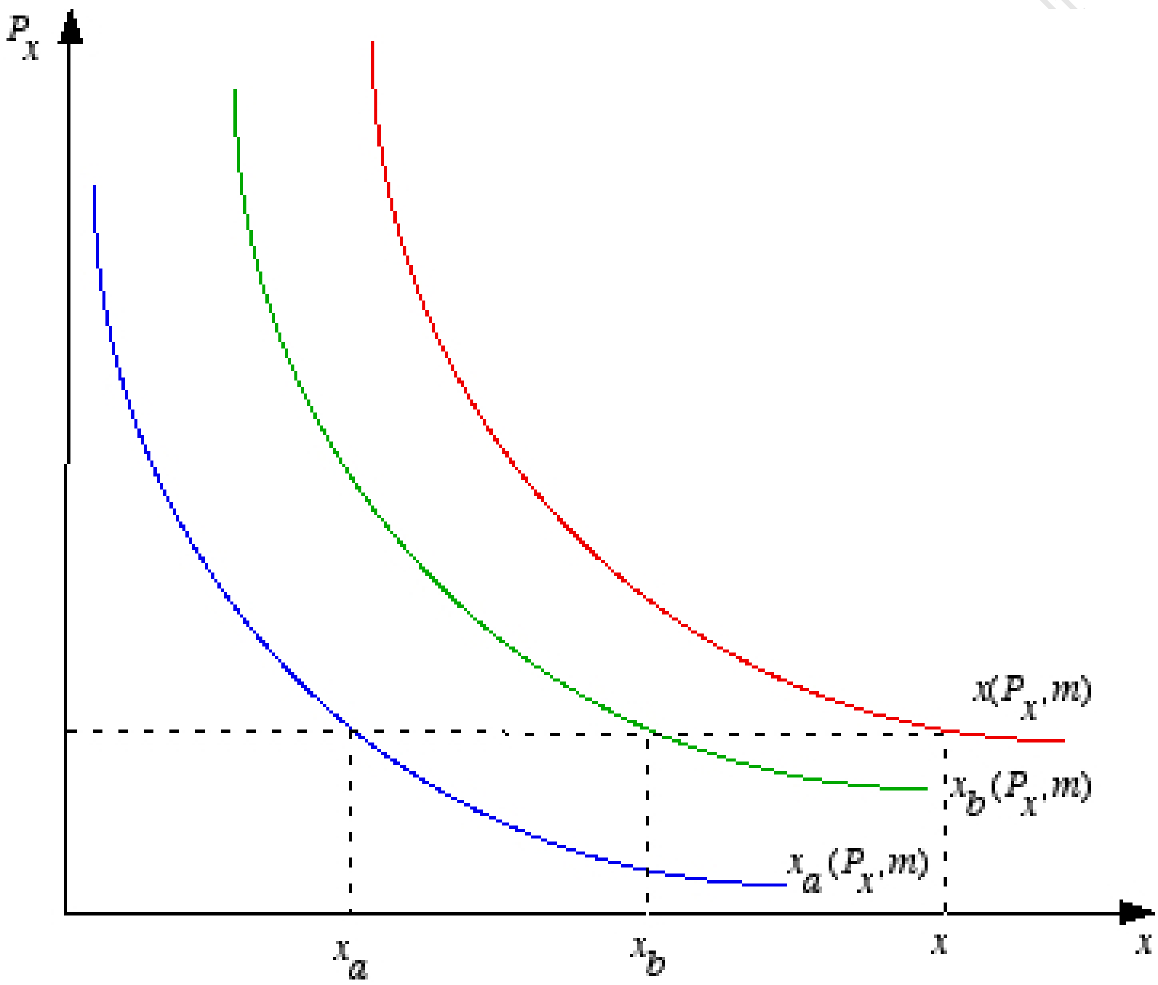
$$U_a(x_a, y_a) = x_a^{\frac{1}{3}} y_a^{\frac{2}{3}}$$
$$U_b(x_b, y_b) = x_b^{\frac{2}{3}} y_b^{\frac{1}{3}}$$

Individual demands:

$$x_a(P_x, m) = \frac{m}{3P_x}$$
$$y_a(P_y, m) = \frac{2m}{3P_y}$$
$$x_b(P_x, m) = \frac{2m}{3P_x}$$
$$y_b(P_y, m) = \frac{m}{3P_y}$$

Market demands:

$$x(P_x, m) = \frac{m}{P_x}$$
$$y(P_y, m) = \frac{m}{P_y}$$


P_x
$x(P_x, m)$
$x_b(P_x, m)$
$x_a(P_x, m)$
x_a
x_b
x
x

Elasticity

◇ own-price elasticity

$$\varepsilon_{x_a} = \frac{\partial x_a}{\partial P_x}\frac{P_x}{x_a} = -\frac{1}{3}$$

$$\varepsilon_{x_b} = \frac{\partial x_b}{\partial P_x}\frac{P_x}{x_a} = -\frac{2}{3}$$

$$\varepsilon_{x} = \frac{\partial x}{\partial P_x}\frac{P_x}{x_a} = -1$$

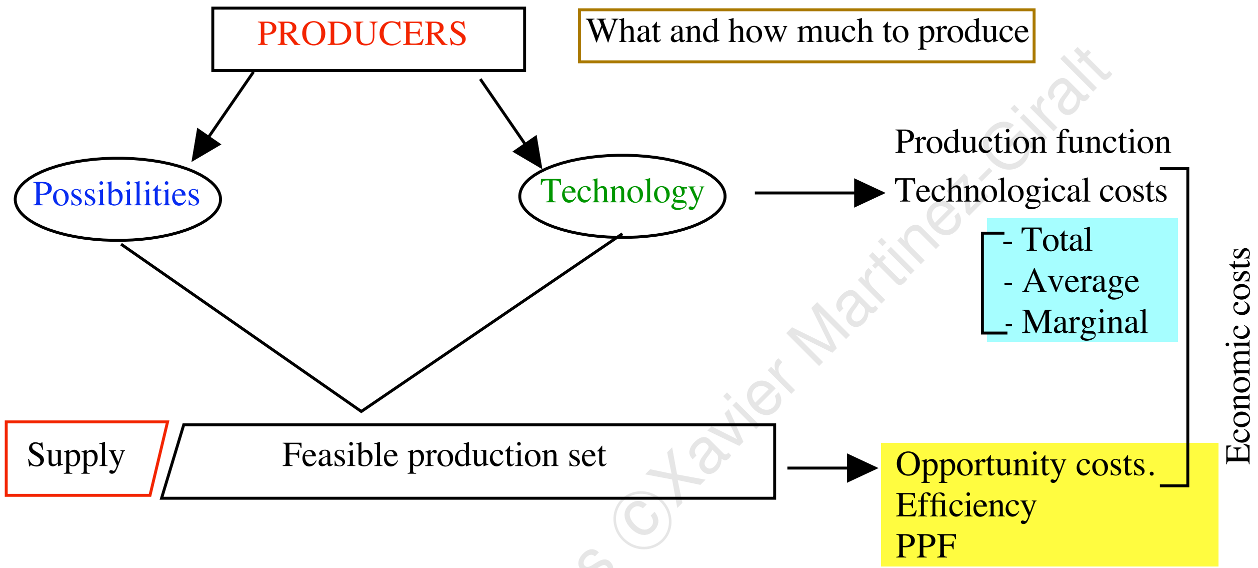
◇ income elasticity

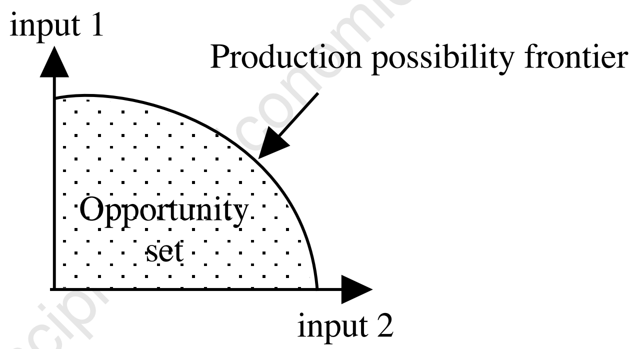
$$\eta_{x_a} = \frac{\partial x_a}{\partial m}\frac{m}{x_a} = 1$$

$$\eta_{x_b} = \frac{\partial x_b}{\partial m}\frac{m}{x_a} = 1$$

$$\eta_{x} = \frac{\partial x}{\partial m}\frac{m}{x_a} = 1$$

Producers (Suppliers).

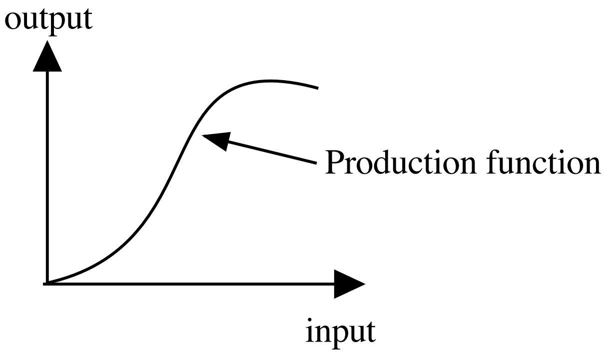




$$C(x) = F + V(x)$$

$$AC(x) = \frac{C(x)}{x}$$

$$MC(x) = \frac{\partial C(x)}{\partial x}$$



Production function

♠ relation between output and inputs: output = f(inputs).
→ engineering approach to prduction activity.

♠ Def.: represents the maximum amount of output that can be obtained from a given combination of inputs. (conveys efficiency)

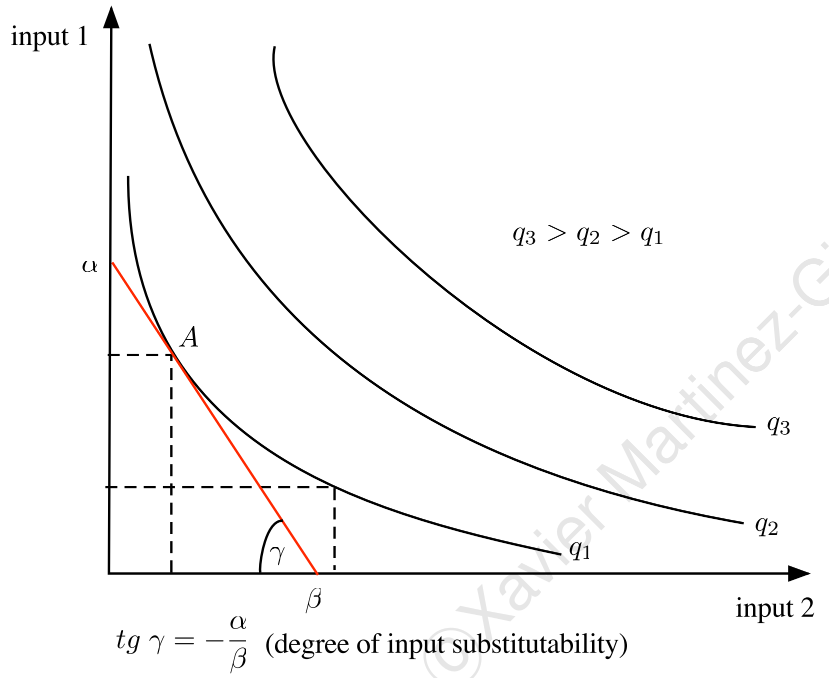
♠ Graphical representation (1 output, 2 inputs):

(a) isoquant map → degree of substitutability of inputs.

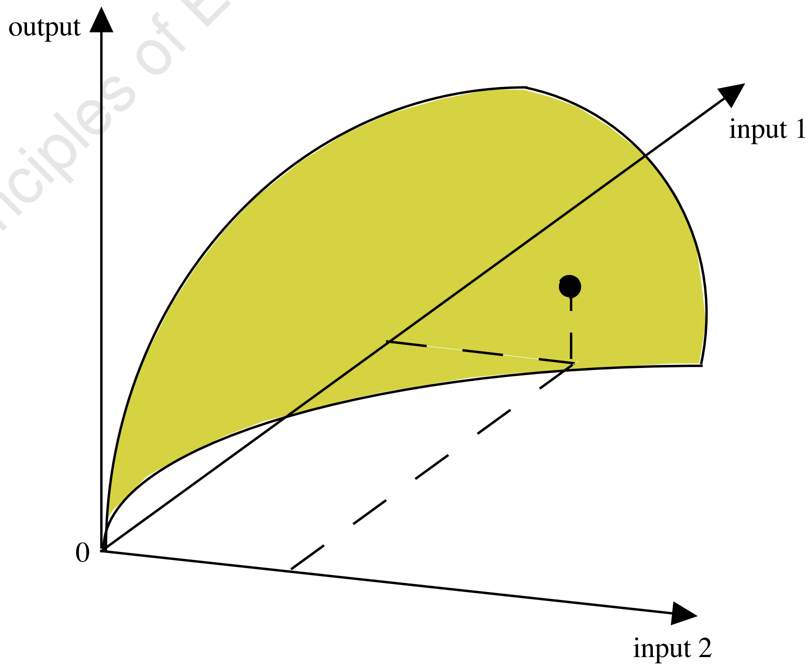
(b) 3D

(c) Production possibility frontier

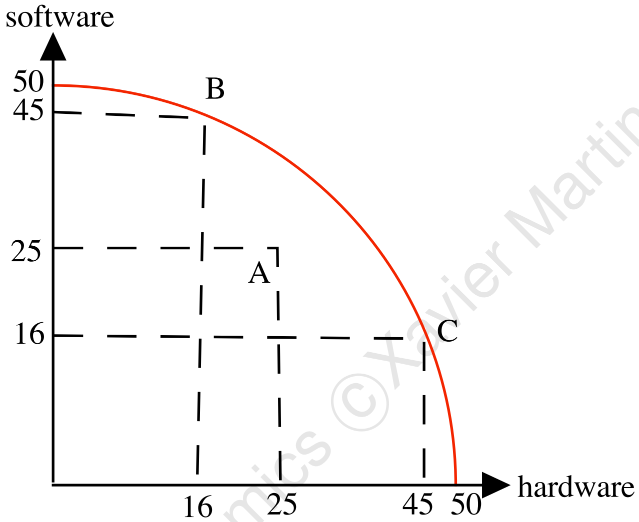
(a) isoquant map



(b) 3D representation



Consider an enterprise producing hardware and software. If all engineers produce hardware $\rightarrow$ 50 units/week; If all inputs to software $\rightarrow$ 50 units/week.



Points $A, B, C \in$ feasible production set. Represent production of firm (supply).
Points $B, C \in$ FPP.

Production possibility frontier:
Set of all the maximum combinations of production levels the firm can achieve given the quantity and productivity of resources available.

Efficiency.

An allocation of resources is efficient if it is impossible to change that allocation to make an agent better off (increase utility/profit) without making another agent worse off (reduce utility/profit).

Efficiency refers to allocations of resources yielding the maximum possible output, i.e. allocations on PPF.

Hence, allocation A is not efficient, while allocations B, C are efficient.

From a social point of view, there is interest in moving from A to B (or C). The firm is able to increase its output with the same inputs.

Efficacy.

Potential benefit of a technology. Probability that an individual benefits from the application of a (health) technology to solve a particular (health) problem, under ideal conditions of application.

Effectiveness.

Probability that an individual benefits from the application of a technology to solve a particular problem, under real conditions of application.

Examples [from the healthcare sector]:

Highly effective treatments: vaccinations, heart surgery, diabetes, influenza, renal insufficiency, ...

Clinical interventions of known efficacy explain 5 of the years won in life expectancy at birth.

Efficacy vs Effectiveness

In general, efficacy or ideal use or perfect use is the ability to produce a specifically desired effect. For example, an efficacious vaccine has the ability to prevent or cure a specific illness. In medicine a distinction is often drawn between efficacy and effectiveness or typical use. Whereas efficacy may be shown in clinical trials, effectiveness is demonstrated in practice.

The distinction between efficacy and effectiveness is important because doctors and patients often do not follow best practice in using a treatment. For instance, a patient using oral contraceptive pills to prevent pregnancy may sometimes forget to take a pill at the prescribed time; thus, while the perfect-use failure rate for this form of conception in the first year of use is just 0.3%, the typical-use failure rate is 8%.

Illustration

★ Clinical essay: efficacy of drug 1=75%.
★ $\exists$ drug 2, same price and efficacy = 70%

more effective to select drug 1 and reject drug 2?

YES, with this information.

Additional INFO

♦ both drugs are correctly prescribed to 75% of patients
♦ drug 1: 50% of patients follow treatment correctly
♦ drug 2: 70% of patients follow treatment correctly

Effectiveness of drugs:

$$E_1 = 0.75 \times 0.75 \times 0.5 = 0.28125$$
$$E_2 = 0.7 \times 0.75 \times 0.7 = 0.3675$$

Conclusion: select drug 2.

Cost function

Cost function shows relationship between output and cost. $\rightarrow$ economic approach to production activity.

Def.: minimum possible cost of production of a given volume of output. (conveys efficiency)

Example: Let,
q represent production of cars,
L represent labor input (with price $w = 1$ €),
K represent capital input (with price $r = 1.2$ €).

We are assuming competitive markets!

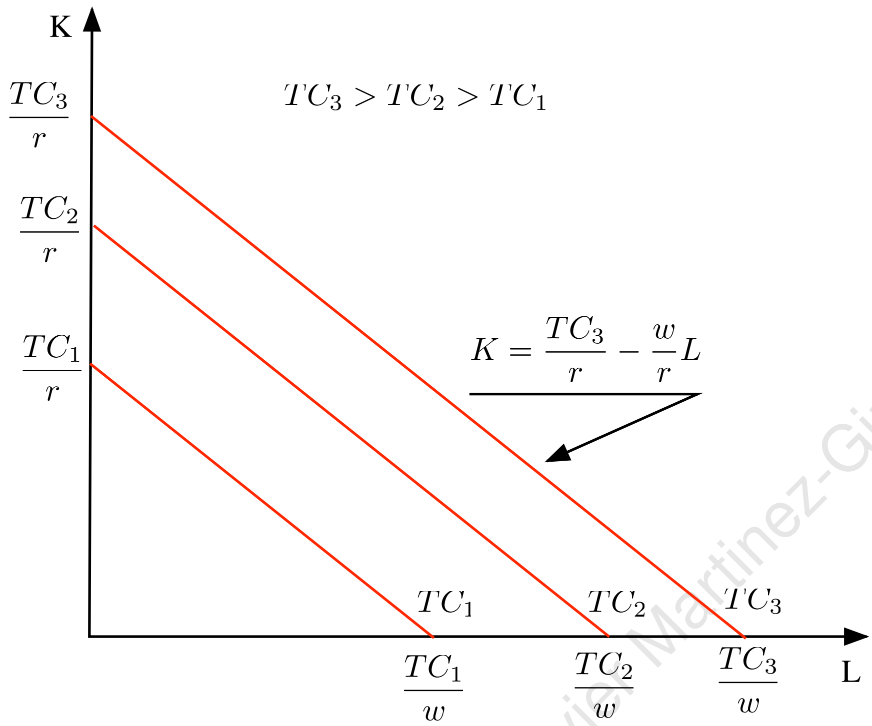
Short run vs. long run: existence of fixed costs.

Total cost: $TC(q) = rK + wL = 1.2K + L$

Average cost: $AC(q) = \frac{TC(q)}{q}$

Marginal cost: $MC(q) = \frac{\partial TC(q)}{\partial q}$

Representation: Isocost map $\rightarrow K = \frac{\overline{TC}}{r} - \frac{w}{r}L$

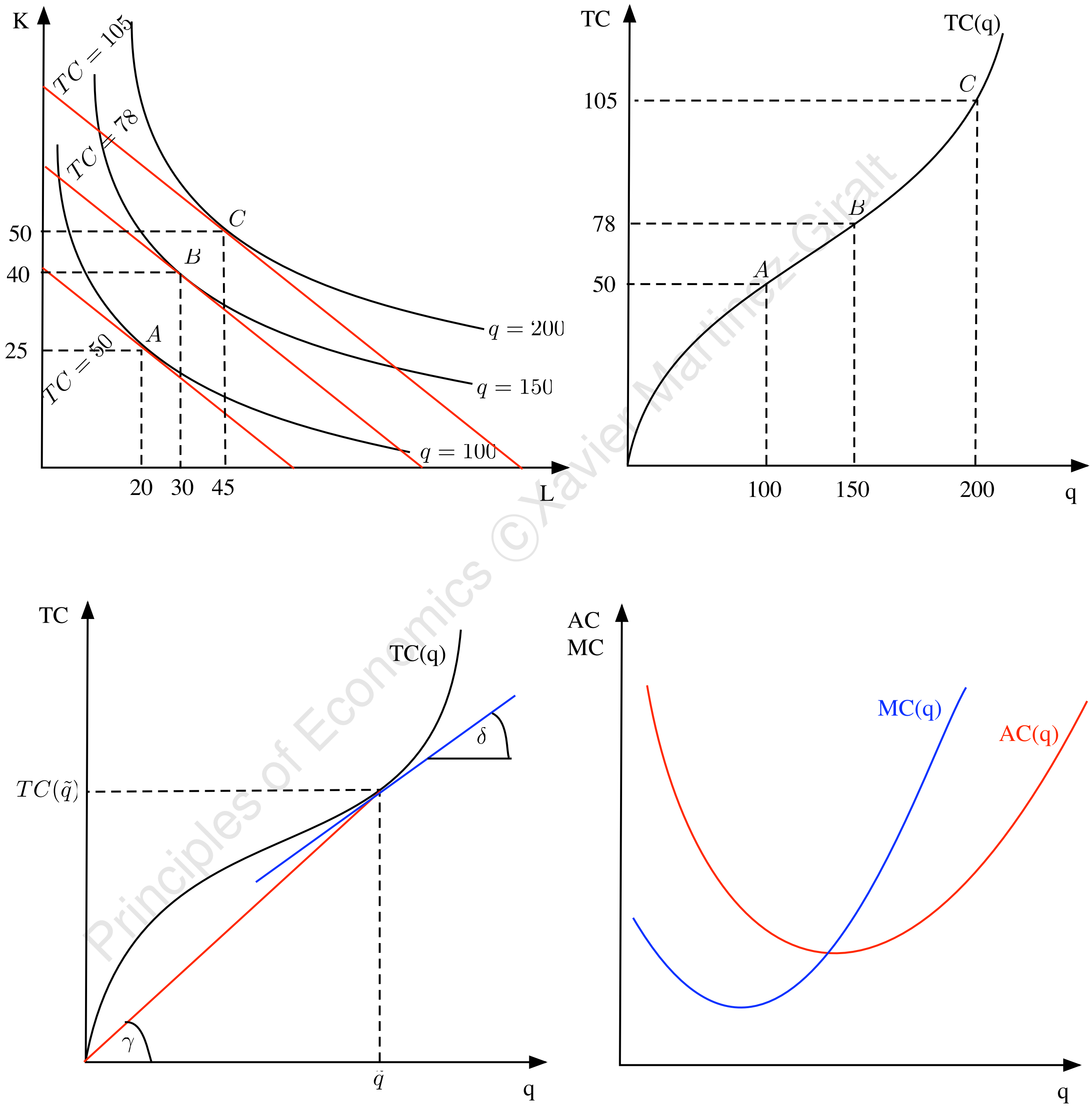


To derive the total cost function, combine isocost map and isoquant map:

- To produce $q = 100$ (i.e. 100 cars) given the prices w and r, the factory minimizes cost by contracting 20 units of labor and 25 of capital. This yields a total cost of $TC(100) = (1.2)25 + 20 = 50$ €.

- To producte $q = 150, \rightarrow TC(150) = (1.2)40 + 30 = 78$

- To producte $q = 200, \rightarrow TC(200) = (1.2)50 + 45 = 105$



$$AC(\tilde{q}) = tg\,\gamma = \frac{TC(\tilde{q})}{\tilde{q}} \quad ; \quad MC(\tilde{q}) = tg\,\delta$$

Remark 1: decreasing (long run) AC implies a range of values of q such that $MC(q) < AC(q)$.

$$\frac{\partial AC(q)}{\partial q} = \frac{\partial \frac{TC(q)}{q}}{\partial q} = \frac{MC(q)q - TC(q)}{q^2} = \frac{MC(q)}{q} - \frac{AC(q)}{q} < 0 \Leftrightarrow MC(q) < AC(q)$$

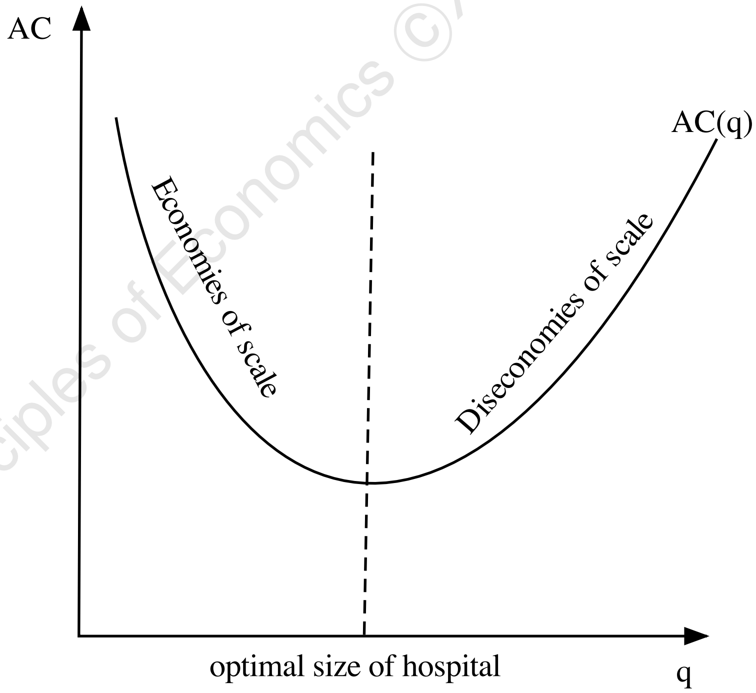
Remark 2: let $\widehat{q}$ be such that $AC(\widehat{q})$ is minimum. Then, $AC(\widehat{q}) = MC(\widehat{q})$.

If $AC(\widehat{q})$ is minimum means derivative = 0. Thus,

$$\left.\frac{\partial AC(q)}{\partial q}\right|_{\widehat{q}} = \left.\frac{\partial \frac{TC(q)}{q}}{\partial q}\right|_{\widehat{q}} = \left.\frac{MC(q)q - TC(q)}{q^2}\right|_{\widehat{q}} = \left.\frac{MC(q)}{q}\right|_{\widehat{q}} - \left.\frac{AC(q)}{q}\right|_{\widehat{q}} = 0 \Leftrightarrow MC(\widehat{q}) = AC(\widehat{q})$$

Economies of scale

Economies (diseconomies) of scale characterizes a production process in which an increase in the level of production causes a decrease (increase) in the long run average cost of each unit.



Economies of scope

Economies of scope are changes in average costs because of changes in the mix of output between two or more products. This refers to the potential cost savings from joint production.

Consider a community with two hospitals. One specialized in pediatric care (q_1), the other specialized in cancer care (q_2). May it be worth to merge both activities in a single hospital?

Scope economies arise if

$$TC(q_1, q_2) < TC(q_1) + TC(q_2)$$

That is, the joint production of pediatric and cancer care allows for savings in the hospital's management structure, administration systems, management of hospital capacity, nurses, and non-sanitary personnel, etc.

Opportunity cost.

The concept of opportunity cost is defined as the benefit given up by not choosing an alternative allocation.

Assume a shift from B to C (page 3b). Consequences?

- 29 additional units of hardware
- 29 less units of software.

The opportunity cost of moving from B to C is the reduction in production of software due to the increase in production of hardware.

The opportunity cost is an economic concept (not in accountancy).

How does society chooses among feasible allocations? VOTING mechanism.

Criteria to be used:

- Efficiency: Select only efficient allocations (rule out allocation A)

- Equity. [Normative criterion] Select allocations meeting society's requirement for justice.
$\rightarrow$ people's values
e.g. social justice is behind the set-up of a NHS, public schools/housing.

★Horizontal and Vertical equity.

■ Horizontal equity: equal treatment of equal need.
□ 2 individuals with same profile should receive same treatment.

■ Vertical equity: unequal treatment of unequal need.
□ preference for individuals with serious conditions (e.g. # of kids) than for those with less serious conditions.
□ passing the financing of NHS, public schools/housing to ability to pay (progressive income tax).

Technical progress and its diffusion (see also Ch.5)

Technical progress: Defs.:

(a) produce "old" goods less costly, or produce "new" goods.

(b) Ability to produce at a lower cost given a quality level.

Diffusion: who adopts a new tech, and why.

2 principles:
- profit principle: firms more likely to adopt a new technique if it is expected to increase their revenue stream. [if present value of future profits due to innovation > 0.]
- information principle: role of friends, colleagues, journals, and conferences at informing and encouraging the adoption decision.

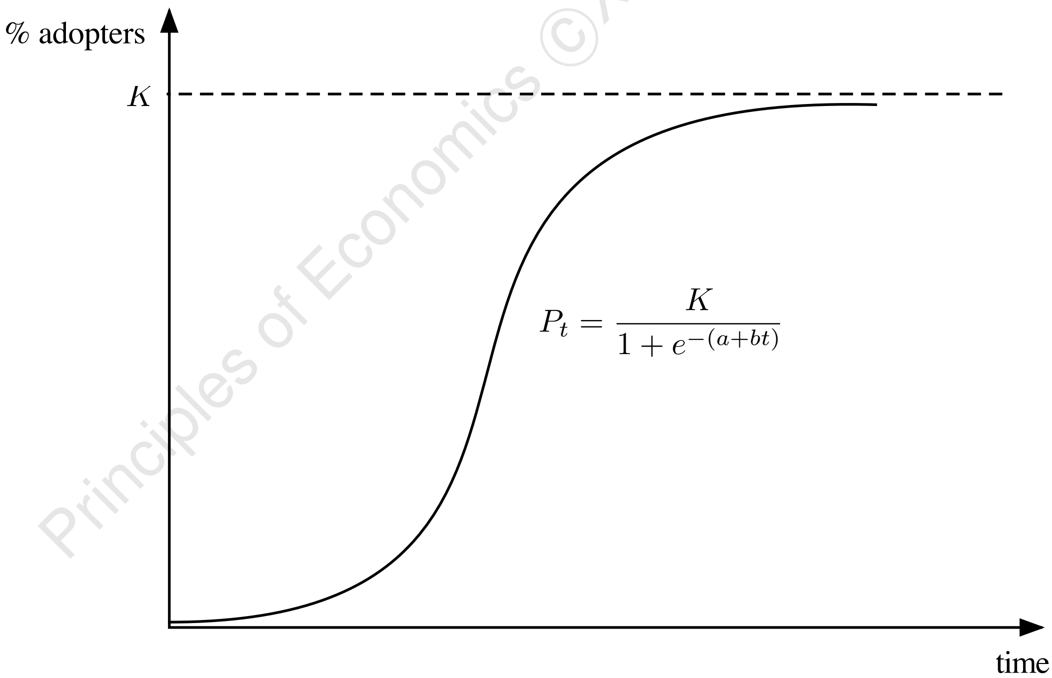
Trade-off:
- waiting may give rivals a competitive advantage;
- waiting allows for learning from others' experience.

(Classic) Pattern of diffusion

- Slow at the beginning;

- Then at an increasing rate;

- Then at a decreasing rate asymptotically reaching its limit K.



(a, b) parameters to be estimated.

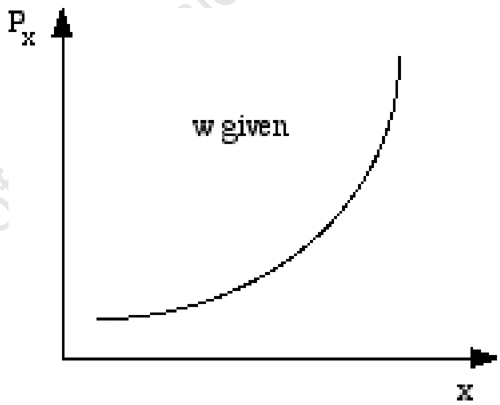
Individual vs. aggregate supply

Individual supply $\longrightarrow$ solution of

$$\max_{x} \Pi(x) = xP_x - C(x)$$

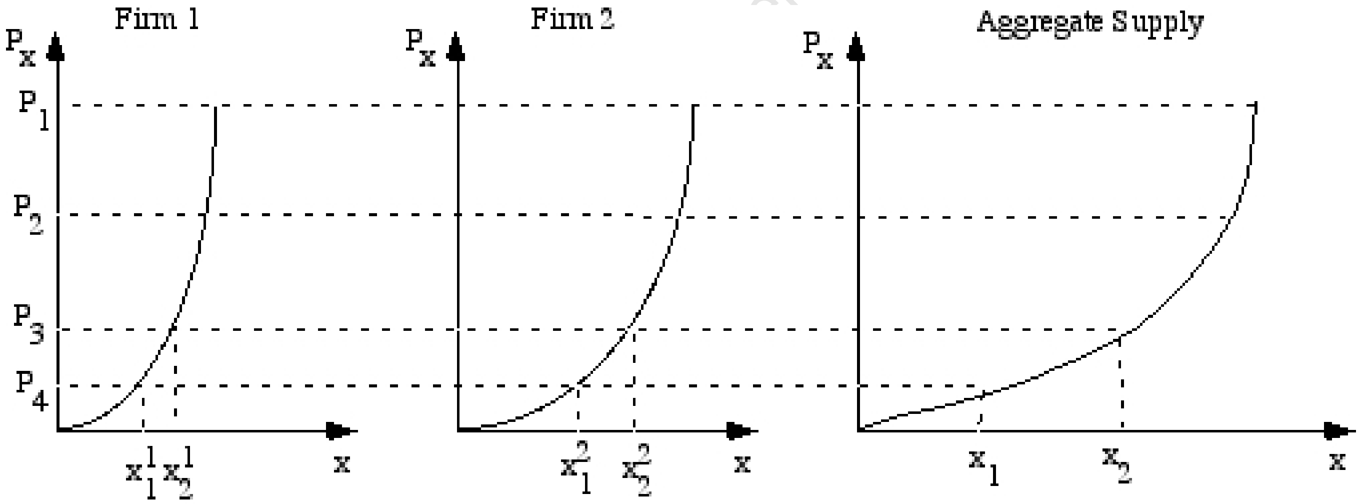
That is,

$$x^*(P_x, w) \longrightarrow \text{market structure?}$$



NOTE: P_x vs. $P(x)$.

Consider 2 firms $x_1(P_x, w)$ and $x_2(P_x, w)$.
The aggregate (market) supply for good x is the horizontal sum of individual supplies.



$x_1 = x_1^1 + x_1^2$

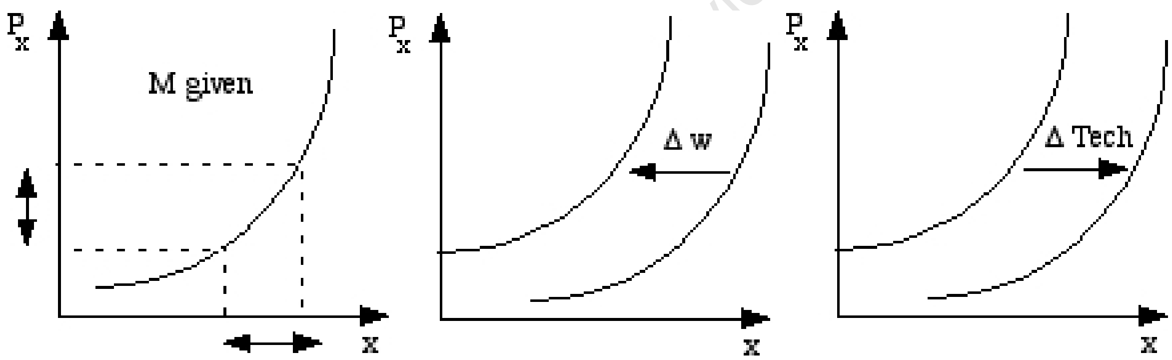
$x_2 = x_2^1 + x_2^2$

Effects on supply

Changes along the supply curve

- $\uparrow P_x, \; x \uparrow$: some firms produce more and some others enter the market.

- $\downarrow P_x, \; x \downarrow$: some firms produce less and some others leave the market.



Shifting the supply curve

- $\uparrow w$, (P_x constant), same productionj level is more expensive $\longrightarrow \downarrow$ production: supply moves inwards.

- R&D $\longrightarrow$ more efficient technology $\longrightarrow$ same production level is cheaper $\longrightarrow$
$\uparrow$ production: supply moves outwards

Illustration

Consider a firm with a production function $x(l) = l^{\delta}$, where l denote working hours and x health services.

The associated cost function $C(w, x) = wl(x)$ where $l(x) = x^{1/\delta}$, that is,

$$C(x, w) = wx^{\frac{1}{\delta}}$$

The (competitive) profit function is

$$\Pi(x) = xP_x - C(x)$$

The problem of the firm is to determine the level of x to maximize profits. Formally,

$$\max_{x} xP_x - wx^{\frac{1}{\delta}} \tag{7}$$

First order condition:

$$\frac{\partial \Pi}{\partial x} = P_x - \frac{1}{\delta} wx^{\frac{1-\delta}{\delta}} = 0.$$

Thus, the supply function of the firm is

$$x(P_x, w) = \left(\frac{\delta P_x}{w} \right)^{\frac{\delta}{1-\delta}}$$

Example Society with 2 (competitive) fims 1 and 2 and a good x.

$$x_1(l) = l^{1/3}$$
$$x_2(l) = l^{1/2}$$

Individual supply functions:

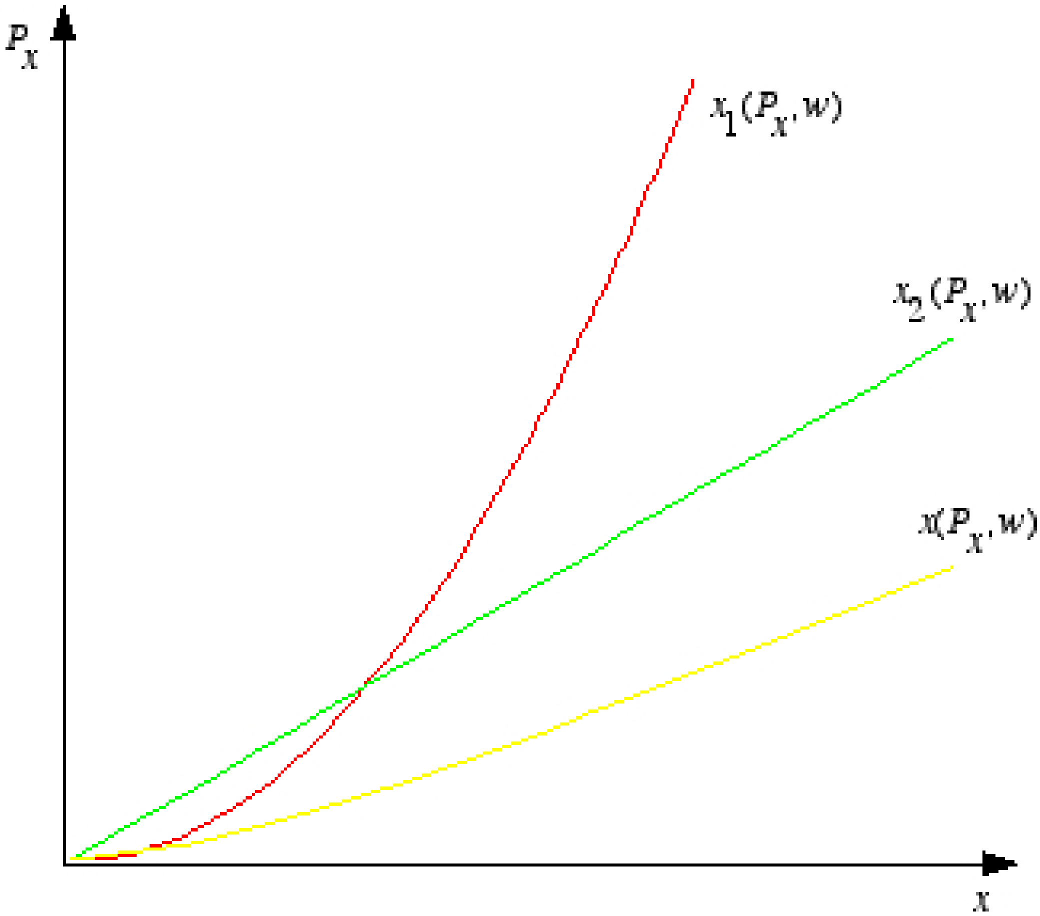
$$x_1(P_x, w) = \left(\frac{P_x}{3w}\right)^{\frac{1}{2}}$$
$$x_2(P_x, w) = \frac{P_x}{2w}$$

Aggregate supply:

$$x(P_x, w) = \left(\frac{P_x}{3w}\right)^{\frac{1}{2}} + \frac{P_x}{2w}$$

Elasticities

$$\varepsilon_{x_1} = \frac{\partial x_1}{\partial P_x}\frac{P_x}{x_1} = \frac{1}{2}$$
$$\varepsilon_{x_2} = \frac{\partial x_2}{\partial P_x}\frac{P_x}{x_2} = 1$$



3-w

3. The market

“Place” where consumers and producers interact (i.e. exchange goods).

What goods compose a market? $\longrightarrow$ demand oriented vs supply oriented

Demand oriented: set of products with high crossed elasticities among them and low wrt other goods.

Examples

(a) crossed elasticity between 95 octane and 98 octane gasoline is high. They are close substitutes. They belong to the same market.
(b) crossed elasticity between consumption of gasoline and mineral water is low. They are independent goods. They belong to different markets.

PROBLEM: ambiguity of high/low enough crossed elasticity.

Supply oriented:

- Europe NACE (General Industrial Classification of Economic Activities [Nomenclature statistique des Activités économiques dans la Communauté Européenne]),

- Spain CNAE (Clasificación Nacional de Actividades Económicas)

PROBLEM: codes assigned according to technologically oriented criteria. May be misleading, e.g. elaboration of wine and champagne have different codes, but often grouped in the same market (high crossed demand elasticity).

Imperative assumption in the study of a market: Rational behavior of agents:

- consumers: maximize utility $\longrightarrow$ individual demand $\longrightarrow$ Market demand

- firms: maximize profits $\longrightarrow$ individual supply $\longrightarrow$ Market supply

Market structures:

Buyers / Sellers	Many	Few	One
Many	Perfect Competition	Oligopsony	Monopsony
Few	Oligopoly	Bilateral Oligopoly	
One	Monopoly		Bilateral Monopoly

PERFECTLY COMPETITIVE MARKET

Justification:

1. Simplicity.

2. Generates the best allocation of resources (no mismanagement): efficient distribution (Pareto-optimality) [$\neq$ equity].

3. No need of the State to achieve efficiency.

4. Benchmark to build models allowing better understanding of real phenomena.

Assumptions:

1. Many sellers (producers): price-takers; given prices choose production volume to max profit.

2. Many buyers (consumers): price takers; given prices choose consumption bundle to max satisfaction.

3. Homogeneous product.

4. Perfect information.

5. Free entry (and exit) of firms.

6. Partial equilibrium. Static set-up.

Additional assumption:

7. Real markets (no financial markets)

    - markets of goods and services: firms sell; consumers buy.

    - labor markets: firms buy; consumers sell.

Implicit assumption: property rights

8. Firms (shareholders) hold the property right over profits $\longrightarrow$ **incentives** to reinvest to improve profitability $\longrightarrow \Delta\Pi$.

9. Consumers hold the property rights over their incomes:

   - **incentives** to work (increase income)

   - **incentivos** to save (increase returns of capital)

   $\Longrightarrow \Delta$ consumption.

A State setting incomes and profits eliminates incentives.

Incentives

Are necessary but ... generate inequality.

Induce proper behavior if linked to profitability: higher profitability $\longrightarrow$ higher income.

Consequence: trade-off between incentives and inequality.

If society offers + incentives (e.g. ∇ Tx, ∇ social benefits) i.e. indiv. welfare. $\sim$ income

$$\longrightarrow \begin{cases} \Delta \text{ production} \\ \Delta \text{ inequality} \end{cases}$$

If society offers - incentives (e.g. Δ Tx, Δ social benefits) i.e. indiv. welfare depends of income and social benefits

$$\longrightarrow \begin{cases} \nabla \text{ production} \\ \nabla \text{ inequality} \end{cases}$$

Societies solve the trade-off between the two forces through *voting* in government elections.

Prices

allocate goods and services through the market to those with highest willingness to pay.

BUT is not the only allocation mechanism, e.g.

(i) Rationing (the consumption bundles consumers get are smaller that what they wish)

- por queuing (cinemas, primary care services, ...) $\longrightarrow$ inefficient

- por lotteries (licences, ...) $\longrightarrow$ inefficient

- por sharing rules (prorate shares in privatization of public firms, food stamp programs, wartime, ...)

  - without market for coupons $\longrightarrow$ inefficient

  - with market for coupons $\longrightarrow$ efficient

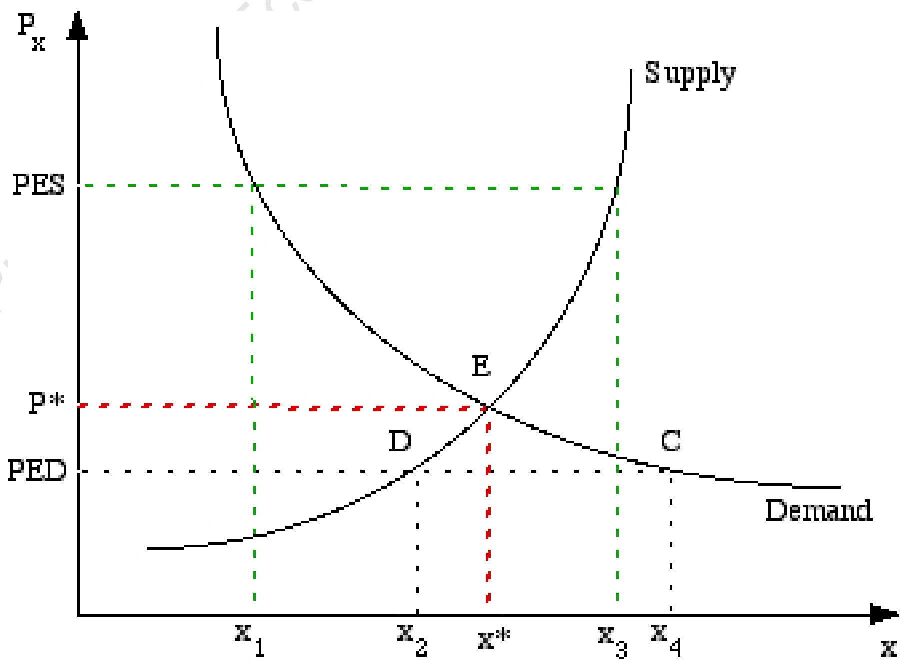
(ii) Fixing prices (gasolines, house-rental, ...)

Market equilibrium: Law of demand and supply.

Aggregate demand and supply of a commodity x jointly determine its (partial) equilibrium price (and quantity) in a perfectly competitive market.

An equilibrium is a situation where no agent has incentives to modify his(her) actions.

The equilibrium pair (P^*, x^*) denotes a situation where firms are maximizing profits and consumers are maximizing satisfaction from consumption.



Ilustration

Recall the market demand in pp. 5j-5k and market supply in pp. 6k-6m.

$$\text{Demand}: x^D(P_x, m) = \frac{m}{P_x}$$

$$\text{Supply}: x^S(P_x, w) = \left(\frac{P_x}{3w}\right)^{\frac{1}{2}} + \frac{P_x}{2w}$$

Assume $m = 10$ and $w = 1/3$, so that

$$\text{Demand}: x^D(P_x) = \frac{10}{P_x}$$

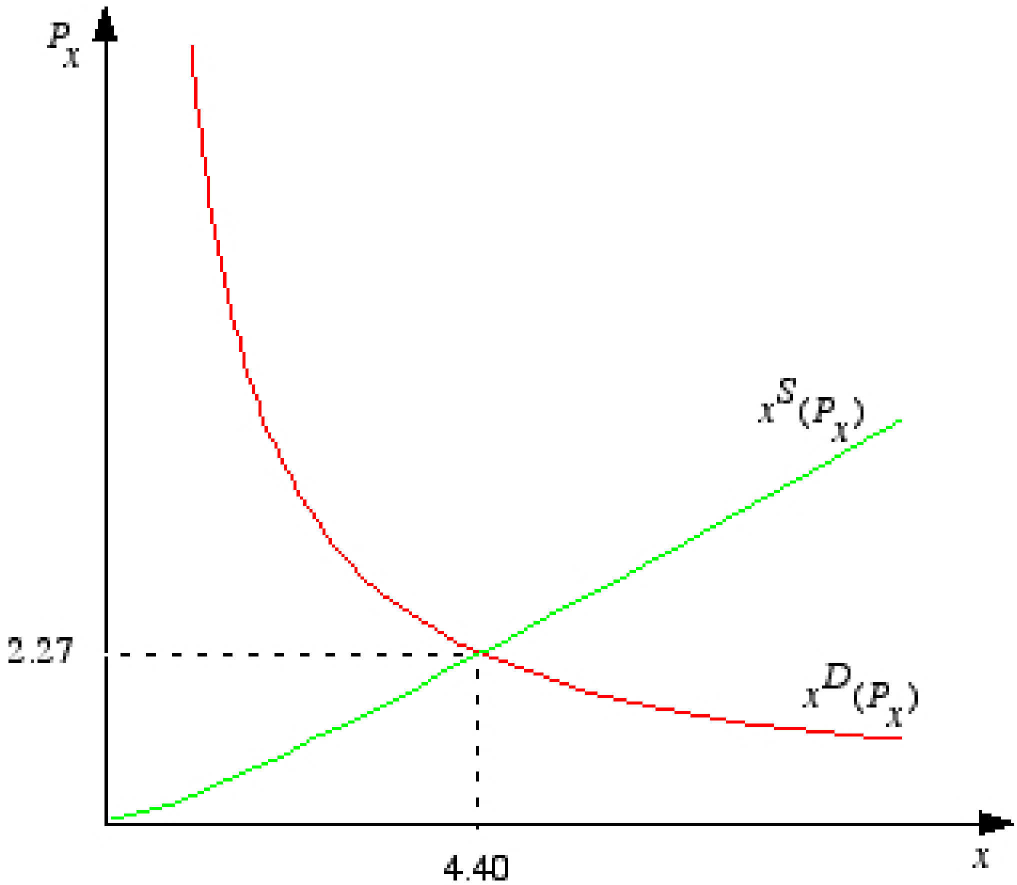
$$\text{Supply}: x^S(P_x) = P_x^{1/2} + \frac{3P_x}{2}$$

Equilibrium is characterized by $x^D(P_x) = x^S(P_x)$. Formally,

$$P_x^{1/2} + \frac{3P_x}{2} = \frac{10}{P_x} \Longleftrightarrow$$

$$\frac{3}{2}P_x^2 + P_x - 10 = 0$$

That is, $P_x \approx 2.27$ and $x \approx 4.40$.



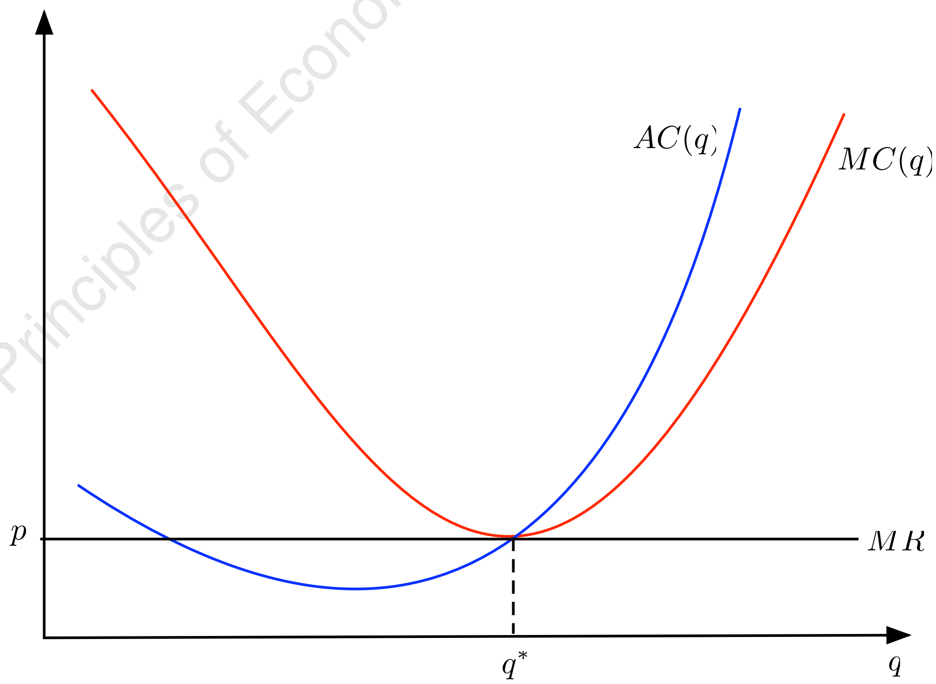
P_x
$x^S(P_x)$
2.27
$x^D(P_x)$
4.40
x

Characterization of competitive equilibrium

- Firms (given prices) choose q to maximize profits,
$\Pi(q) = pq - TC(q)$
$\frac{\partial \Pi(q)}{\partial q} = 0 \rightarrow q^*$ s.t. $p = MC(q^*)$

- free entry guarantees zero profits, $\Pi(q^*) = 0$
$\rightarrow pq^* = TC(q^*) \rightarrow p = TC(q^*)/q^* = AC(q^*)$.

Hence, at q^*, $p = MC(q^*) = AC(q^*)$.



Equivalence Max profits and Min costs

- Profit maximization:

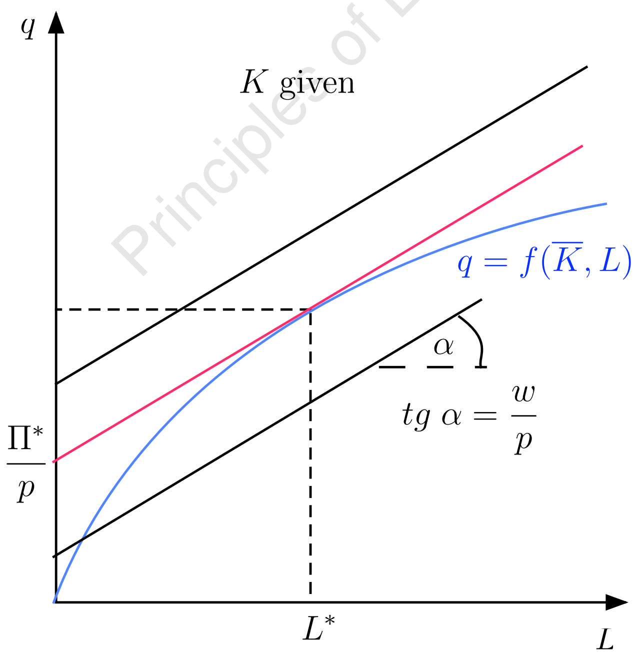
$\max_q \Pi(q) = pq - wL - rK$ s.t. $q = f(K, L)$

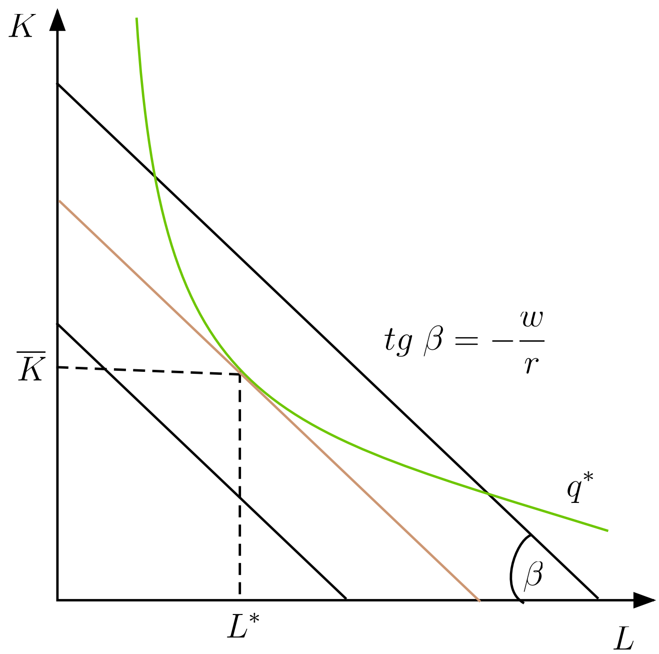
Isoprofit map: $q = \frac{\overline{\Pi}}{p} + \frac{w}{p}L + \frac{r}{p}K$

$\longrightarrow$ optimum satisfies

$$\frac{w}{p} = \frac{\partial f}{\partial L}, \text{ and } \frac{r}{p} = \frac{\partial f}{\partial K}.$$

Thus, profits are maximized at $\frac{w}{r} = \frac{\frac{\partial f}{\partial L}}{\frac{\partial f}{\partial K}}$.





- Cost minimization:

$$\min_{K,L} wL + rK \text{ s.t. } q = f(K,L)$$

Isocost map: $K = \frac{\overline{TC}}{r} - \frac{w}{r}L$
$\longrightarrow$ optimum satisfies

$$-\frac{w}{r} = -\frac{\frac{\partial f}{\partial L}}{\frac{\partial f}{\partial K}}.$$

Conclusion:

With given prices (p, r, w), max profits $\Leftrightarrow$ min total cost. If a firm max profits producing q^*, it must be minimizing cost. Otherwise, it would mean there is a cheaper way to produce q^* contradicting profit maximization.

4. Sources of market failure

I. Supply side

(i) natural monopolies (scale economies) → large initial investment: supply of water, gas, electricity, transport, telecommunications, ...

Regulation (limit monopoly power) widely accepted (prices)

(ii) oligopolies (monopoly power) [see below]

Regulation (limit monopoly power): antitrust laws

(iii) Externalities → difficult to measure, diversity of effects, diversity of types. [see below]

Regulation (limit monopoly power): OK but how?

(iv) Merit goods and incomplete markets [see below]

II. Demand side

(i) imperfect and incomplete information on products and markets.

Regulation: control on sales of dangerous products; info on label of products (expiry date, ingredients, ...); control on advertisement campaigns.

(ii) information as a public good* → private market does not provide enough information (see below).

Regulation: increase volume of information.

---

* public goods: no exclusion, no rivalry (public gardens, roads, army)

OLIGOPOLY

Consider a market with two firms (duopoly) 1 and 2. Firm 1's decision will be affected by firm 2's behavior $\longrightarrow$ Strategic interaction

Firm 1's decision-making process

- Market price will depend on firms production levels: $P(x_1, x_2)$. Therefore,

1's profit maximization: find production level solving

$$max_{x_1} \Pi(x_1, x_2) = x_1 P(x_1, x_2) - C(x_1)$$

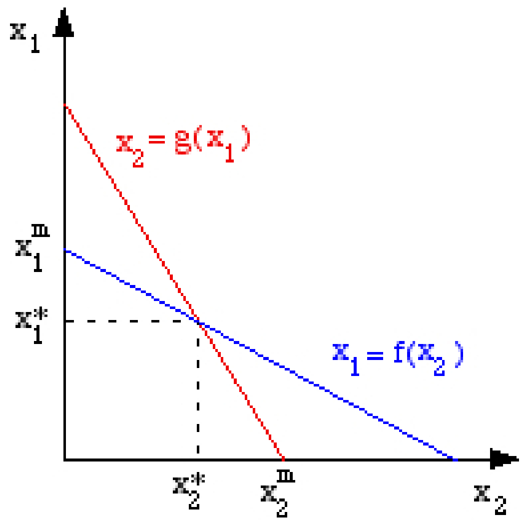
Solución: $x_1 = f(x_2)$

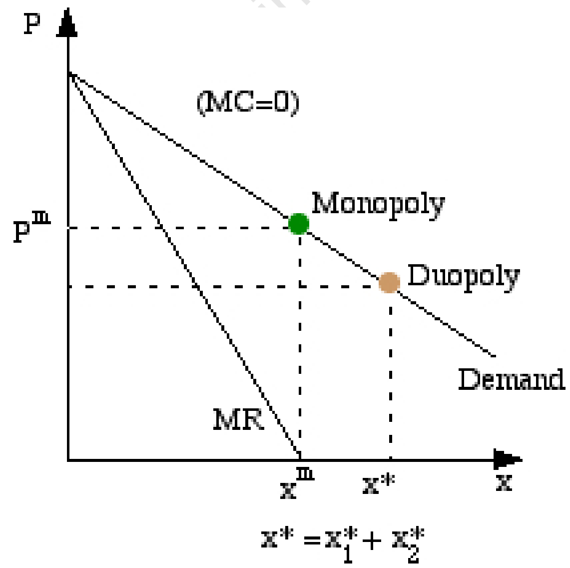
Similarly, firm 2 maximizes profits producing

$$x_2 = g(x_1)$$

Market equilibrium

(x_1^*, x_2^*) such that $f(x_2)$ is compatible with $g(x_1)$





Formally, (x_1^*, x_2^*) is a Nash (Cournot) equilibrium. That is,

$$\pi_i(x_i^*, x_j^*) \geq \pi_i(x_i, x_j^*),\ \forall i, j\ i \neq j$$

MONOPOLY

Profit maximization

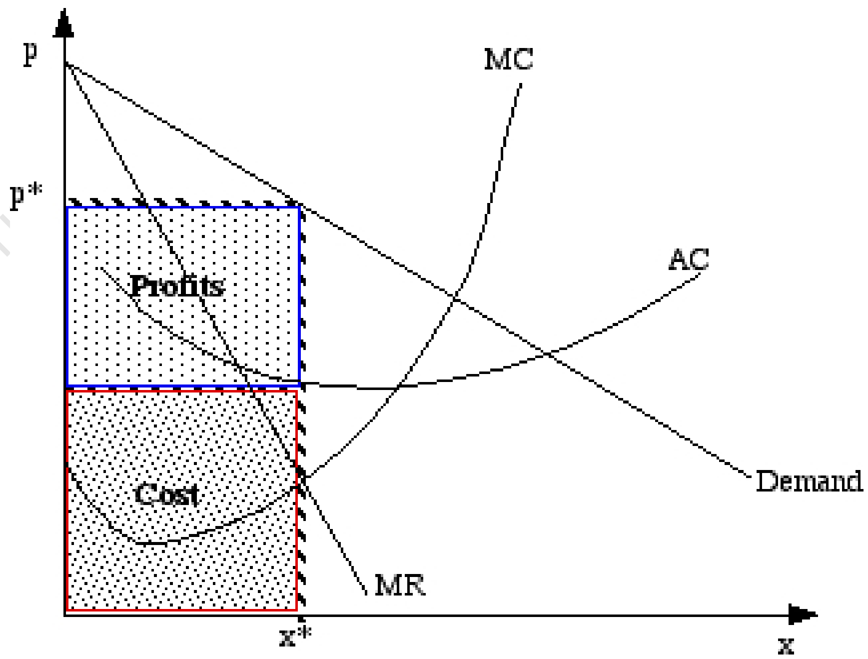
$\max_x \Pi(x) = xP(x) - C(x) = R(x) - C(x)$

Marginal Revenue: $\triangle$ revenue when selling one additional unit

Marginal Cost: $\triangle$ cost when producing one additional unit

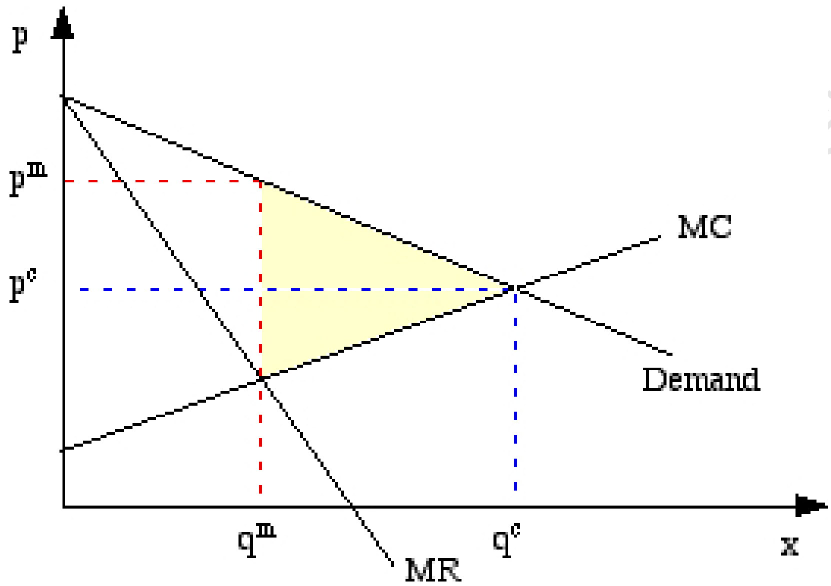
Average Cost: Total Cost/production (unit cost)

Firm's problem: $\max_x \Pi(x), \Longrightarrow MR = CM$



Monopoly power

Monopolist: $p^m > MC = p^c \Rightarrow$ deadweightloss



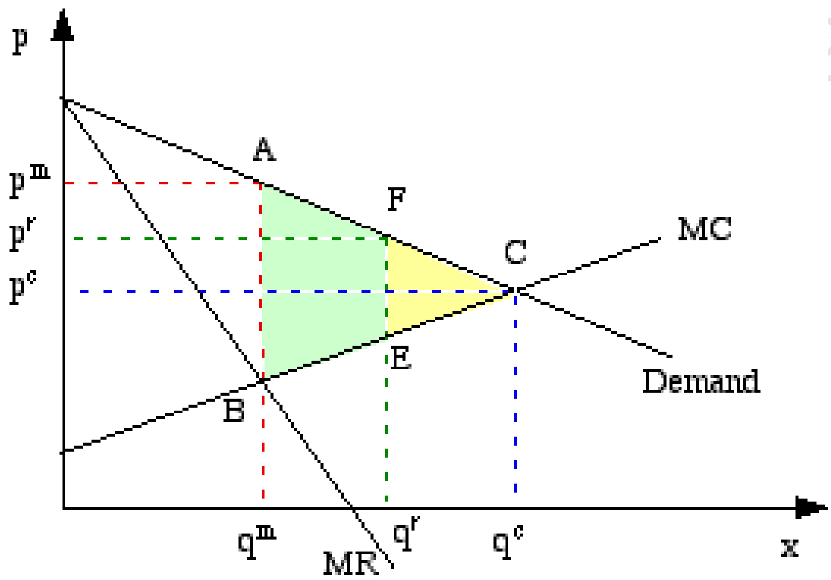
Deadweightloss: Monopolist expels consumers unable to pay $p^m \rightarrow$ aggregate consumption $\downarrow$ $(q^c - q^m)$ Remaining consumers pay higher price. Consumer surplus $\downarrow$ upper yellow triangle.

Monopolist sells q^m at higher price, but does not produce $(q^c - q^m)$ that could sell at a price $> MC \rightarrow$ Producer surplus $\downarrow$ lower yellow triangle.

Overall loss of efficiency: yellow triangle.

Regulation: may worsen situation if not adequate. BUT may improve situation if regulation is efficient.

Example: control on monopoly prices



Monopoly: $(P^m, q^m) \to$ welfare (deadweight) loss $= ABC$.

Government regulation: price cap $p^r \to q^r \to$ welfare (deadweight) loss $= FEC < ABC$.

Problem: Firm often multiproduct producer + demand and technology evolve $\to$ difficult to regulate properly.

Measuring monopoly power

♠ Firm level

Lerner index: $L_i = \frac{p_i - MC_i}{p_i} \in [0, 1)$

♠ Aggregate level

$$\mathcal{L}_k = \frac{\sum_{i=1}^{k} L_i}{k}$$

$$\mathcal{L}_a = \sum_{i=1}^{n} m_i L_i, \; m_i = \frac{q_i}{\sum_{i=1}^{n} q_i}$$

$$\mathcal{L}_g = \prod_{i=1}^{n} (L - I)^{m_i}, \; L_i \neq 0$$

5. R&D and technology transfer

R&D

- One of major use of funds by firms → develop new processes and/or products.

- Important element in competitive strategy of firms.

- Means to achieve an end.

Definitions

• Technology: "book" of specifications or blueprints of a process or product (engineering)
(i.e. something that if built/produced according to specifications will work).

→ isoquant: technically efficient frontier of all possible techniques using the set of inputs.

→ selection of technology according to relative prices of inputs (isocost).

• Innovation: first use of a new technology.

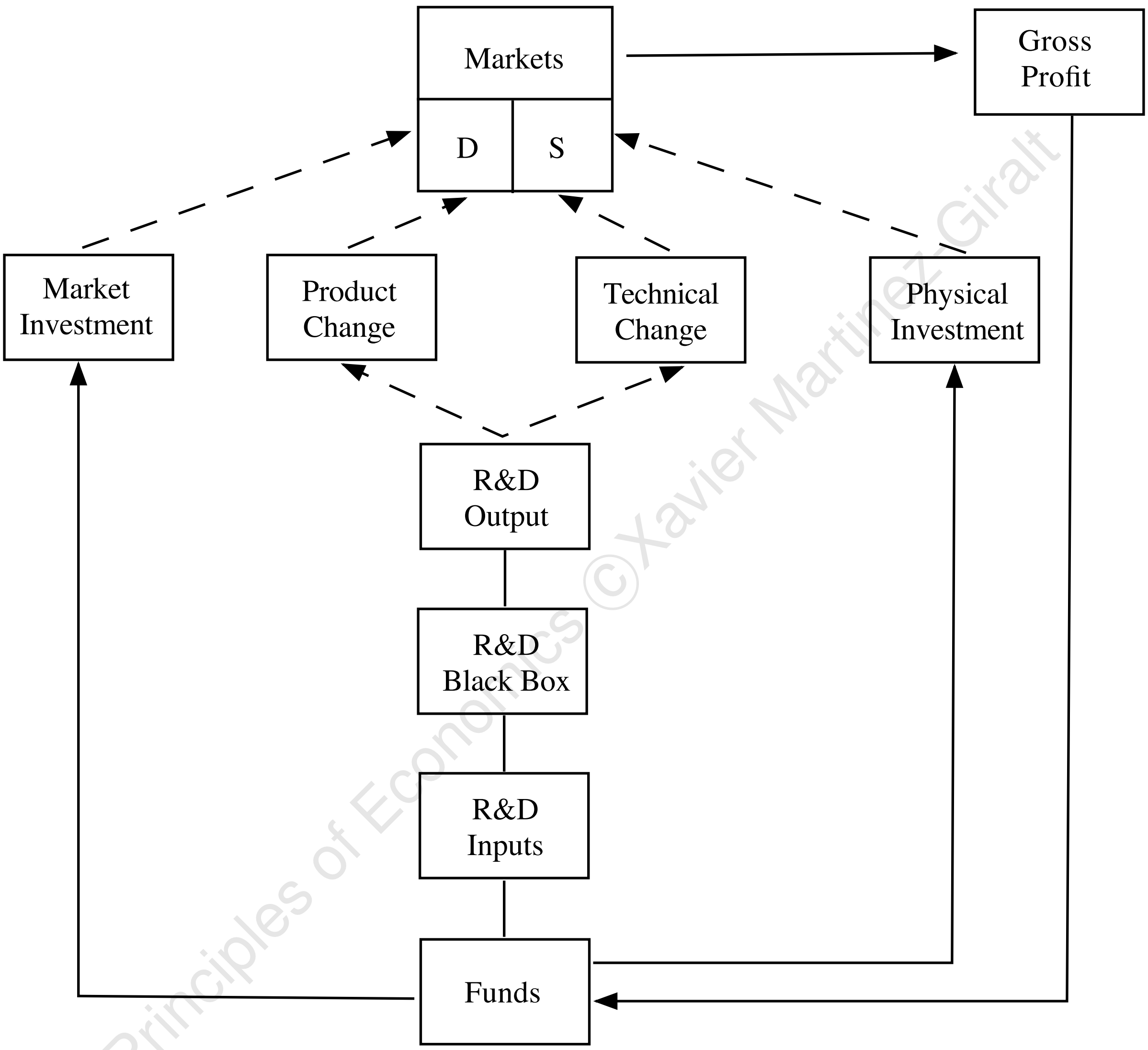
• Diffusion: spread of a (new) technology among users.

• Technological/product change: variation in the "book" of blueprints. Includes innovation and diffusion.

- Process innovation:

→ shift isocost: no R&D expenditure
→ shift isoquant: outcome of R&D investment.

Elements in the R&D expenditure decision



Total funds split in three uses:

- Market investment (advertising, ...)
- Physical investment (new plants, ...)
- R&D investment

R&D investment

• 2 sources of uncertainty:
- prospective stream of expected returns in market (see below)
- likelihood of success, cost, and time span $\longrightarrow$ project evaluation techniques.

• Expenses made on R&D inputs (scientists, research facilities, materials)

• R&D inputs "transformed" into R&D outputs (patents, significant inventions) through R&D "production function (black box).

• R&D output subject to test of market profitability.

Productivity of R&D effort: related to
- (a) scale of operation
- (b) technological opportunities of sector
- (c) management of firm, R&D unit, ...

(a) scale of operation

- indivisibilities in equipment → scale economies.
- pooling of risks of several projects → steadier flow of innovations → enables higher risk projects.
- parallel teams attraction for more and better researchers in better working conditions in wider array of projects.

(b) technological opportunities

Difficult to define. Proxies:
- distinction between science-based and traditional industries
- technological spillovers from R&D efforts of other firms

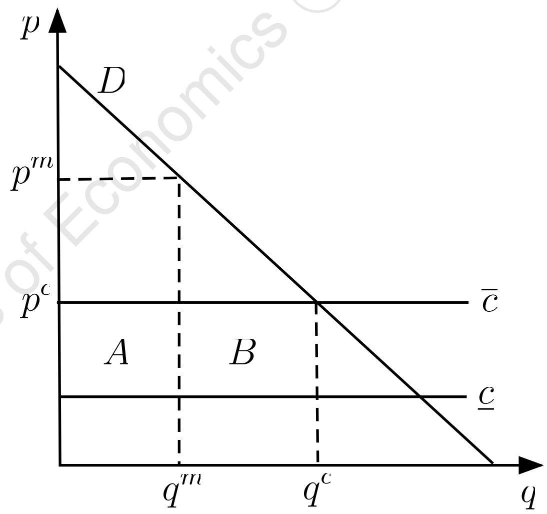
(c) management

- R&D complex activity involving wide range of managerial, behavioral and sociological influences.
- e.g. decision of in-house and outsourcing projects.

Market structure, capacity and incentives for R&D

2 views:

- Schumpeter (1950): large firms are the main source of R&D. They have more resources to invest and capital markets are imperfect (limiting borrowing capacity to small firms). Capacity argument
- Replacement effect: more competitive industries more incentives to mor R&D investment. Incentives argument



- Assume process innovation allowing $\overline{c} \rightarrow \underline{c}$.
- Under monopoly, innovation is worth

$$q^m(\overline{c} - \underline{c}) \equiv A$$

- Under perfect competition, initially all firms use $\overline{c}$ and get $\pi_i = 0$.
One firms obtains innovation $\longrightarrow \ \tilde{p} = \overline{c} - \varepsilon$, captures all market, and $\pi_{innov} = q^c(\overline{c} - \underline{c}) \equiv A + B$.
As initially, $\pi_{innov} = 0, \ A + B =$ value of cost-reducing innovation, and $A + B > A$.

Why?
Monopolist's *disincentive* created by pre-innovation monopoly profits,
Competitiors' pre-innovation profits =0.

However, argument not fully consistent. Under perfect competition, innovator becomes an ex-post monopolist in the short-run.
In the long-run (after patent expiration), imitation $\pi_i \longrightarrow 0$.

Hence, optimal market structure: form of dynamic competition involving some degree of monopoly power in the short-run.

Dynamics of R&D competition

• Timing of innovation crucial in the market place.

• Innovation has winners and losers: first to innovate gets an advantage over rivals (due to patents).

• Rivalry in innovation $\Leftrightarrow$ race over time: firm devoting most resources in the shortest period of time is on average (because of uncertainty), winner of race.

• Fundamental asymmetry between firms in the R&D race:
- some firms are patent-holders and/or incumbents in the market
-some other firms innovate to gain next patent and enter the market.

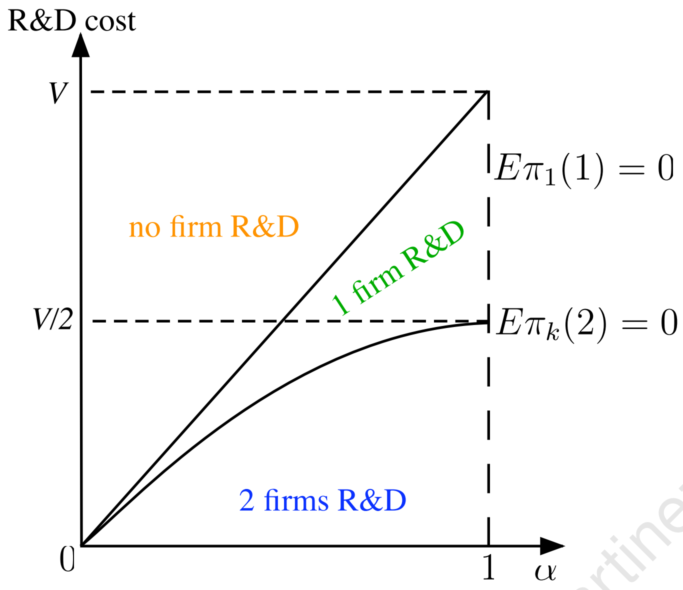
THUS, different firms have different incentives to win the patent race.

Patent races

- Industry with 2 firms deciding whether to engage in R&D.
- Investment of firm k : $i_k = \{0, I\}$.
- If $i_k = I$, innovation success with prob. α.
- If $i_k = I$ value of innovation= V if only successful; $V/2$ if both successful; 0 if failure.
- $E\pi_k(n)$: k's expected profit when $i_k = I$ and n firms innovating ($n = 1, 2$).

• Let $n = 1$.
Then, firm 1 invests if $E\pi_1(1) = \alpha V - I \geq 0$.
That is, low success probability (α) or high R&D cost (I) yield no R&D investment even under monopoly.

• Let $n = 2$.
Then $E\pi_k(2) = \alpha(1-\alpha)V + \alpha^2\frac{V}{2} - I$.
Both firms invest if $E\pi_k(2) \geq 0 \Leftrightarrow \frac{\alpha(2-\alpha)V}{2} \geq I$.



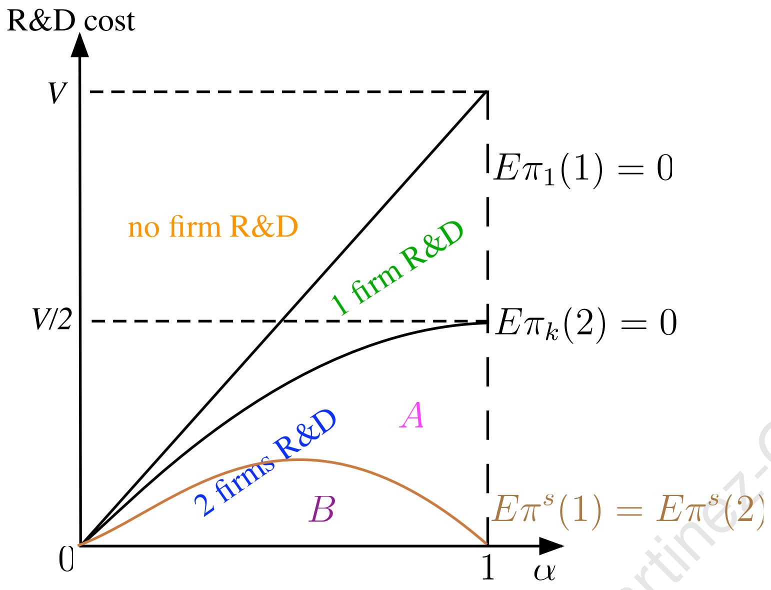
Socially optimal RD investment

From the society's viewpoint, $\triangle n$ increases probability of success, but also increases R&D costs. $\rightarrow$ trade-off.

Let $E\pi^s(n)$ denote the industry (social) expected profits when n firms do R&D.

• If $n = 1$, then $E\pi^s(1) = E\pi_1(1)$.
That is, when in equilibrium only one firm engages in R&D, it is also socially optimal.

• If $n = 2$, $E\pi^s(2) = 2\alpha(1-\alpha)V + \alpha^2 V - 2I$.
Then, $E\pi^s(2) \geq E\pi^s(1) \Leftrightarrow \alpha(1-\alpha)V \geq I$.
Thus, for $n = 2$ we distinguish 2 regions: A and B.



♠ Region A: Characterized by $E\pi^s(2) < E\pi^s(1)$ and $E\pi_k(2) > 0$.
A relatively low R&D cost makes it profitable for 2 firms to engage in R&D.
However, the duplication of the R&D cost offsets, from a social viewpoint, the benefits of the increased likelihood of success. This happens because individual firms do not take into account how their R&D affect rival firms' profits.

♠ Region B: Characterized by $E\pi^s(2) > E\pi^s(1)$ and $E\pi_k(2) > 0$.
Here R&D cost are low enough for the benefits of increased probability of success offset the R&D cost duplication.

Expected date of discovery

Assume the race just described is repeated until one firm actually obtains the innovation.
Let $ET(n)$ be the expected date at least one firm obtains the innovation when n firms do R&D.

- Let $n = 1$. Then,

$$\begin{aligned} ET(1) =& \alpha + 2\alpha(1-\alpha) + 3\alpha(1-\alpha)^2 + 4\alpha(1-\alpha)^3 + \ldots \\ =& \alpha \sum_{t=1}^{\infty} t(1-\alpha)^{t-1} = \frac{1}{\alpha}. \end{aligned}$$

- Let $n = 2$. Then,

$$\begin{aligned} ET(2) =& \alpha(2-\alpha) + 2\alpha(2-\alpha)(1-\alpha)^2 + \\ &+ 3\alpha(2-\alpha)(1-\alpha)^4 + \ldots \\ =& 2\alpha(2-\alpha) \sum_{t=1}^{\infty} t(1-\alpha)^{2(t-1)} = \frac{1}{\alpha(2-\alpha)}. \end{aligned}$$

Note:
- $\frac{\partial ET(n)}{\partial \alpha} < 0$. An ↑ in prob of success, shortens expected date of discovery.
- $ET(2) < ET(1)$. The more firms engage in R&D, the shorter the expected date of discovery.

Cooperation in R&D Antitrust legislation bans cooperation by firms in the final good markets. However, less clear in other dimensions.

Consider an economy with 2 firms deciding over investment i R&D and output levels in a 2-stage set-up:
- stage 1: firms simultaneously decide R&D investment;
- stage 2: firms simultaneously decide output levels.

Let q_i denote firm i's output level, and x_i its investment in R&D.

<u>Assumptions</u>
- Market demand: $p = 100 - (q_1 + q_2)$,
- Production unit cost function:
$c_i(x_1, x_2) = 50 - x_i - \beta x_j,\ \beta > 0$ [positive externality]
- R&D cost function: $TC_i(x_i) = x_i^2/2$.

Equilibrium concept: subgame perfect equilibrium

- Def.: An outcome is a SPE if it induces a Nash eq. in every subgame of the original game.

Solving methodology: backwards induction.

- take as given (x_1, x_2) and solve stage 2 $\rightarrow q_i^*(x_i, x_j)$
- plug-in $q_i^*(x_i, x_j)$ in $\pi_i(x_1, x_2)$ and solve stage 1.

Meaning of SPE

Firm i when deciding x_i (given its expectation on x_j), anticipates the consequences on its decision on q_i (given its expectation on q_j).

stage 2

Given (x_1, x_2), firm i solves

$$\max_{q_i} \pi_i(q_i, q_j) = q_i(100 - q_i - q_j) - c_i q_i.$$

F.O.C.

$$\frac{\partial \pi_i}{\partial q_i} = 100 - 2q_i - q_j - c_i = 0$$

Therefore,

$$q_i^*(x_1, x_2) = \frac{1}{3}[100 - 2c_i(x_1, x_2) + c_j(x_1, x_2)]$$

$$Q^*(x_1, x_2) = \frac{1}{3}[200 - c_1(x_1, x_2) - c_2(x_1, x_2)]$$

$$p = \frac{1}{3}[100 + c_1(x_1, x_2) + c_2(x_1, x_2)]$$

$$\pi_i^*(x_1, x_2) = \frac{1}{9}[100 - 2c_1(x_1, x_2) + c_2(x_1, x_2)]^2$$

stage 1 Decision on R&D investment. 2 alternatives

- non cooperative
- cooperative

Non-cooperative behavior

Firm i solves,

$$\max_{x_i} \pi_i(x_1, x_2) = \frac{1}{9}[100 - 2(50 - x_i - \beta x_j) + + (50 - x_j - \beta x_i)]^2 - \frac{x_i^2}{2}$$

$$= \frac{1}{9}[50 + (2-\beta)x_i + (2\beta - 1)x_j]^2 - \frac{x_i^2}{2}$$

yielding,

$$x_1^{nc} = x_2^{nc} = x^{nc} = \frac{100(2-\beta)}{9 - 2(2-\beta)(1+\beta)}$$

Note,

- $x^{nc} > 0$ if $\beta < 2$.

- $\frac{\partial x^{nc}}{\partial \beta} < 0$: ↑ means ↑ externality. Thus, firm i has less incentives to invest in R&D expecting to profit from investment of its rivals. *Prisoner's dilemma*→ less investment than optimal.

Cooperative behavior

Firms 1 and 2 solve

$$\max_{x_1, x_2}(\pi_1 + \pi_2)$$

yielding,

$$x_1^c = x_2^c = x^c = \frac{100(\beta + 1)}{9 - 2(\beta + 1)^2}$$

Note,

- $x^c > 0$ if $\beta < 1.125$ (aprox.).
- $\frac{\partial x^c}{\partial \beta} > 0$: Incentives are aligned. The higher the externality the higher the higher the effort to profit from mutual externalities.

In turn, it implies $\pi_1^c + \pi_2^c > \pi_1^{nc} + \pi_2^{nc}$. Also, given the symmetry of the model, $\pi_i^c > \pi^{nc}, \ i = 1, 2$.

Cooperative vs noncooperative behavior

Let $\beta \in (0, 1.125)$. Then,

$x^c > x^{nc} \Leftrightarrow \beta > 1/2$.

Also, $x^c > x^{nc} \Rightarrow Q^c > Q^{nc} \Rightarrow p^c < p^{nc}$.

Patents

Def.: Legal right granted by Government giving the inventor the sole right to exploit the invention for a given period of time.

Patent: 2 social goals
- provide incentives to produce know-how,
- spread info about new discoveries as fast as possible (thus avoiding duplication of R&D efforts).

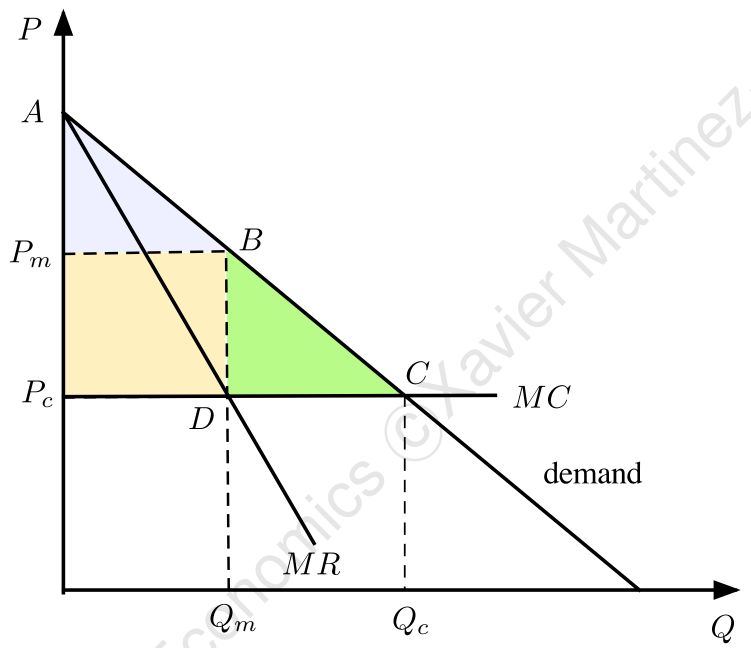
An invention to be protected by a patent must be
- novel,
- non-trivial,
- useful.

Effects of a patent

Distinguish
- during patent protection,
- close to patent expiration

Innovation under patent protection

Patent protection grants monopoly power to manufacturer → pricing rule: $P = MC \Rightarrow$ deadweight loss wrt perfect competitive pricing.



$CS(P_m) = AP_mB$

$CS(P_c) = AP_cC = AP_mB + P_mP_cDB + DBC$

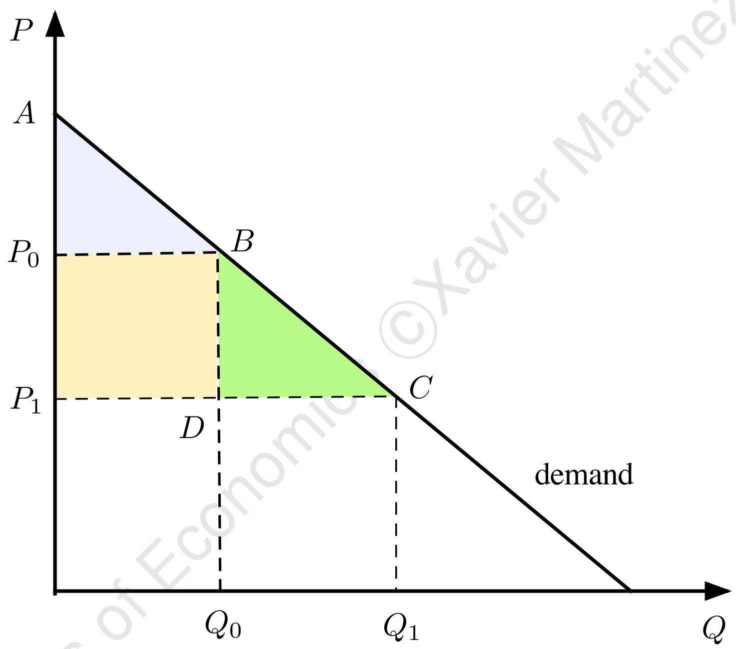
$\triangle CS = P_mP_cDB + DBC$, that is,

$\triangle CS$ transfer to firms $+ \triangle CS$ deadweight loss

In addition to consider CS, discussions of welfare effects must consider change in deadweight loss before and after the protection.

Innovation close to patent expiration

Argument: when patent expires, competition will lower prices → higher consumer surplus (proxy for social welfare)



$CS(P_0) = AP_0B$

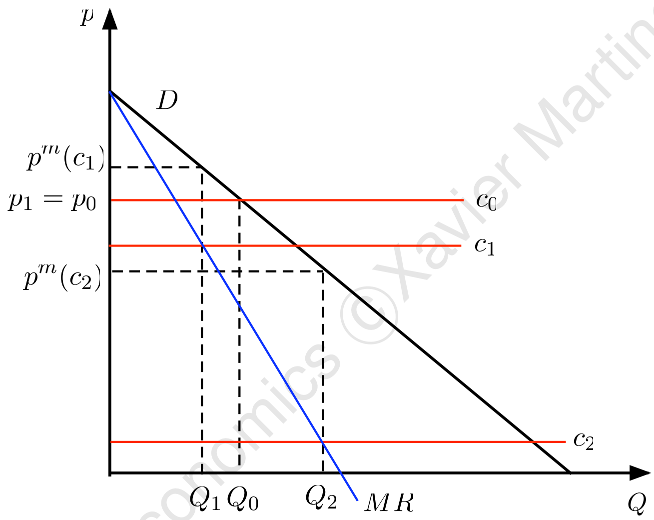
$CS(P_1) = AP_1C = AP_0B + P_0P_1DB + DBC$

$\triangle CS = P_0P_1DB + DBC$, that is,

$\triangle CS$ from ↓ price + $\triangle CS$ from ↑ consumption

Types of innovation

Consider a competitive economy with all firms using technology unit cost c_0.
In equilibrium, $p_0 = c_0,\ Q_0$, and $\pi_i = 0, \forall i$.
One innovator: $c < c_0$. As monopolist, max profits at $MR = c$. Let $p^m(c)$ denote monop. price for c.



Def.: Innovation is major if $p^m(c) < c_0$.
Let $c = c_2$. Innovator can undercut rivals charging monop. price for c_2.
Major innov. $\downarrow$ price and $\uparrow$ production $(Q_2 > Q_0)$.

Def.: Innovation is minor if $p^m(c) > c_0$.
Let $c = c_1$. Innovator cannot exploit monop. power.
It can only undercut with $p_1 = c_0 - \varepsilon$, captures all market (Q_0), and $\pi_i = (c_0 - c_1)Q_0 > 0$.

Optimal duration of a patent

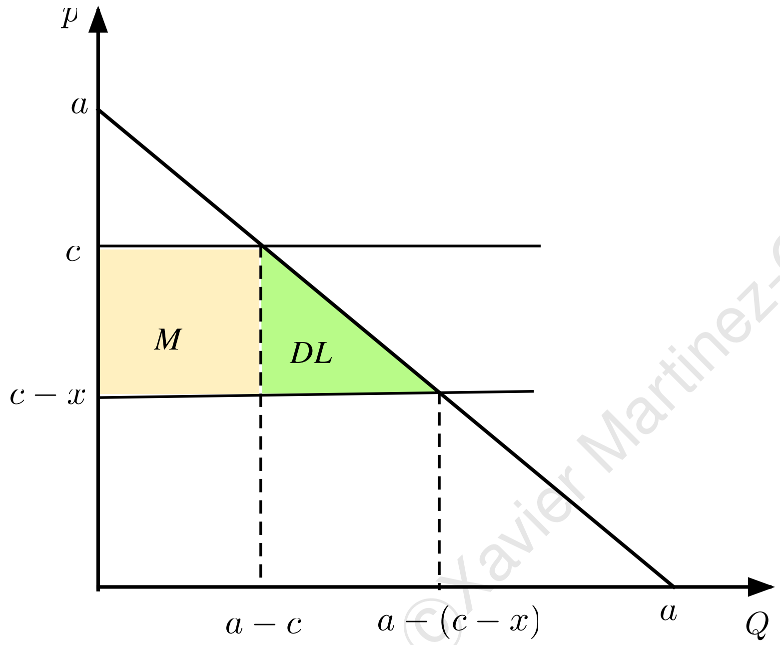
Fundamental issue in design of a patent system (US: 17 years; EU: 20 years)

To assess optimal value of T consider 2-stage game:
- stage 1: Govt determines T,
- stage 2: innovator obtains patent during T periods.

Consider a firm investing in R&D to obtain a cost-reducing innovation.

Assumptions and notation

- Investment of x yields innovation reducing firm's unit cost from $c > 0$ to $c - x$,
- Cost of R&D: $TC(x) = x^2/2$,
- Innovation is minor (i.e. profit max price is $p = c$),
- Market demand: $p = a - Q, \ a > c$,
- Discount factor: $\rho \in (0, 1)$,
- Innovator's present value of profits when investing x in $t = 1$: $\pi(x; T)$.



Area $M = (a - c)x$: innovator's profit gain.
Profit M is enjoyed during T periods. From $T + 1$ on $\pi_i = 0$.

Area $DL = x^2/2$: society's deadweight loss due to monopoly power held by innovator.
After T price falls to $c - x$, production expands, and $\uparrow$ in $CS = M + DL$.

Discounted present value (time value of money)

[money today is more valuable than money in the future by the amount of interest that money can earn.]

Compute the investment today at a return rate of 5%, so that in three years we will receive 100 EUR:

$$x(1.05)^3 = 100$$
$$x = \frac{100}{1.05^3} = 86.383759$$

In general, the present value of a capital K to be payed in n years at the interest rate r is given by,

$$x = \frac{K}{(1+r)^n} = \rho^n K$$

where $\rho = 1/(1+r)$ is called the *discount rate*.
Example:
- 1EUR at $r = 5\%$ in 10 years: $1.05^{10} = 1.629$

- present value in 10 years of weight control:

$$\frac{50}{1.629} = 30.69$$

- present value in 10 years of check-up:

$$\frac{200}{1.629} = 122.77$$

Solving the game

Stage 2: The innovator's problem

Innovator decides x to max present value of profits (recall profits after T are zero):

$$\max_x \pi(x;T) = \sum_{t=1}^{T} \rho^{t-1} M(x) - TC(x) =$$

$$= \frac{1-\rho^T}{1-\rho}(a-c)x - \frac{x^2}{2},$$

where $\rho = 1/(1+r)$.

The solution of this problem is

$$x^I = \frac{1-\rho^T}{1-\rho}(a-c).$$

Note

$$\frac{\partial x^I}{\partial T} > 0, \ \frac{\partial x^I}{\partial \rho} > 0, \ \frac{\partial x^I}{\partial a} > 0, \ \frac{\partial x^I}{\partial c} < 0.$$

Stage 1: The government problem

Society's welfare is $M(x)$ during T periods and $M(x)+DL(x)$ from $T+1$ on. The planner's problem is,

$$\max_T W(T) = \sum_{t=1}^{T} \rho^{t-1} M(x^I) + \sum_{T+1}^{\infty} \rho^{t-1} DL(x^I) - \frac{(x^I)^2}{2} =$$

$$= \frac{(a-c)x^I}{1-\rho} - \frac{(x^I)^2}{2} \frac{1-\rho^T}{1-\rho}.$$

The solution of this problem, T^*, depends on the characteristics of the demand function, the production cost, and the cost of R&D function.

We can prove the following (important) result:
The optimal time span of a patent is finite, $T^* < \infty$.
Compute,

$$W(1) = \frac{(a-c)^2}{1-\rho} - \frac{(a-c)^2}{2}$$

$$W(\infty) = \frac{(a-c)^2}{(1-\rho)^2} - \frac{(a-c)^2}{2(1-\rho)^3}$$

and verify $W(1) > W(\infty)$.

Transfer of technology

- Over 80% of patented inventions are licensed to other firms.

- 2 questions:

• why should an innovator be willing to give access to its innovation to a competitor?

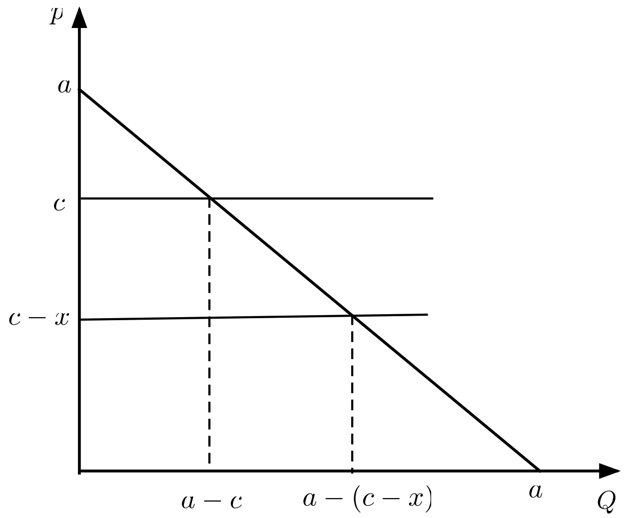
• Elements in the license contract design? (see chapter 9)

Consider a 2-firm economy withy demand $p = a - Q$. Initial technology, unit cost c, and R&D cost is $TC(x) = x^2/2$.

Assume firm 1 obtains a minor cost-reducing innovation, $c_1 = c - x$.

Assume firm 1 charges firm 2 a *per unit fee* ϕ for every unit sold by firm 2.

How does firm 1 determines ϕ?



• Fim 2's gain from using new tech = $c-(c-x) = x$.

• Therefore, if firm 1 sets $\phi = x$ will leave firm 2 indifferent between accepting or rejecting the contract. Assume, $\phi = x - \varepsilon$.

• Firm 2 faces cost $c_2 = c - x - \phi \approx c$. Therefore, in equilibrium firm 2 does not change its production $q_2 \to$ profits remains the same.

• However, firm 1 obtains all the surplus generated by new technology, $\pi_1(c_1, c) + q_2(c_1, c)\phi$.

Summarizing

When firms decide production levels, welfare increases when the innovator licenses a minor cost-reducing discovery (Q remains unchanged $\to$ P remains unchanged $\to$ CS remains unchanges. Also, π_2 remains unchanged, but π_1 increases.

6. Externalities

A good shows externalities when it generates third-party effects *outside the price system*

- positive: vaccination of my neighbors on my chances to get infected, spillovers of R&D, etc.

- negative: pollution, neighbor's loud music, etc.

Competitive market only considers private costs and benefits, not social ones $\rightarrow$ inefficiency:
negative externalities $\rightarrow$ overproduction;
positive externalities $\rightarrow$ underproduction.

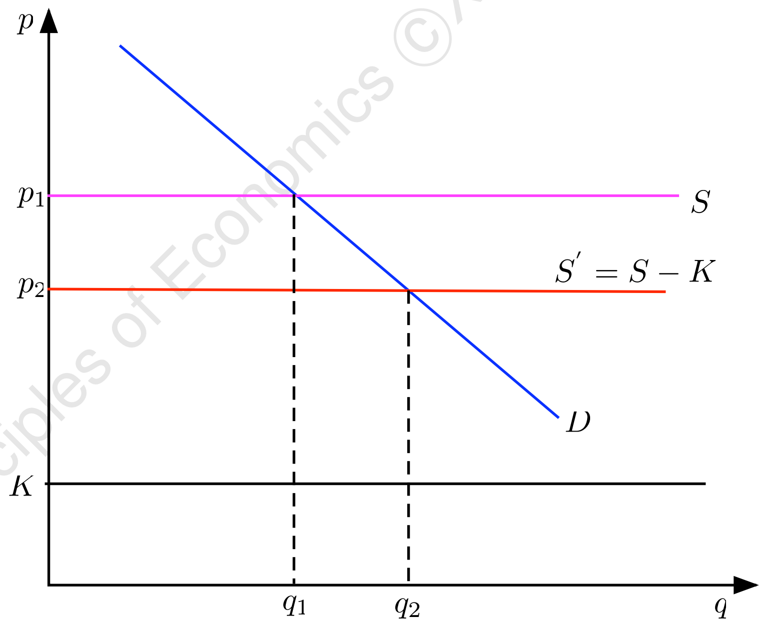
Example: market of vaccination.

D: demand (marginal private benefit)
S: supply (marginal private cost)
K: marginal external benefit

Initial situation: Competitive allocation A. $\rightarrow$ inefficient under positive externality K:
marg. social benefit $= D + K > S =$ marg. social cost (=private social cost)

Government intervention: direct subsidy to producers of K €$\rightarrow$ supply shifts to $S^{'} = S - K$.

New equilibrium allocation: q_2 at price p_2 $\rightarrow$ efficient.



7. Merit goods

Commodities that are "good" regardless of each individual's preferences: arts, compulsory education, compulsory social insurance, ...

Govt. regulation: promotion of their consumption.

Incomplete markets

Private insurers may not provide coverage for some illnesses: AIDS, cancer, ...

Govt. regulation: public provision of insurance, compulsory contracts on private insurers.

8. Uncertainty, Risk and Insurance

Individual: income Y, Utility $U(Y)$.

Two states: success, failure (prob. p) $\longrightarrow\ Y_s, Y_e$

"Expected income": ex-ante average income weighted by p: $E(Y) = pY_e + (1-p)Y_s$

"Expected utility": ex-ante average utility weighted by p: $E(U) = pU(Y_e) + (1-p)U(Y_s)$

Individual behavior facing probability of failure?

Distinguish Uncertainty and Risk

Def.: Risk

Individual can assign probabilities to the different states he may face.

Def.: Uncertainty

Probabilities of the different situations are exogenous.

example 1 *(Risk)*: 2 lotteries

1. Careless driver:

Prob 1/10,000 $\rightarrow$ accident

Prob 9999/10,000 $\rightarrow$ no accident

2. Careful driver:

Prob 1/100,000 $\rightarrow$ accident

Prob 99,999/100,000 $\rightarrow$ no accident

Remarks

1. Driving style is a choice variable.

2. Occurrence of accident no proof of careless driving.

3. Occurrence of acccident is observable.

Example 2 *(Uncertainty)*: 2 lotteries

1. Good researcher:

Prob 1/100 $\longrightarrow$ bad project

Prob 99/100 $\longrightarrow$ good project

2. Worse researcher:

Prob 2/100 $\longrightarrow$ bad project

Prob 98/100 $\longrightarrow$ good project

Remarks

1. “Researcher ability” is not choice variable.

2. Occurrence of bad project no proof of lack of ability.

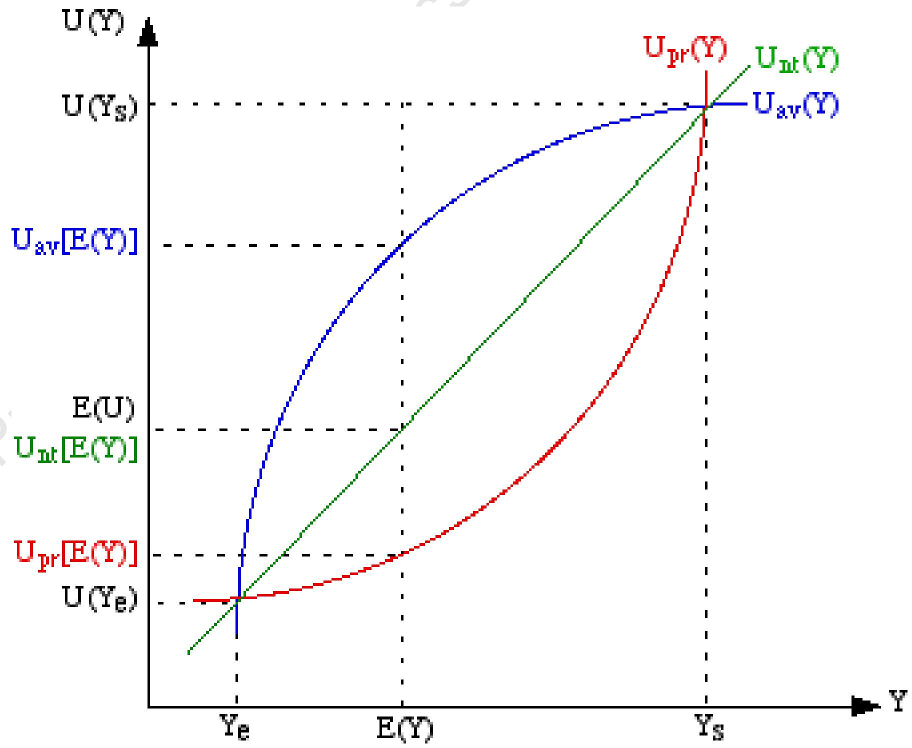
3. Bad project is observable.

Three attitudes towards risk. Two alternatives: participate in a risky situation $\rightarrow E(U)$; do not participate $\rightarrow U(E(Y))$.

Def.: Risk aversion: $E(U) < U(E(Y))$.

Def.: Risk neutrality: $E(U) = U(E(Y))$.

Def.: Risk preference: $E(U) > U(E(Y))$.



Example 1: tossing a coin

Individual: $Y = 49$ €, $U(Y) = \sqrt{Y}$.

Alternative 1. Participate in a lottery: toss a coin.

If win $\rightarrow$ 98 €. If loss $\rightarrow$ 0 €.

Cost of participation: 49 €.

Expected utility:

$$E(U) = \frac{1}{2}U(49 + 98 - 49) + \frac{1}{2}U(49 - 49) = \frac{1}{2}U(98) + \frac{1}{2}U(0) \approx 4.9497$$

Alternative 2. Do not participate $\rightarrow U(49) = 7$

Conclusion: $E(U) < U(E(Y))$. Risk averse individual decides not to participate.

Remark: $U(Y)$ is strictly concave.

How can the individual be induced to participate?

- △ payment if winning: e.g. 256 €

$$E(U) = \frac{1}{2}U(49 + 256 - 49) + \frac{1}{2}U(49 - 49) = \\ \frac{1}{2}U(256) + \frac{1}{2}U(0) = \\ \frac{1}{2}16 = 8 > 7$$

-▽ participation cost: e.g. 24 €

$$E(U) = \frac{1}{2}U(49 + 98 - 24) + \frac{1}{2}U(49 - 24) = \\ \frac{1}{2}U(147) + \frac{1}{2}U(25) \approx \\ \frac{1}{2}12.1243 + \frac{1}{2}5 \approx \\ 6.0622 + 2.5 \approx 8.56232 > 7$$

Remark: either way implies rising the expected value of the lottery. The seller of the lottery tickets would make a loss for sure if selling many tickets!

Example 2: contracting insurance

Individual with assets valued 21000 €.

Probability of losing 600 €= 1%

Probability distribution:

$$\begin{cases} 1\% \longrightarrow 15000 \text{ €} \\ 99\% \longrightarrow 21000 \text{ €} \end{cases}$$

Insurance: alter probability distribution

Insurance contract:

- indemnity = 6000 €
- premium = 60 €

New probability distribution:

$$\begin{cases} 1\% \rightarrow 20940 \text{ €}(= 21000 - 6000 + 6000 - 60) \\ 99\% \rightarrow 20940 \text{ €}(= 21000 - 60) \end{cases}$$

Equal wealth in both states of nature: Individual fully insured against loss.

Risk aversion $\rightarrow$ contract insurance.

★Demand of insurance

Recall:

- Individual: income Y, Utility $U(Y)$ concave.
- Two states: success, failure (prob. p) $\rightarrow$ Y_h, Y_s
- L loss of income if failure.
- Protection against loss L $\rightarrow$ insurance indemnity: Z € when failure. Premium: αZ €.

How much insurance to buy? (i.e. choose the value of Z to max $E(U)$)

$$Y_s(Z) = Y - L - \alpha Z + Z = Y - L + (1-\alpha)Z$$
$$Y_h(Z) = Y - \alpha Z$$

Formally,

$$\max_Z E(U) = pU(Y_s) + (1-p)U(Y_h)$$

Solution:

$$\frac{\partial E(U)}{\partial Z} = p\frac{\partial U}{\partial Y}\Big|_{Y_s}\frac{\partial Y_s}{\partial Z} + (1-p)\frac{\partial U}{\partial Y}\Big|_{Y_h}\frac{\partial Y_h}{\partial Z}$$
$$= (1-\alpha)p\frac{\partial U}{\partial Y}\Big|_{Y_s} - \alpha(1-p)\frac{\partial U}{\partial Y}\Big|_{Y_h} = 0$$

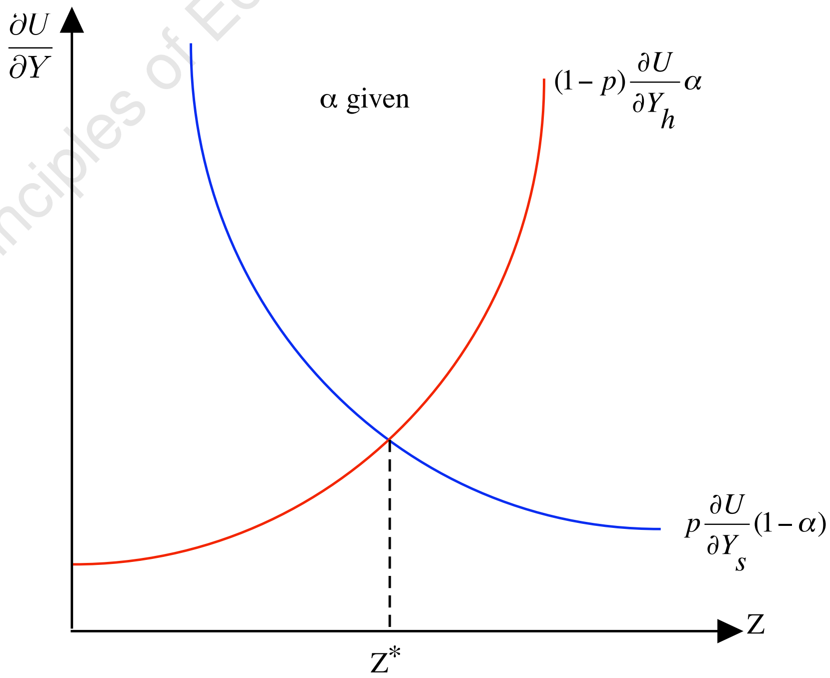
Interpretation

Concave utility $\rightarrow$ decreasing marginal utility.

♠ Each extra euro of coverage implies higher income when failure. But expected marginal utility of each extra euro of coverage diminishes. Formally, $p\frac{\partial U}{\partial Y_e}(1-\alpha)$ diminishes as Z increases (marginal benefit).

♠ Each extra euro of coverage implies higher cost (less income) when success. Thus, marginal income increases. Formally, $(1-p)\frac{\partial U}{\partial Y_s}\alpha$ increases as Z increases (marginal cost).

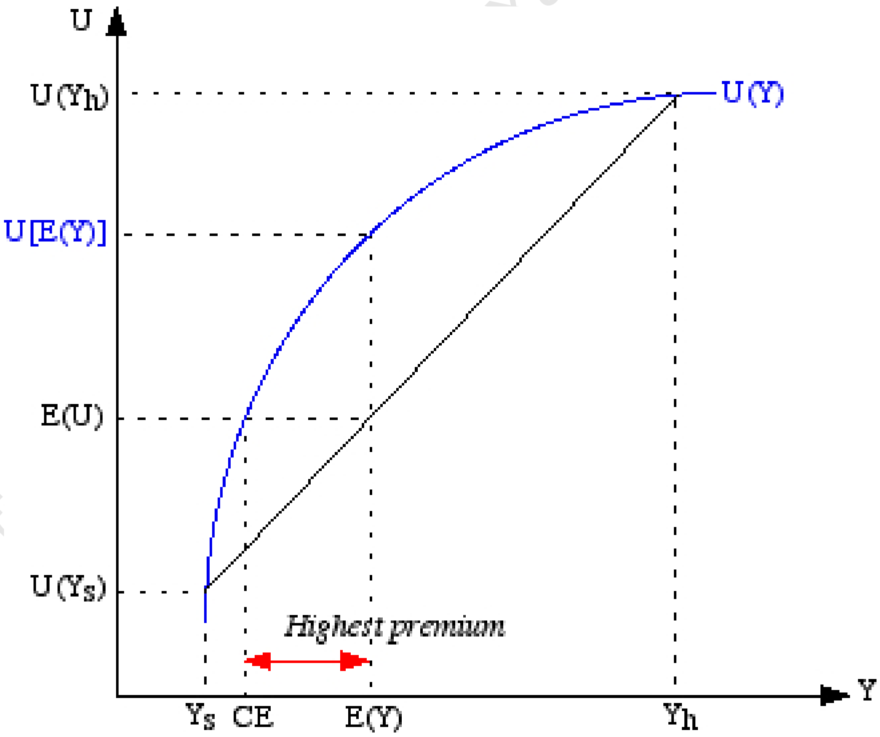
♠ Combination of these two opposite effects determines optimal demand of insurance.



Highest premium willing to pay?

Def.: Certainty equivalent (CE). Level of income whose utility is equal to expected utility, $U(CE) = E(U)$.

Highest premium $= E(Y) - CE$



★Supply of insurance

Z^* depends on α. In turn, α is a decision of insurance company. Such decision depends on the structure of insurance market.

Assumption: perfectly competitive market.

Expected profit = premia - indemnity payments

$$E(B) = (1-p)\alpha Z - p(1-\alpha)Z = Z(\alpha - p)$$

Problem: determine α solution of $E(B) = 0 \rightarrow$ fair premium. Thus,

$$\widehat{\alpha} = p$$

Interpretation
The *fair premium* is equal to the probability of failure. If insurer sets lower premium will incur (expected) losses. If insurer sets too a high premium will obtain (expected) extra profits $\rightarrow$ new entrants offering lower premia.

[Oligopoly: solve $\max_\alpha E(B)$]

★Equilibrium of the insurance market

- Demand: [marginal benefit = marginal cost]

$$p(1-\alpha)\frac{\partial U}{\partial Y}\bigg|_{Y_s} = \alpha(1-p)\frac{\partial U}{\partial Y}\bigg|_{Y_h}$$

- Supply

$$\alpha = p$$

Therefore, $p(1-\alpha) = \alpha(1-p)$, and market equilibrium is characterized by

$$\frac{\partial U}{\partial Y}\bigg|_{Y_s} = \frac{\partial U}{\partial Y}\bigg|_{Y_h}.$$

Equality only satisfied when $Y_s = Y_h$, i.e.

$$Y - L + (1-\alpha)Z = Y - \alpha Z, \quad \text{or}$$
$$Z^* = L.$$

The individual optimally fully insured against expected loss.

9. Contract theory

Introduction

So far, market failure $\longrightarrow$ mkt power, $\triangle$ returns, public goods, externalities.

New element of analysis: private information (asymmetric, imperfect).

What is a contract?
- credible commitment between two parties specifying responsibilities and payments under all contingencies.
- Bilateral agreement: credible commitment s.t. contracting party (*principal*) delegates in contracted party (*agent*) decision making, against a payment.

Elements of a contract:
$\diamondsuit$ Principal: offers contract; verifiable variables
$\diamondsuit$ Agent: if accepts, performs effort for Principal.

Perfect agent: manager as perfect agent for the owner takes decisions (R&D investment) "as if" (s)he would be the very owner taking decisions should (s)he have the same information as the manager.

- If there is no conflict, the agent behaves as if (s)he would be the principal rather than himself.
- If conflict of interest, problem for the principal: make sure that the agent (manager) respects the interest of the principal (owner).
- Usual scenario: conflict of interest between principal and agent.

Conflict of objectives:

♠ salary: income for agent, cost for principal

♠ effort: benefits principal, costly for agent

INFORMATION?

Complete (perfect), incomplete (imperfect), symmetric (public), asymmetric (private)

Definitions

Perfect information: at each move, party knows history of decisions so far.

Imperfect information: not perfect.

Complete information: every party knows all relevant information about other party.

Incomplete information: ∃ party uncertain about other party's behavior, i.e. there are random elements in the relationship.

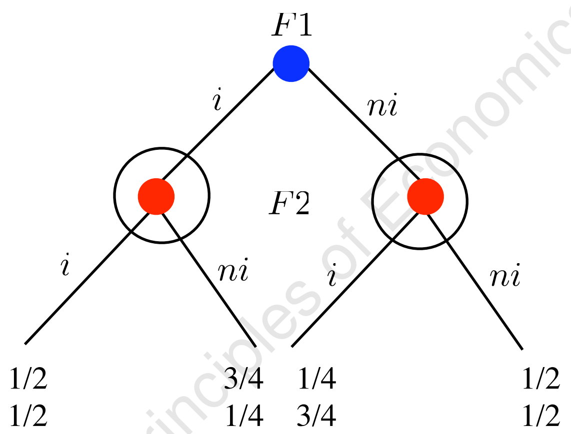
Symmetric information: all parties have exactly the same information;

Asymmetric information: One party has more information than the other party.

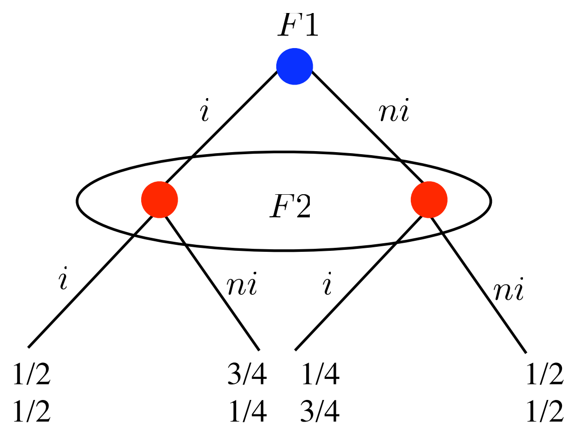
Illustration 1: complete information

2 firms deciding whether or not, investing in R&D.

Payoff: profits.



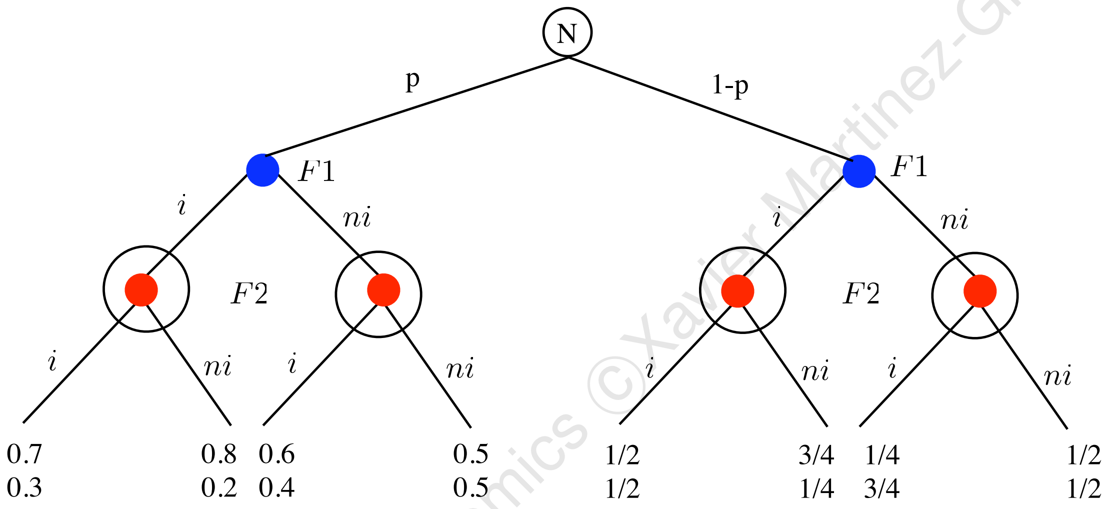
Complete and perfect information



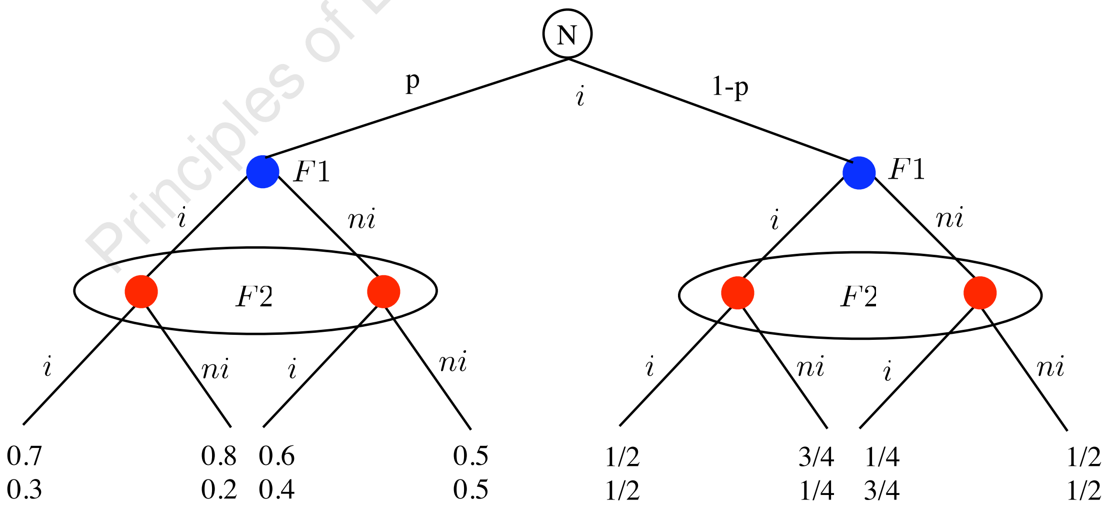
Complete and imperfect information

Illustration 2: incomplete information

F1 may be aggressive (pr. p) or soft (pr. $(1-p)$). Nature determines. F2 does not know attitude F1.



Incomplete and perfect information



Incomplete and imperfect information

Asymmetric info and conflict of objectives. Example

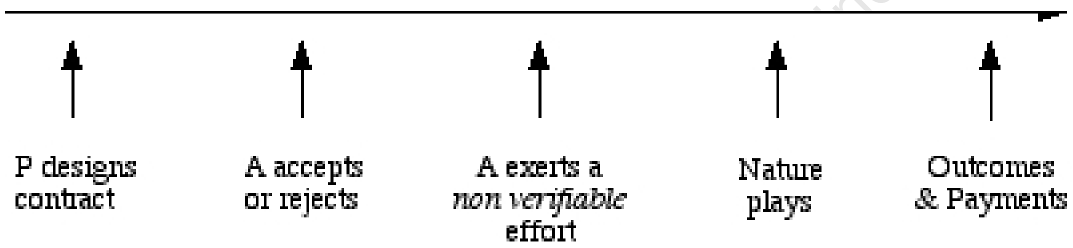
Owner (principal) contracts manager (agent) to defend interests of firm.
Owner cannot perfectly control manager's decisions.
Contract cannot be based on manager's behavior (not verifialble).
Owner does not have info on manager's characteristics.
Manager can exploit his informative advantage to his own benefit, instead of hospital's.

Aim: study relation between two individuals, where one of them has an informative advantage over the other and their objectives are not aligned. $\Longrightarrow$
Provision of incentives to reach objective.
If interests would coincide, info would be communicated eliminating asymmetry.

3 topics:
moral hazard
adverse selection
signalling

Moral hazard

In a moral hazard situation both parties have the same info at the moment of signing the contract, BUT afterwards the agent receives private info. The principal cannot observe (verify) the effort (action) exerted by the agent.



Source: Macho-Stadler et al. (1994, p. 21)

Examples

★ labor contracts: publisher representative to sell books. Only verifiable element: # books sold. Effort (# hours visiting clients) not verifiable by publisher → payment cannot be dependent on effort.

★ hospital: manager contracted to control costs. If fixed payment → insufficient effort.

★ researchers: research center contracts researcher in a project. → difficult to distinguish a thinker from a dreamer. Fixed payment → little incentives to think.

Example 1. Public school with retrospective budget $\longrightarrow$ little incentives for cost containment
Naïve solution: prospective budgets.

Example 2. Fully insured driver $\longrightarrow$ little incentive for careful driving.
Naïve solution: "bonus-malus" system

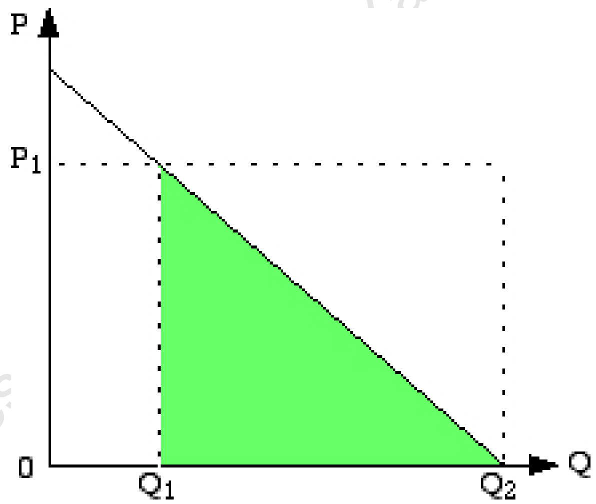
Example 3. Fully insured physician $\longrightarrow$ little incentive to exert the (costly) efficient level of effort to obtain best diagnostic.
Naïve solution: make physician responsible for diagnostic errors. Reputation (cf. TV series "House")

Naïve solutions because too much risk on the agent:
(i) public school may have high costs because unexpected $\triangle$ students, repair works ...(and for lack of effort)
(ii) driver may be unlucky on one occasion along the year.
(iii) physician may obtain a wrong diagnostic by accident.

Effect of a deductible

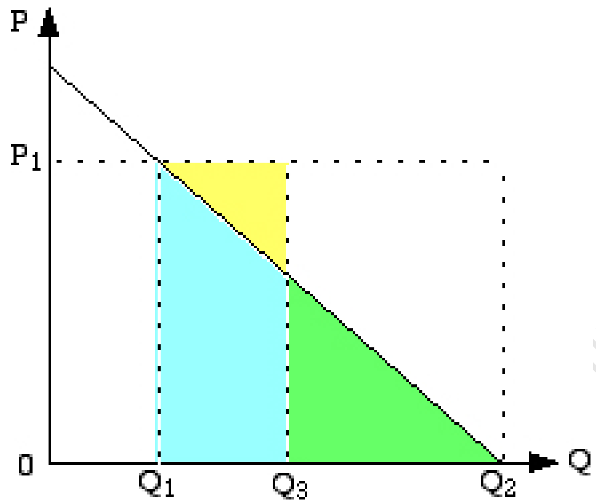
Assume insurance contains a deductible of D € (Cost borne by insuree before insurer starts covering expenses). Individual compares the level of services obtained after paying the deductible (Q_2) and without insurance (Q_1).

Example



★ p: prob "accident"
★ $D = P_1 Q_1$
★ individual obtains Q_2 paying D
★ benefit: area under demand curve between Q_2 and Q_1 (green area)

Insurer ΔD to $D' = P_1Q_3$. Will the individual buy the insurance?



♣ △ payment if accident = $P_1(Q_3 - Q_2)$ (blue+yellow)

♣ benefit: area under demand curve between Q_2 and Q_1 (blue+green)
♣ Summary:
- expense increase: yellow
- benefit increase: green

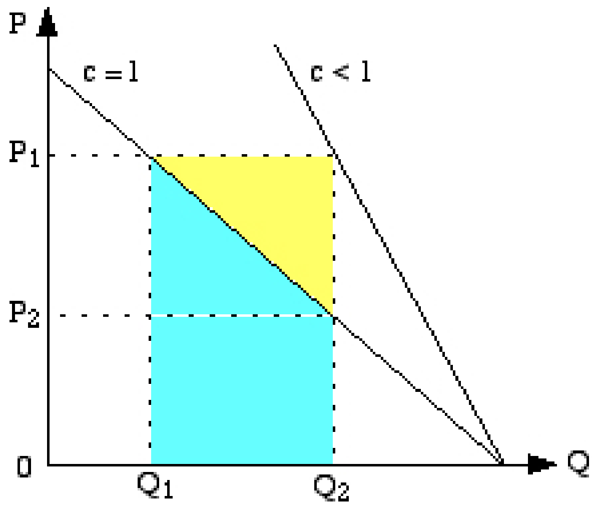
Conclusion:
If green $>$ yellow $\rightarrow$ contract insurance with deductible D'.

Too a high deductible $\rightarrow$ eliminates incentives to contract insurance

Effects of a copayment

Initial situation: no insurance (P_1, Q_1)

Contract insurance with copayment $c \in (0, 1) \Rightarrow$ Demand increases $Q_1 \rightarrow Q_2$

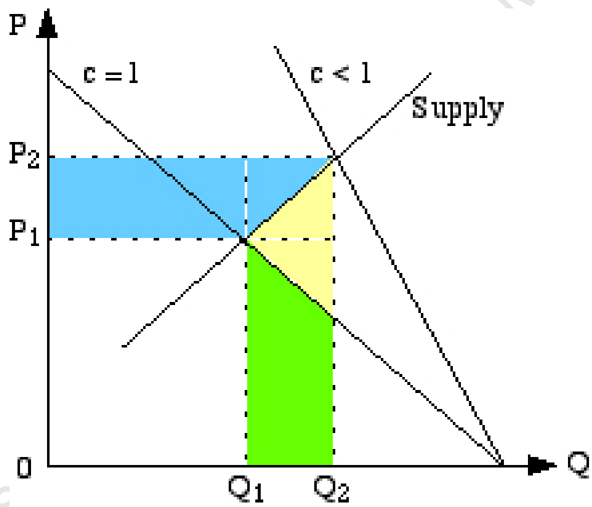


Value of services = $P_1 Q_2$
Δ expenditure = $P_1(Q_2 - Q_1)$ (blue+yellow)
Δ benefit = area under demand curve between Q_2 and Q_1 (blue)
Triangle yellow: welfare loss $\rightarrow$ Individual demands more insurance services than optimum.

Interpretation
Insurance $\rightarrow$ consumer "as if" ignorant real cost of health services $\rightarrow$ distortion in resource allocation between demand for insurance and other goods.

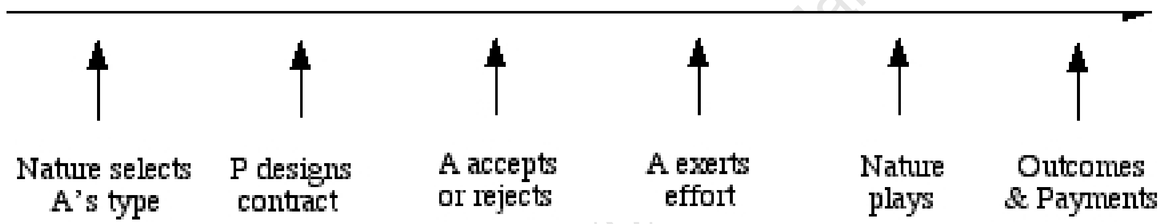
Copayment and market equilibrium

Initial situation: no insurance (P_1, Q_1) with demand = supply
Contract insurance with copayment $c \in (0, 1) \Rightarrow$
Demand increases $Q_1 \rightarrow Q_2$
New equilibrium: (P_2, Q_2).



$\triangle$ expenditure = $P_2Q_2 - P_1Q_1$ (blue+green+yellow)
resource allocation distortion:
$\triangle$ benefit induced by copayment = green
$\triangle$ costs additional demand = blue
Deadweight loss from overproduction of insurance services = yellow

Adverse selection appears in situations where the agent has private information before signing the contract. In this case the principal can verify the agent's behavior. Principal knows there are several types of agents but cannot identify it at the moment of the contract.



Source: Macho-Stadler et al. (1994, p. 23)

Examples

★ Insurance company may face a potential client with high or low risk. Insurer can design a contract for each type of insuree, but does not know *ex-ante* which is the optimal one.

★ Regulation of a public monopoly. Theory: price to marginal cost and cover fixed cost with a transfer. → monopoly knows better its cost function than regulator. Regulator includes monopolist informational advantge in the design of the contract (transfer, price).

Asymmetric info may cause the market to perform poorly, and even disappear.

Asymmetric info, key element in insurance and health care markets.

Illustration: Akerlof's (1970) lemons market.

Used-cars on sale with $\neq$ qualities.
Sellers know about qualities better than buyers.
Lemons principle: Good cars are driven out of the market by the lemons

Simplified Akerlof's example (FGS, 2004, ch. 9):

- 9 used-cars qualities$= (0, \frac{1}{4}, \frac{1}{2}, \frac{3}{4}, 1, 1\frac{1}{4}, 1\frac{1}{2}, 1\frac{3}{4}, 2)$
- Uniform prob. of picking a car $(= \frac{1}{9})$
- Sellers know quality
- Buyers only know distr. qualities
- Reservation value to sellers= 1000 €/unit quality
- Reservation value to buyers= 1500 €/unit quality
- Auctioneer calls out market prices
- Sale at a price s.t. D=S

Let $p = 2000€$ per car

• Supply:
Sellers willing to sell each car if for each car, price/unit q$\equiv \widehat{p} \geq 1000 \times q$ of car.

car (Q=2)$\rightarrow \widehat{p} = \frac{2000}{2} = 1000€ \rightarrow$ S=9.

• Demand:
Average quality=1;
Buyers willing to buy if $p \leq 1500 \times 1 = 1500$;

(price)$2000 > 1500$(res.value) $\rightarrow D = 0$.

Let $p = 1500$€ per car

• Supply:
Sellers willing to sell each car if for each car, price/unit q$\equiv \widehat{p} \geq 1000 \times q$ of car.

car (Q=2)$\rightarrow \frac{1500}{2} = 750$€ per unit of quality.
car (Q=1.75)$\rightarrow \frac{1500}{1.75} = 875$€ per unit of quality.
car (Q=1.5)$\rightarrow \frac{1500}{1.5} = 1000$€ per unit of quality.
$\rightarrow$ S=7 cars; average quality = 3/4.

• Demand:
Average quality=3/4;
Buyers willing to buy if $p \leq 1500 \times \frac{3}{4} = 1125$;
(price)$1500 > 1125$(res.value) $\rightarrow D = 0$.

etc, etc.

<u>Conclusion:</u>
Under asymmetric info, $\nexists p$ at which $D = S$.

Why? Lemons principle.

Assume symmetric info:

Buyers and sellers only know average quality ($\bar{q} = 1$).

Let $p = 1500$€ per car

• Supply:
Sellers willing to sell if $p \geq 1000 \times \bar{q} = 1000$;
(price)$2000 > 1000$(res.value) $\rightarrow S = 9$.

• Demand:
Average quality=1;
Buyers willing to buy if $p \leq 1500 \times 1 = 1500$;

(price)$1500 = 1500$(res.value) $\rightarrow D = 9$.

Equilibrium price of 1500 € and 9 cars are sold.

Adverse selection and the insurance market

Football player has more info on his real ability (value of his legs) than insurer.
Player insurance against (unknown) prob p of injury.

If insurer ignores this fact, and sets premium according to average player statistics $\rightarrow$ losses. Why?
- high risk (quality) players more interested in contracting insurance $\rightarrow$
- insurer's customers will be a biased population sample.

Insurers anticipates it $\rightarrow$ contracts with higher premia. Low risk (quality) players do not contract insurance: Exclusion

Conclusion: asymmetric info $\rightarrow$ inefficient resource allocation.
★ ind. do not know their p $\rightarrow$ insurance against risk.
★ If insurer offers same contract to everybody $\rightarrow$
- low risk indiv, too high premium $\rightarrow$ underinsurance
- high risk indiv, too low premium $\rightarrow$ overinsurance.

Solutions

Solution 1: Screening

Insurer offers menu of contracts:
- i) contract with high coverage and high premium;
- ii) contract with low coverage and low premium

Consequence: self-selection:
- low risk indiv, $\longrightarrow$ contract ii)
- high risk indiv, $\longrightarrow$ contract i).

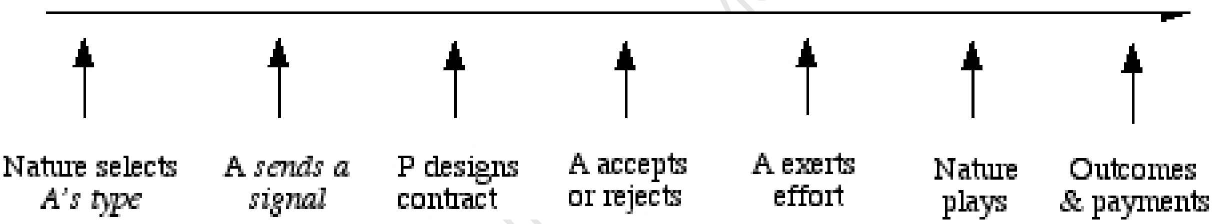
Problems

1. Argument OK if insurer is monopolist. $\nexists$ eq. if competition.
2. Even when $\exists$ eq, it is inefficient: low risk indiv. overinsured.

Solution 2: Signaling

Signaling

Similar situation to adverse selection. After knowing his type and before signing the contract, the agent may send a signal observable by the principal.

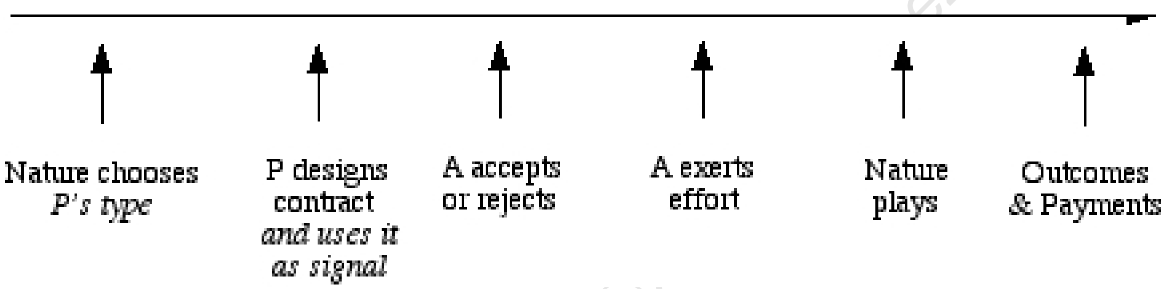


Source: Macho-Stadler et al. (1994, p. 24)

Example

★ Manager shows credentials (Ph.D., etc) as signal of ability when being contracted by owner. Also hangs from the walls of his office credentials so that owner and visitors can see them.

Alternatively, the principal may posses private info that transmits to the agent through the contract design.



Source: Macho-Stadler et al. (1994, p. 25)

Example

★ University Dpts in job market include “goodies” in offers as signals of quality.

What is a signal? investment to disclose some info (the “type”) yielding some advantage over keeping it secret.

Solution 2: Signaling

Low risk indiv. willing to show they are low risk: e.g. volunteer medical reports.
⇒ Signaling theory

Problem
high risk indiv. want to look like low risk imitating their signals.

Consequence
- Insurers very cautions in interpreting signals
- As signaling is costly, low risk indiv. may prefer not to signal.

Equilibria: 2 types
(i) Separating equilibrium
(ii) Pooling equilibrium

(i) Separating equilibrium

Appears when signaling is very costly for high risk indiv. →
- high risk indiv. do not imitate
- Insurer takes signals serously
- low risk indiv. obtain better contracts
- signaling attractive for low risk indiv.

(ii) Pooling equilibrium

Appears when imitation is not very costly →
- Insurer ignores signals
- Signals are useless
- Nobody signals

Problem (technical, but important)

Even with high signaling costs, often also exist pooling equilibria.

Examples:
- Corporation places add looking for "young graduate" → education as a signal of ability
- Physicians' ability hard to know by patient.

10. Pricing

We already know:

• (perfectly) competitive markets: $p = MC$, $\pi_i = 0\ \forall i$, and Pareto-optimal with all surplus to consumers.

• Imperfectly competitive markets: $p > MC$, $\pi_i > 0\ \forall i$, surplus shared consumers/producers, but (efficiency) deadweight loss.

Is there a way to improve upon the deadweight loss induced by market power? YES if...

$\star$ firm gets info on individual demand characteristics (reservation prices, demand elasticities);

$\star$ no arbitrage opportunities in commodity transfers.

THEN

Firms can adjust prices to profiles of (sets of) consumers $\rightarrow$ Price discrimination

On arbitrage

2 types

- commodity transferability (low transaction costs): Firm sells a commodity to a consumer at unit price p and to another consumer at a (discriminated) price $q < p$. Then the latter can resell to the former at a price p gaining $(p - q)$ per unit.

- demand transferability (self selection mechanisms): Firms sells a commodity in single units and in packs of two units at prices $p(1)$ and $p(2)$ respectively aiming at capturing the low and high demand consumers separately.

Consequences:

- commodity transferability $\longrightarrow$ eliminates price discrimination.

- demand transferability $\longrightarrow$ favors price discrimination.

Some examples

- turist vs. business class airplane tickets,
- kids vs. adults entrance tickets in amusement parks,
- fixed payment + variable payment in electricity bill, water supply bill, telephone calls, taxi rides, ...
- single ticket vs. multiple trips ticket in public transport

Definition of Price Discrimination

A firm price discriminates when the ratio of prices is different from the ratio of marginal costs for two goods offered by a firm. (Stigler, 1987).

In particular,

Price discrimination exists when sales of identical goods or services are transacted at different prices from the same provider.

Price discrimination can also arise with product differentiation. For example, so-called "premium products" (capuccino compared to black coffee) have a price differential that is not explained by the cost of production.

Taxonomy of price discrimination (Pigou, 1920)

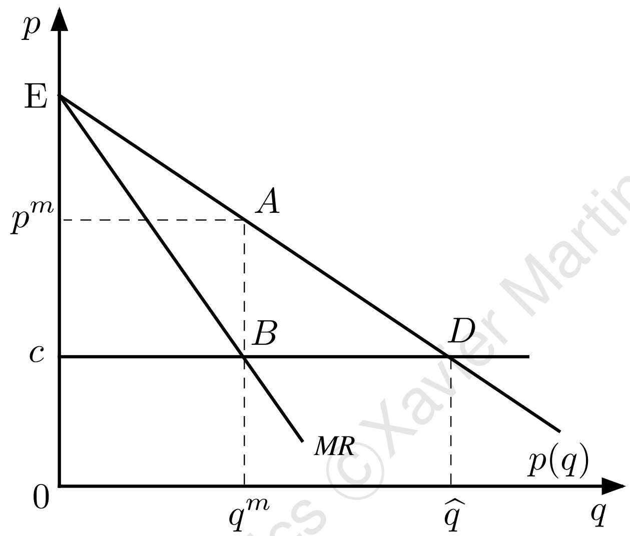
3 types according to the info producer has on consumer:

- First-degree (perfect) price discrimination: full info.

- Second-degree price discrimination: discrimination according to quantity demanded.

- Third-degree price discrimination: discrimination according to personal characteristics.

First degree (perfect) price discrimination
Producer knows the demand function of individual. It charges for every unit the consumer's willingness to pay $\rightarrow$ all surplus to producer.



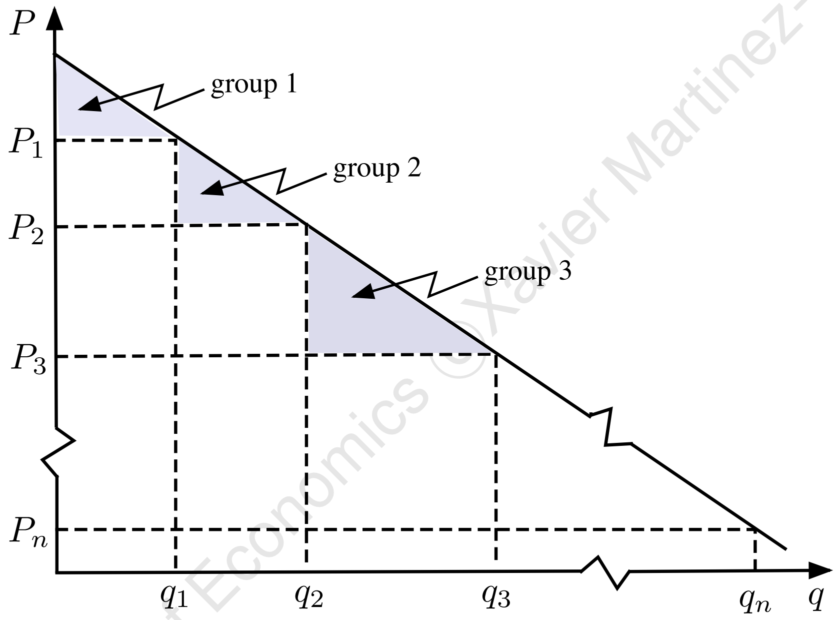
Non-discr monop: (q^m, p^m) and $\pi^m =$ area $[cp^m AB]$. Also, $CS =$ area $[Ep^m A]$.
Perfect discr. monop: p = willingness to pay between $[E, D]$ so that π^m_{pd1} = area $[EcD]$. Also, $CS = 0$.

Remarks
$\star[EcD] - ([Ep^m A] + [cp^m AB]) = [ABD] > 0 \rightarrow$
1st degree PD: yields
- $\triangle$ efficiency
- transfer of resources: consumers to producers.

$\star$ no costs associated to discrimination.

Second-degree price discrimination

Producer can associate consumers in n groups according to q purchased. Charges a different price to each group.
Consumers in group k with reservation price $> p_k$ pay price $p_k, \; k = 1, \ldots, n$



Producer announces price menu and consumers choose group (price). Self-selection mechanism.
Price policy also known as *non-linear prices*.
Some consumers within each group obtain some surplus.
All consumers can participate. No exclusion.

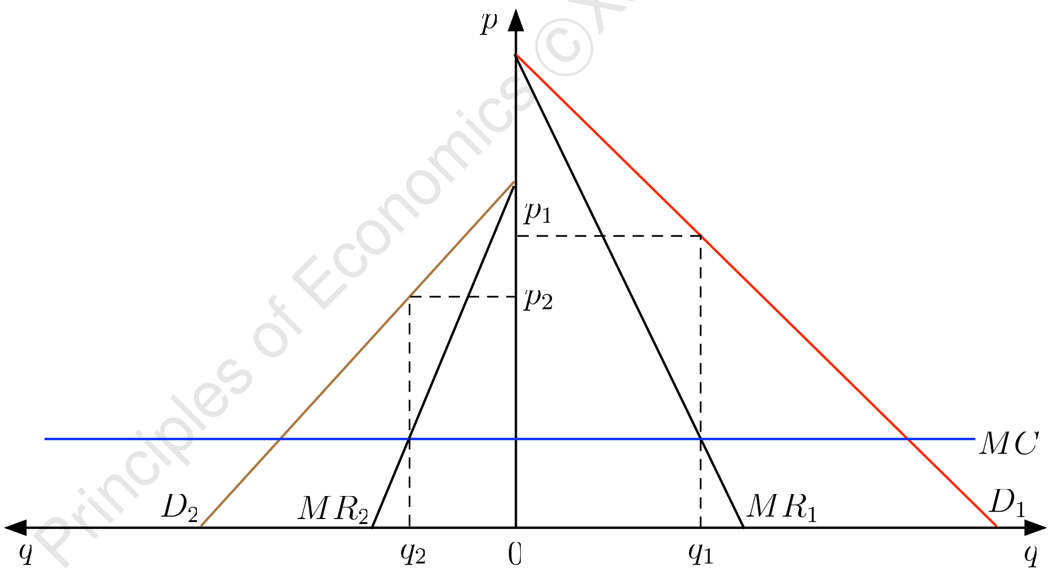
Examples: business vs. tourist class tickets.
2×1 sales; bundling.

Third-degree price discrimination

Producer defines n groups according to personal characteristics (age, gender,...).

Charges a different price to each group.

May involve exclusion of some consumers.



Examples: cheaper theater tickets for students.
free access to public transport for children and elderly.

Two illustrative examples

Example 1:

⋆ Monopolist facing 2 consumers A and B.

⋆ Monopolists produces a good at mg cost=3

⋆ Consumers may buy 1 or 2 units of good.

⋆ Reservation prices are:

	1st unit	2nd unit
A	10	6
B	20	7

Benchmark 1: *Perfect competition*

$p^c = 3, \ \pi = 0, \ CS = 7 + 3 + 17 + 4 = 31,$
$W = CS + PS = 31$ maximum $(DL = 0)$.

Benchmark 2: *Nondiscr. monopolist*

Monop. compares profits at each feasible price:

$$\begin{aligned} p = 6 &\quad \Pi = 6 \times 4 - 12 = 12 \\ p = 7 &\quad \Pi = 7 \times 3 - 9 = 12 \\ p = 10 &\quad \Pi = 10 \times 2 - 6 = 14 \\ p = 20 &\quad \Pi = 20 \times 1 - 3 = 17, \end{aligned}$$

Therefore,

$p^m = 20, \ \pi = 17, \ CS = 0, \ DL = 14$.

First degree (perfect) price discrimination

Monopolist sells first unit to A at $p_1^A = 10$ and the second unit at $p_2^A = 6$. Also, sells first unit to B at $p_1^B = 20$ and the second at $p_2^B = 7$. Thus,

$\pi = 31,\ CS = 0,\ W = 31,\ DL = 0$.

Second-degree price discrimination[quantities]

p_1 denotes price of 1st unit, and p_2 price of 2nd unit. Monopolist computes π for every feasible (p_1, p_2):

$$(p_1, p_2) = (10, 6); \pi = (2 \times 10) + (6 \times 2) - 12 = 20.$$
$$(p_1, p_2) = (10, 7); \pi = (2 \times 10) + (7 \times 1) - 9 = 18.$$
$$(p_1, p_2) = (20, 6); \pi = (1 \times 20) + (6 \times 1) - 6 = 20.$$
$$(p_1, p_2) = (20, 7); \pi = (1 \times 20) + (7 \times 1) - 6 = 21.$$

Therefore,

$(p_1, p_2) = (20, 7),\ \pi = 21,\ CS = 0,\ DL = 10.$

Third-degree price discrimination[consumers]
p_a price to consumer A, and p_b price to consumer B.
Monopolist computes π for every feasible (p_a, p_b):

$$(p_a, p_b) = (6, 7); \pi = (2 \times 6) + (2 \times 7) - 12 = 14.$$
$$(p_a, p_b) = (6, 20); \pi = (2 \times 6) + (1 \times 20) - 9 = 23.$$
$$(p_a, p_b) = (10, 7); \pi = (1 \times 10) + (2 \times 7) - 9 = 15.$$
$$(p_a, p_b) = (10, 20); \pi = (1 \times 10) + (1 \times 20) - 6 = 24.$$

Therefore,
$(p_a, p_b) = (10, 20),\ \pi = 24,\ CS = 0,\ DL = 7.$

Remarks
1. Monopolist's ordering:

$$\text{1st degree} > \text{3rd degree} > \text{2nd degree} > \text{no-discr} > \text{perf. compet}$$

General: 1st degree best choice if feasible. Perf. compet. worst.
Specific: 2nd and 3rd degree.

2. $CS = 0$. General for 1st degree. Specific for others.

3. $DL = 0$. General for 1st degree and perfect compet. $\rightarrow$ both equally efficient. Only appropriation of surplus.

Example 2:

⋆ Monop. produces cars, blue and red. $MC = 10$.

⋆ Consumers snobs and normal. n of each type. Each buys 1 unit.

⋆ Reservation prices:

Cons./car	Red	Blue
Snob	25	20
Normal	22	20

Benchmark 1: *Perfect competition*

$p_r = p_b = 10$. Produce $2n$ red cars.

$CS = n(25-10)+n(22-10) = 27n, \ DL = 0$.

Benchmark 2: *Nondiscr. monopolist*

Monopolist computes profits under alternative prices. Then,

$p = 22$. Produce $2n$ red cars. $\pi = 24n$,

$CS_{snobs} = 3n, \ W = 27n, \ DL = 0$.

First degree (perfect) price discrimination

Monopolist produces $2n$ red cars. Sells them to snobs at $p_r^s = 25$, and to normal at $p_r^n = 22$. Thus, $\pi = 27n, \ DL = 0$.

Second-degree price discrimination[quantities]

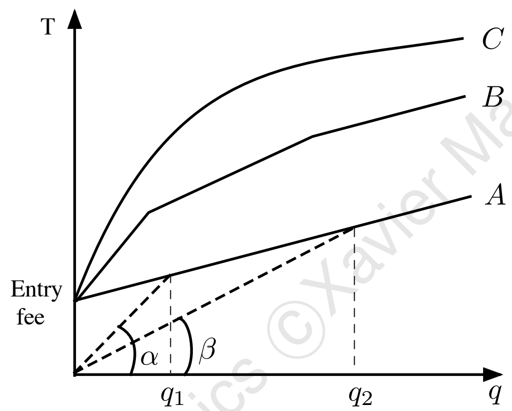
Monopolist sells red cars at $p_r = 25$ and blue cars at $p_b = 20$. Then, $\pi = 25n, \ CS = 0, \ DL = 2n$.

Third-degree price discrimination[consumers]

Monopolist produces red cars only and sells them at $p_r^s = 25$ and $p_r^n = 22$. Then, $\pi = 27n, \ CS = 0, \ DL = 0$.

Second-degree price discrimination. Analysis

Non-linear prices: depend on quantity $\rightarrow$ different *average price*.



$$T = A + pq \quad \text{(2-part tariff)}$$

A: entry fee to amusement park; access fee to telephone service, water supply, electricity supply, ...
p: price per unit of consumption

$$T = p_1\hat{q} + p_2\tilde{q} \quad \text{(2-part tariff)}$$

- charge price p_1 to $q \in (0, \hat{q})$
- charge price p_2 to demand beyond $\hat{q}$.

Illustration

Market with 2 consumers. Inverse demand functions:

$$q_i(p) = \frac{\theta_i - p}{\theta_i}$$

Monopolist: constant mg. cost (c), uses 2-part tariff $T = A + pq$.

Assume $c < \theta_1 < \theta_2$ (participation constraint)

Monopolist's problem: determine (A, p) to max. profits.

1. Aggregate demand:

$$Q(p) = \begin{cases} \frac{\theta_2 - p}{\theta_2} & \text{if } p > \theta_1 \\ 2 - p\frac{\theta_1+\theta_2}{\theta_1\theta_2} & \text{if } p \le \theta_1 \end{cases}$$

2. Profit function:

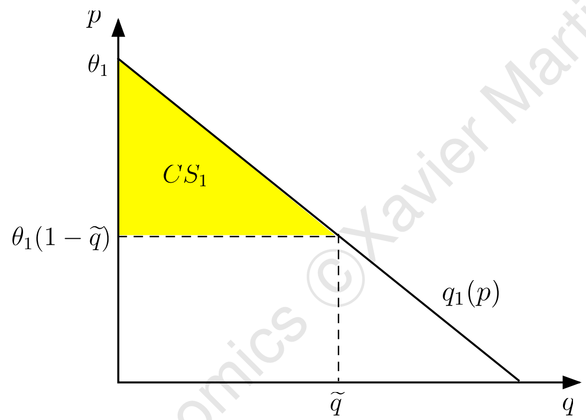
$$\pi(A, p) = 2A + (p - c)\Big(2 - p\frac{\theta_1 + \theta_2}{\theta_1\theta_2}\Big).$$

3. Determination of A.

To max profits, monopolist has two instruments: A, p.

Strategy: (a) extract all surplus from low willingness-to-pay consumer;

(b) extract max surplus from the other consumer with p.



$$CS_1 = \frac{(\theta_1 - p)^2}{2\theta_1} = A^*$$

Then,

$$\pi(A, p) = 2\Big(\frac{(\theta_1 - p)^2}{2\theta_1}\Big) + (p - c)\Big(2 - p\frac{\theta_1 + \theta_2}{\theta_1\theta_2}\Big).$$

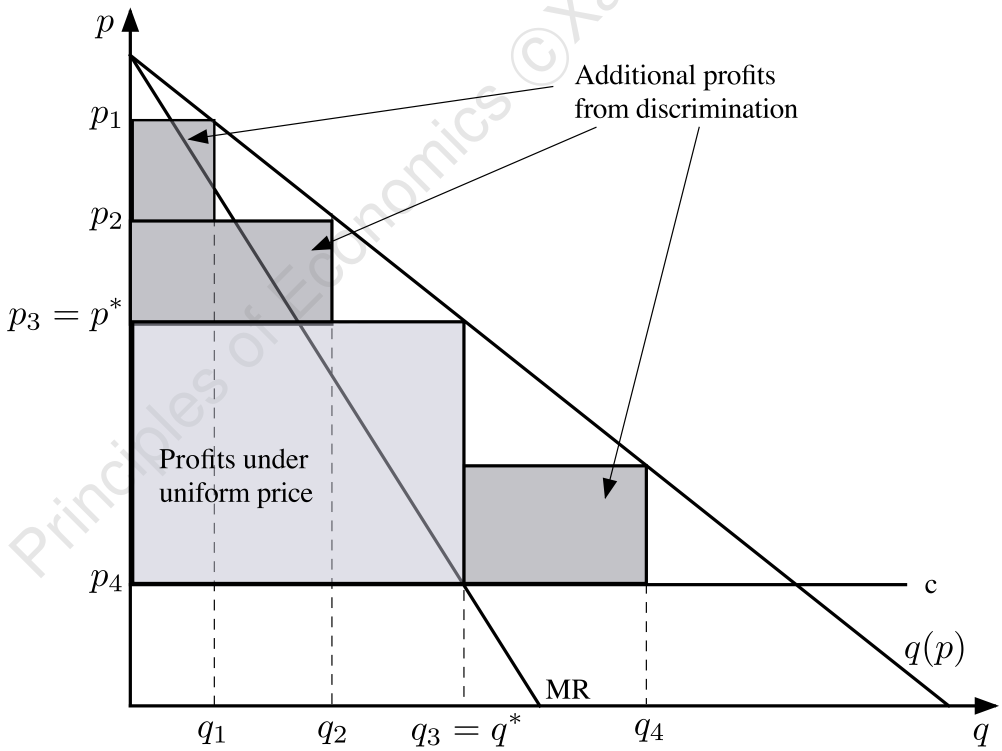
and

$$p^* = \frac{c(\theta_1 + \theta_2)}{2\theta_1} \ \Big(> c\Big)$$

2dPD vs. uniform price

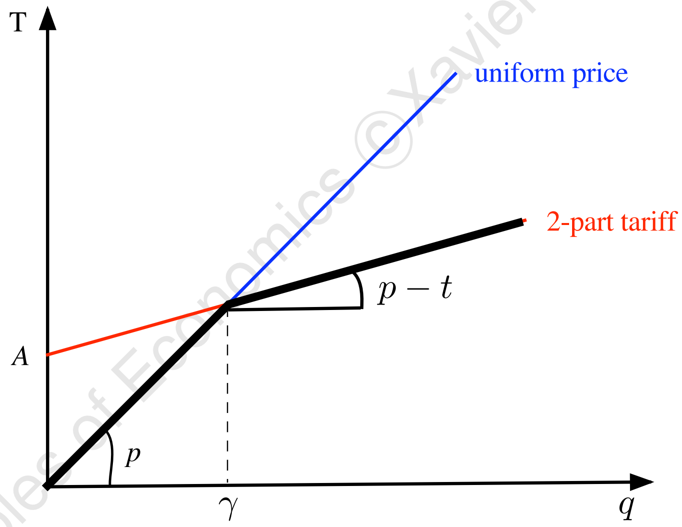
⋆ Producers' viewpoint

Discriminatory prices $(p_1, \ldots, p_n)$ yield higher profits than uniform price (p^*)



⋆ Consumers' viewpoint

Consumer can choose between uniform price p, and 2-part tariff $T = A + (p - t)q$.

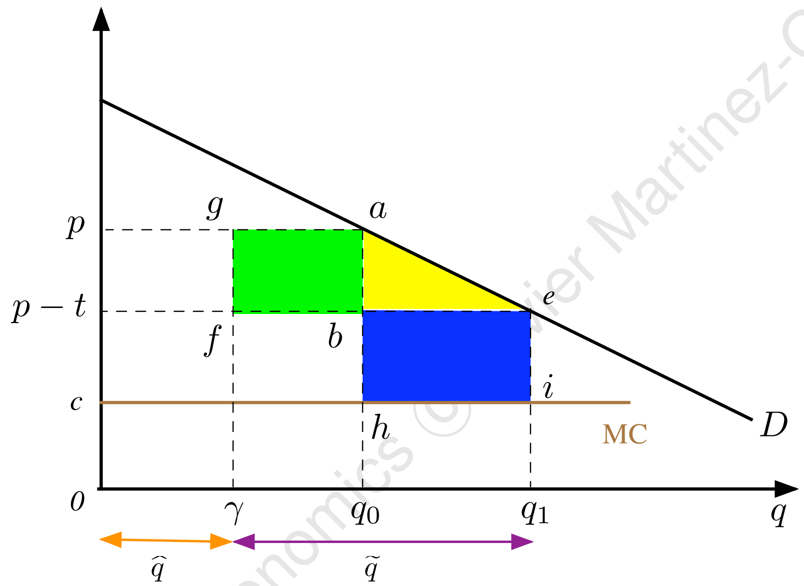


Consumers demanding less than $\gamma \rightarrow p$

Consumers demanding more than $\gamma \rightarrow T$

⋆ Welfare

Consider a (representative) consumer:
- if $q < \gamma \to$ uniform price p
-if $q \leq \gamma \to$ 2-part tariff $T = p\hat{q} + (p-t)\tilde{q}$.



Initial situation: (p, q_0)
Change $p \to (p-t)$ implies $q_0 \to q_1$.

Net welfare gain: $\triangle CS + \triangle PS$
- $\triangle CS = gaef$
- $\triangle PS = behi - gabf$ (profit on new units - profits lost on old units)

Note:
- $behi > 0$ if $p - t > c$
- $gafb$ decreasing in γ.

Third-degree price discrimination. Analysis

- Monopolist selling in n markets (defined by e.g. personal characteristics, age, gender, education, income, ...)
- Monopolist produces single good with $C(Q)$.
- Demand in each market: $p_i(q_i),\ i = 1, \ldots, n$.
- Monopolist's profit function

$$\pi(q) = \sum_{i=1}^{n} q_i p_i(q_i) - C(Q)$$

where $Q = \sum_i q_i$, and $q = (q_1, \ldots, q_n)$.

<u>Monopolist's problem</u>

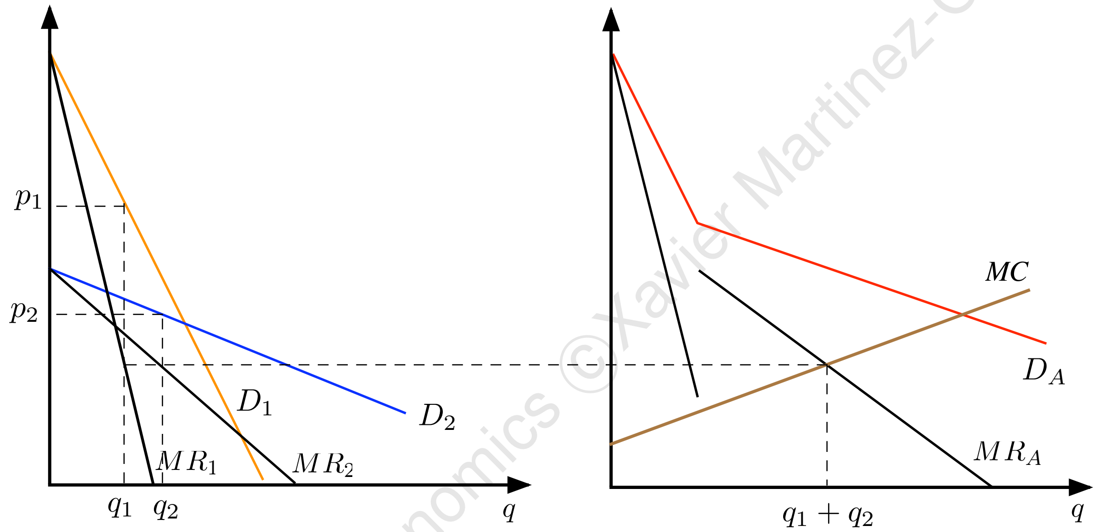
Determine profit maximizing output volume in each market, i.e.

$$(q_1^*, \ldots, q_n^*) \text{ solution of } \max_q \pi(q)$$

Solve system of FOCs:

$$\frac{\partial \pi(q)}{\partial q_i} = p_i + q_i \frac{\partial p_i(q_i)}{\partial q_i} - \frac{dC(Q)}{Q} = 0, \ \forall i \qquad (8)$$

Solution: $(q_1^*, \ldots, q_n^*)$ s.t.
$MR_1(q_1) = \cdots = MR_n(q_n) = MC(Q).$



Interpretation: Rewrite (8) as

$$p_i\left(1 - \frac{1}{\varepsilon_i}\right) = p_j\left(1 - \frac{1}{\varepsilon_j}\right) = MC(Q), \forall i, j; i \neq j. \qquad (9)$$

Hence, $p_i > p_j \Rightarrow \varepsilon_i < \varepsilon_j$. Monopolist exploits lower sensibility of demand to ↑ price.
Market power: rewrite (9) as

$$\frac{p_i - MC}{p_i} = \frac{1}{\varepsilon_i}, \forall i. \qquad (10)$$

Welfare aspects of 3dPD

Consider transition from uniform price p^u to discriminatory prices $p = (p_1, \ldots, p_n)$.

2 potential effects:

(a) markets already covered with p^u, under $p \to$ $\uparrow \pi$; $\downarrow CS$; $\uparrow\downarrow Q_{old}$.

(b) p *may* give access to new markets: $\uparrow \pi, \uparrow CS, \uparrow Q_{new}$.

In general, $p^u \to p$ conveys $\downarrow W$ except perhaps if $\uparrow Q$ under discrimination.

Thus, $\uparrow Q$ Nc condition for $\uparrow W$ under discrimination, but not sufficient.

Ramsey prices

Consider a monopolist serving several markets. Produces a good with $C(Q) = F + cQ$.

Question: determine quantities (prices) in each market under the constraint of zero (economic) profits.

Examples:
- Pharma companies seeling drugs to several countries,
- (nonprofit) Hospital allocating laundry/catering/cleaning among services,
- (nonprofit) Research center allocating the cost of infrastructure among different projects.

Problem: Find Nc conditions for 2nd best efficiency.

$$\max_{\{p_i\}} W(p) = \sum_i^n (CS_i + PS_i) \text{ s.t. } \sum_i^n (p_i - MC)q_i = F$$

$$\max_{\{p_i\}} L(p) = \sum_i^n (CS_i + PS_i) + \lambda(\sum_i^n (p_i - MC)q_i - F)$$

Solution:

$$\frac{p_i - MC}{p_i} = \frac{\lambda}{1+\lambda}\frac{1}{\varepsilon_i} \qquad (11)$$

Remarks

- All markets are served and fixed costs are covered
- Ramsey prices minimize welfare loss due to pricing above MC: more sensitive markets, smaller mark-up (i.e. minimize demand distortion).
- Complies with equity if lower income markets are associated with more elastic demands.

Ramsey prices vs. 3dPD

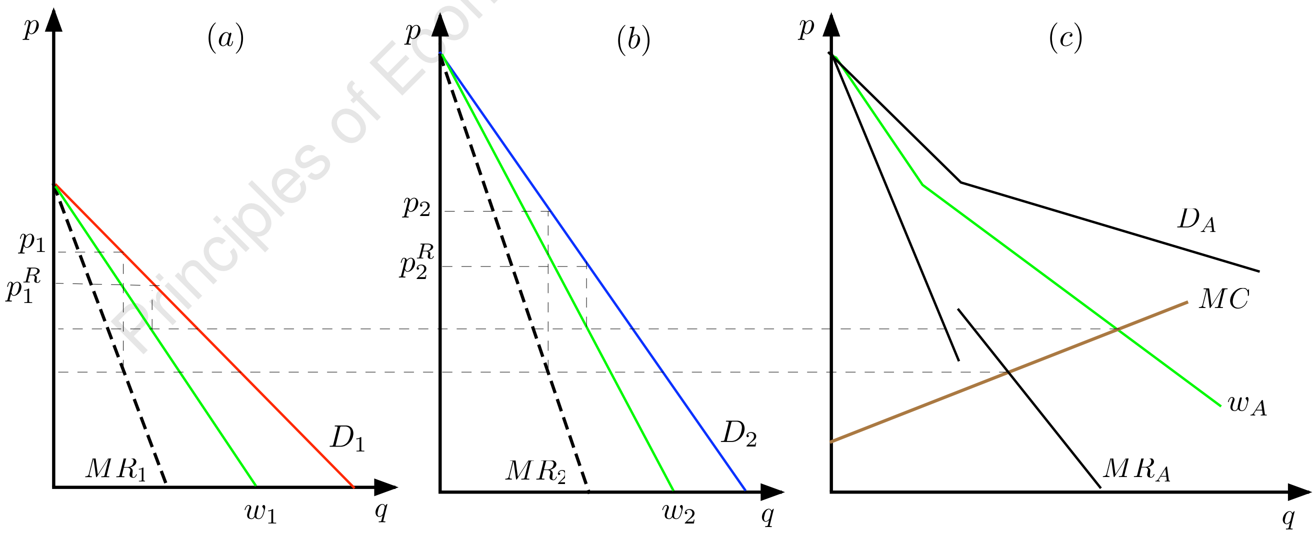
Compare (10) and (11).

Rewrite (11) as

$$\frac{p_i - MC}{p_i} = (1-\mu)\frac{1}{\varepsilon_i}, \text{ with } \mu = \frac{1}{1+\lambda} \in (0,1). \tag{12}$$

Rewrite (12) as

$$\mu p_i + (1-\mu)MR_i = MC \tag{13}$$



Therefore, $p_i^R \leq p_i$.

11. Macroeconomics

What is Macroeconomics about?

Global behavior of the economy. Aggregation.

Macro variables: GDP, Aggregate expenditure, Unemployment, Inflation, Consumption, Saving, Investment, Exports, Imports, Public expenditure, etc.

Questions:

Long term growth,

Economic cycles,

Unemployment,

Inflation,

International Trade and Development,

Economic Policy (monetary, fiscal, labor, etc).

Definition of GDP: market value of all final goods and services produced within a country in a given period of time. [“Gross” means depreciation of capital stock included]

Measures of GDP: *Two approaches*: expenditure and income (equivalent)

GDP - expenditure: adding up expenditure on all final goods and services produced during the year.

$$\begin{aligned} GDP &= \text{private consumption + investment} \\ &\qquad \text{+ government spending + (exports - imports)} \\ &\equiv C + G + I + (X - M) \end{aligned}$$

GDP - income: adding up all payments to owners of resources used to produce output during the year (aggregate income)

$$GDP = W + P + (T - S)$$

Equivalence in the National Income Accounts,

$$W+P+(T-S) = GDP = C+G+I+(X-M)$$

Private consumption (C): commodities and services acquired by households.

Investment (I): goods and services increasing the capital stock. *Investment = Savings*.

Public consumption (G): goods and services acquired by the public administrations (army, roads). No transfers (pensions, social programs) because these are transfers.

Net exports (X-M): net spending from rest of the world in goods and services yielding income to national producers.

Wages and salaries (W): Compensation of employees measures the total remuneration to employees for work done. It includes wages and salaries, as well as employer contributions to social security and other such programs.

Profits (P): Surplus due to owners of incorporated businesses. Often called profits.

Net taxes (T-S): Difference between the resources transferred from the families to the State and the transfers from the State to the families.

Illustration:

real GDP components in Spain in 2006 (constant prices 2000)

Demand components

	10^6 €	%
Private consumption (C)	553.867	56.7
Public consumption (G)	184.233	18.9
Investment (I)	298.362	30.6
Exports	254.985	26.1
Imports	315.258	-32.3
Net exports (X-M)	-60.273	
TOTAL	976.189	100

Source: Contabilidad Nacional de España, INE.

Illustration (2):

real GDP components in Spain in 2006 (constant prices 2000)

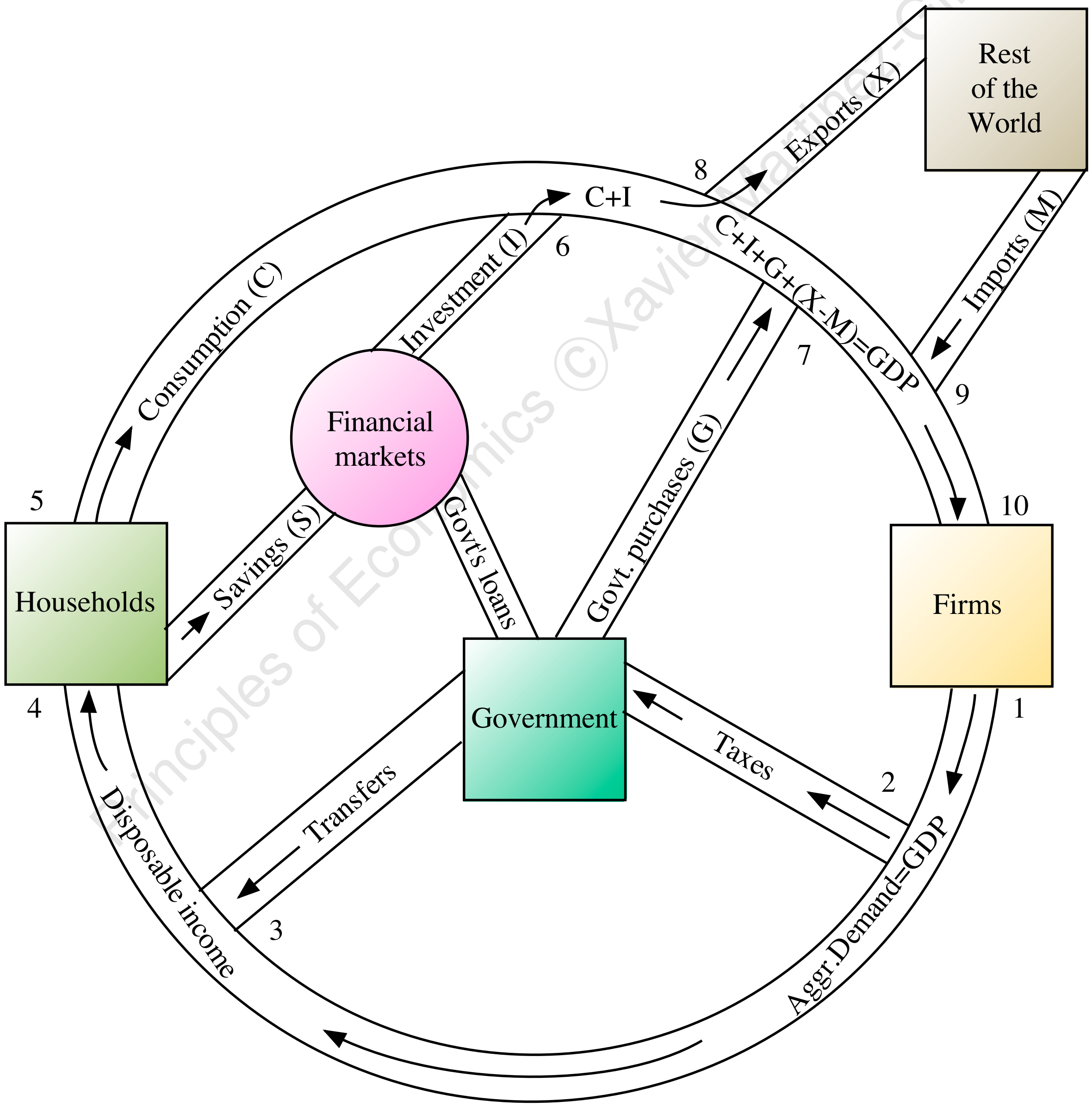
Supply components

	10^6 €	%
Agriculture	27.199	2.8
Industry	151.709	15.5
Construction	106.437	10.9
Services	583.773	59.8
Net taxes	107071	11.0
TOTAL	976.189	100

Source: Contabilidad Nacional de España, INE.

Circular flow model:

Flow of resources, products, income, and revenue among economic decision makers.



Legend:

Flows of income:

(1): GDP = Aggregate income.
(2): Taxes are transfers from families to the State.
(3): Transfers from the State to the families.
(4): Disposable income of families = Aggregate income-taxes+transfers.

Flows of expenses:

(5): Disposable income splits in consumption and savings (= investment).
(6): Investment adds to flow of expenditure.
(7): Public expenditure adds to flow of expenditure.
(8): Exports add to flow of expenditure from the rest of the world.
(9): Imports are transfers to the rest of the world.
(10): National account identity.

Example

Orange Inc.		Juice Inc.	
Wages and salaries	15000	Wages and salaries	10000
Taxes	5000	Taxes	2000
		Purchase of oranges	25000
Revenues from oranges	35000	Revenues from juice	40000
Consumers	10000		
Juice Inc.	25000		
Profits before taxes	20000	Profits before taxes	5000
Profits after taxes	15000	Profits after taxes	3000

VA Orange Inc. = 35000 (revenues from oranges)

VA Juice Inc. = 40000 - 25000 = 15000 (revenues from juice - cost of oranges)

VA total= 35000 + 15000 = 50000 = GDP (production)

GDP (income): 10000 + 40000 = 50000 (consumers expenditure)

GDP (income): (15000 + 10000) + (20000 + 5000)= 50000 (wages + profits before taxes)

Total production = Total income = Total expenditure real GDP and nominal GDP.

nominal GDP: market value of production at today's prices.

Example: Economy with two goods (apples and oranges)

$$GDPn^{2006} = (P_{ora}^{2006} * Q_{ora}^{2006}) + (P_{app}^{2006} * Q_{app}^{2006})$$

Problem: If prices double, GDP also doubles $\Longrightarrow$ poor welfare indicator.

real GDP: market value of production at prices of a reference year (1996).

$$GDPr^{2006} = (P_{ora}^{1996} * Q_{ora}^{2006}) + (P_{app}^{1996} * Q_{app}^{2006})$$

Illustration:

Evolution $GDPn$ and $GDPr$ Spain 1995-2003 (10^6 €).

Year	GDPn	price index	GDPr
1995	437.783	100	437.783
1996	464.251	103.5	448.457
1997	494.140	105.9	466.513
1998	527.975	108.5	486.785
1999	565.419	111.4	507.346
2000	610.541	115.3	529.691
2001	653.927	120.1	544.496
2002	698.589	125.5	556.651
2003	744.754	130.5	570.556

Source: INE.

The working of the Economy

Model of aggregate demand and supply:

(1) understand incidence of the different forces on macro variables, and

(2) measure potential effectiveness of economic policies.

Aggregate demand is (the value of) the total quantity the different sectors of the economy are willing to spend in a particular period.

Graphically, market demand curve: relation between general price level of the economy and aggregate spending in goods and services in the economy.

Aggregate supply: (value of the) total quantity of goods and services firms in the country are willing to produce in a given period.

The market supply curve shows the production level firms are willing to supply at any given price level.

Macroeconomic equilibrium: characterization of the production level and of the price level.

Graphically: intersection point of aggregate demand and supply curves. Compatibility between consumers and producers behavior.

Equilibrium: two (potential) problems
1. negative results: equilibrium price-production pair may not satisfy macro objectives (inflation, unemployment, investment level, ...)
2. unstable results: even if the economy reaches optimal equilibrium may be perturbed by external shocks. *oil crisis, bird flu, ...*

⟹ MACROECONOMIC POLICY

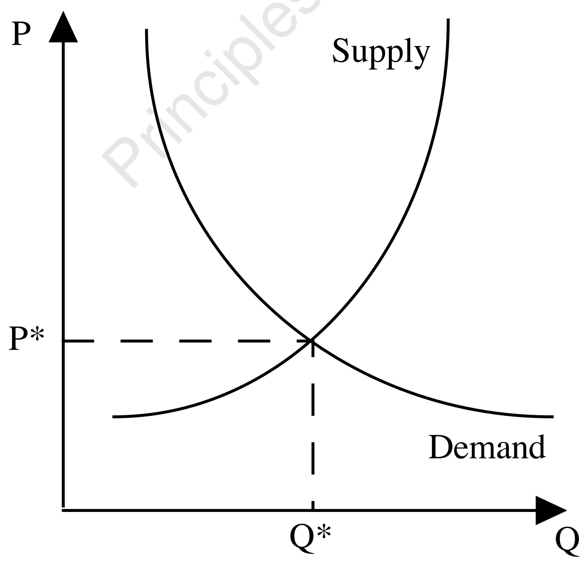
Aggregate supply and demand curves are shifted by changes in consumers and/or producers behavior (endogenous and/or exogenous shocks).

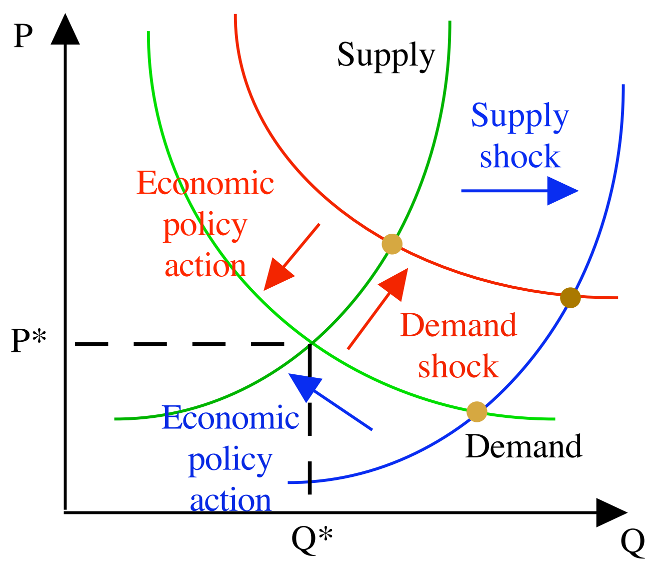
Options of the macroeconomic policy:

1. shift demand curve through fiscal and monetary policy;

2. shift supply curve through R&D policies;

3. do nothing if the causes of the perturbation are not identified.





Unemployment.

Objective: maximize employment level.

Active population: set of people legally able to work = employed + unemployed.

Activity rate: (employed/active pop.)*100

Unemployment rate: (unemployed/employed)*100.

Labor market equilibrium: wage level inducing compatibility between labor supply and demand.

Full employment $\neq$ absence of unemployment $\longrightarrow$ *frictional unemployment* $(3\% - 5\%)$.

Structural unemployment: lack of adjustment between labor demand and supply. (labor market rigidities, professional qualifications, ...)

Frictional + structural unemployment = involuntary unemployment = unemployment rate.

Measuring Unemployment.

“Encuesta de Población Activa” (Active population enquiry): estimated unemployment [harmonized across OECD countries].

Sampling on population $\longrightarrow$ number of employed, unemployed, discouraged, by age, sex, education level, length of unemployment, etc.

Def.: unemployed individual not working the previous week, but ready to take a job along the following two weeks.

Def.: employed individual with a job ($\geq$ 1 hour) in the previous week.

Active population = population employed + population unemployed.

RESUMEN DE INDICADORES DEL MERCADO DE TRABAJO

	Último dato (1)		Tasa de variación anual en %					
	Miles	? anual	2004-I	2004-II	2004-III	2004-IV	2005-I	2005-II
EPA								
Activos	20.839,6	746,6	3,5	3,4	3,2	3,2	3,5	3,7
- Varones	12.207,9	353,2	2,5	2,4	2,4	2,3	2,9	3,0
- Mujeres	8.631,7	393,5	4,9	4,9	4,4	4,6	4,5	4,8
Tasa de actividad (2)	57,4	-	1,0	0,9	0,8	0,8	1,0	1,1
- Varones	68,7	-	0,5	0,4	0,3	0,3	0,7	0,8
- Mujeres	46,5	-	1,4	1,4	1,2	1,3	1,3	1,4
Ocupados	18.693,8	1.029,1	4,0	3,6	3,8	4,1	5,1	5,8
- Sector no agrario	17.908,4	1.021,9	4,1	3,9	4,0	4,6	5,5	6,1
- Industria	3.262,8	62,4	-1,1	-0,1	-0,1	2,6	2,6	2,0
- Construcción	2.339,3	101,6	5,8	5,5	7,7	9,8	5,1	4,5
- Servicios	12.306,3	857,8	5,3	4,7	4,6	4,2	6,4	7,5
- Varones	11.317,8	435,4	2,6	2,3	2,6	3,1	3,8	4,0
- Mujeres	7.577,1	593,7	6,3	5,7	5,8	5,9	7,0	8,5
- Extranjeros	2.043,8	436,1	34,0	28,6	25,1	25,8	25,7	27,1
- A tiempo completo	16.476,8	196,2	3,5	3,0	2,8	3,7	-0,1	1,2
- A tiempo parcial	2.418,1	832,9	9,7	10,4	16,2	8,9	59,5	52,5
- Tasa de parcialidad (3)	12,8	-	0,4	0,5	0,9	0,4	4,5	3,9
Asalariados	15.440,1	830,7	4,4	3,8	4,1	4,5	4,2	5,7
- Sector Privado	12.596,7	747,7	4,8	4,1	4,2	4,5	4,4	6,3
- Sector Público	2.843,5	83,0	3,1	2,2	3,7	4,7	3,2	3,0
- Con contrato indefinido	10.305,3	381,7	3,8	3,3	2,4	3,2	3,8	3,8
- Con contrato temporal	5.134,8	449,4	5,8	4,7	7,6	7,4	5,0	9,6
- Tasa de temporalidad (4)	33,3	-	0,4	0,3	1,1	0,9	0,3	1,2
No asalariados	3.454,8	198,4	2,1	3,0	2,7	2,5	9,0	6,1
Parados	1.944,7	-282,5	-0,5	1,6	-2,0	-4,1	-8,2	-12,7
- Varones	890,1	-82,3	1,6	2,8	-0,2	-6,2	-6,7	-8,5
- Mujeres	1.054,6	-200,2	-2,1	0,8	-3,4	-2,5	-9,4	-16,0
- Menores de 25 años	508,1	-27,9	-3,2	-0,1	-3,7	-8,1	-1,6	-5,2
- Sin empleo anterior	258,1	-79,1	-6,7	-9,4	-9,1	-15,5	-26,4	-23,5
Tasa de paro (5)	9,3	-	-0,5	-0,2	-0,6	-0,8	-1,3	-1,8
- Varones	7,3	-	-0,1	0,0	-0,2	-0,7	-0,8	-0,9
- Mujeres	12,2	-	-1,1	-0,6	-1,2	-1,0	-2,1	-3,0
- Jóvenes (16-24 años)	20,4	-	-0,6	0,1	-0,7	-1,6	-1,0	-2,0
AFILIACIÓN A LA S.S								
Total afiliados	17.968,5	895,4	2,9	2,6	2,7	3,1	2,8	3,9
- Asalariados	14.733,4	816,9	2,9	2,4	2,6	3,1	2,8	4,2
- No asalariados	3.235,1	78,5	3,2	3,2	3,2	3,2	2,9	2,7
- Extranjeros	1.633,9	576,3	12,5	12,8	12,9	15,1	15,1	29,1
OFICINAS DE EMPLEO								
Paro registrado	2.019,1	-30,5	1,6	2,4	1,0	-1,7	-2,2	-3,6
Contratos registrados	1.298,4	173,3	13,9	13,9	15,0	4,0	-8,8	10,0
- Indefinidos (6)	7,1	-	-0,3	0,2	0,2	0,0	1,0	-0,1
- A tiempo parcial (6)	21,8	-	1,1	2,1	1,5	1,5	1,0	0,7

(1) Segundo trimestre para la EPA y mes de agosto para las Afiliaciones y datos del SPEE.
(2) Porcentaje de activos sobre la población de 16 años y más. En las columnas finales aparece la variación anual en puntos porcentuales.
(3) Porcentaje de ocupados a tiempo parcial sobre el total de ocupados. En las columnas finales aparece la variación anual en puntos porcentuales.
(4) Porcentaje de asalariados con contrato temporal. En las columnas finales aparece la variación anual en puntos porcentuales.
(5) Porcentaje de parados sobre la población activa. En las columnas finales aparece la variación anual en puntos porcentuales.
(6) Porcentaje sobre el total de contratos. En las columnas finales aparece la variación anual en puntos porcentuales.
Fuente: INE (EPA) Y MTAS

EVOLUCIÓN DE LAS PRINCIPALES VARIABLES DE LA EPA. Datos corregidos *

	Variaciones interanuales			
	En miles		En porcentaje	
	1° Trim. 2005	2° Trim. 2005	1° Trim. 2005	2° Trim. 2005
Ambos sexos				
Población de 16 años y más	604,2	599,5	1,7	1,7
Activos	650,5	693,0	3,3	3,4
- Ocupados	760,3	897,1	4,3	5,0
- Parados	-109,8	-204,0	-4,8	-9,2
Inactivos	-46,3	-93,4	-0,3	-0,6
Varones				
Población de 16 años y más	323,9	319,8	1,9	1,8
Activos	324,0	335,1	2,8	2,8
- Ocupados	370,8	396,3	3,4	3,6
- Parados	-46,8	-61,3	-4,6	-6,3
Inactivos	-0,1	-15,3	0,0	-0,3
Mujeres				
Población de 16 años y más	280,3	279,7	1,5	1,5
Activas	326,5	358,0	4,0	4,3
- Ocupadas	389,5	500,7	5,7	7,2
- Paradas	-63,0	-142,8	-4,9	-11,4
Inactivas	-46,2	-78,1	-0,5	-0,8
Ocupados por ramas				
- Agricultura	-16,7	5,1	-1,6	0,5
- Industria	30,1	8,6	0,9	0,3
- Construcción	175,9	168,0	8,1	7,5
- Servicios	571,0	715,4	5,1	6,2
Ocupados por situación profesional y tipo de contrato				
Trabajadores por cuenta propia	31,1	-60,8	1,0	-1,9
Asalariados	678,3	907,5	4,7	6,2
- Con contrato indefinido	294,4	300,9	3,0	3,0
- Con contrato temporal	384,0	606,6	8,4	12,9
Otros	50,8	50,4	285,0	336,7
Ocupados según jornada				
A tiempo completo	236,0	444,3	1,5	2,7
- Varones	242,6	291,2	2,3	2,7
- Mujeres	-6,7	152,9	-0,1	2,7
A tiempo parcial	524,3	452,9	34,5	28,6
- Varones	128,2	105,2	44,4	34,6
- Mujeres	396,1	347,6	32,1	27,1
Tasa de actividad (1)	0,9	1,0	-	-
- Varones	0,6	0,7	-	-
- Mujeres	1,1	1,2	-	-
Tasa de paro (1)	-0,9	-1,3	-	-
- Varones	-0,6	-0,7	-	-
- Mujeres	-1,4	-2,3	-	-

* Variaciones corregidas del impacto de los cambios en el cuestionario y método de entrevista calculado a partir de datos definitivos del primer trimestre

(1) Variaciones interanuales en puntos porcentuales.

Fuente: Elaboración propia a partir de INE (EPA).

Inflation.

Sustained and generalized increase of the general level of prices of goods and services in an economy.

How to define that price level? $\rightarrow$ Two alternative price indices (weighted average of prices):

1. GDP deflator,

2. CPI (Consumer price index).

$\star$ GDP deflator

GDP deflator = (nominal GDP)/(real GDP).

In our economy with oranges and apples,

$$GDP\text{deflator} = \frac{(P_{app}^{2006} * Q_{app}^{2006}) + (P_{ora}^{2006} * Q_{ora}^{2006})}{(P_{app}^{1996} * Q_{app}^{2006}) + (P_{ora}^{1996} * Q_{ora}^{2006})}.$$

Comparison of a consumption bundle evaluated at today's prices and at the base year prices.

⋆ Consumer Price Index.

CPI = nominal value of consumption bundle/real value of that consumption bundle.

consumption bundle: "Encuesta de Presupuestos Familiares del INE" → representative sample of consumption goods of families weighted by their importance.

CPI evolution: monthly, yearly, aggregated within the year, last 12 months.

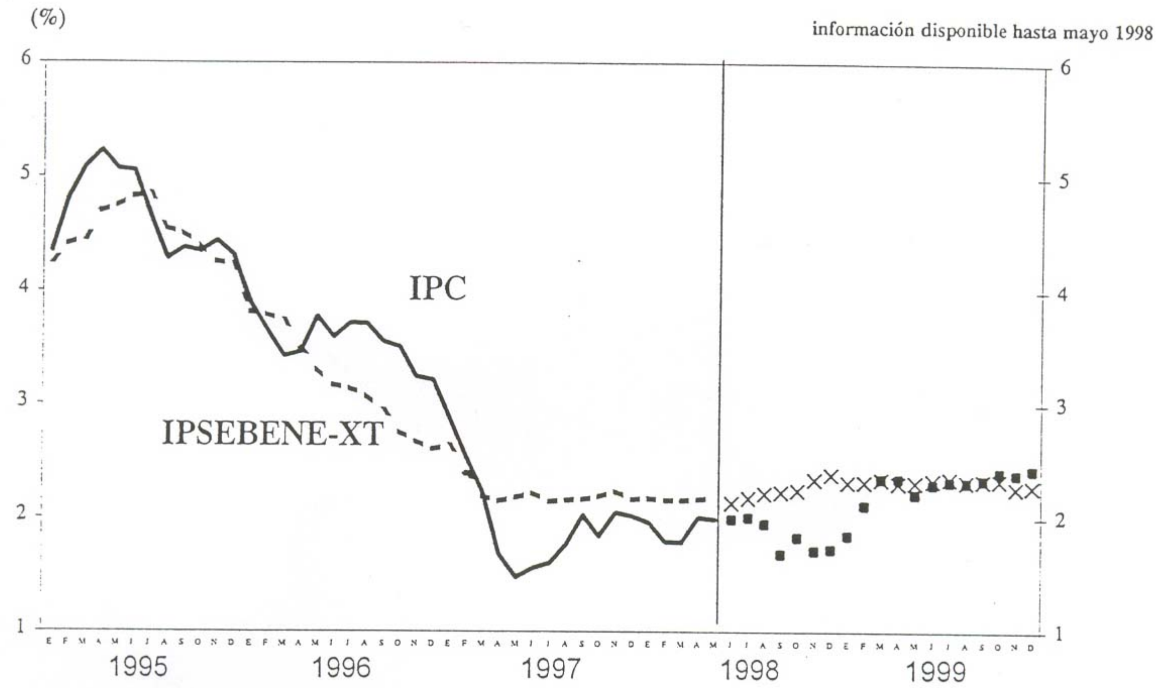
Disaggregate CPI in sectorial price indices: non-energy goods and services, energy goods and services, non-manipulated food, ... → analyze their evolution. (See sample figures)

PRINCIPALES INDICADORES DE PRECIOS

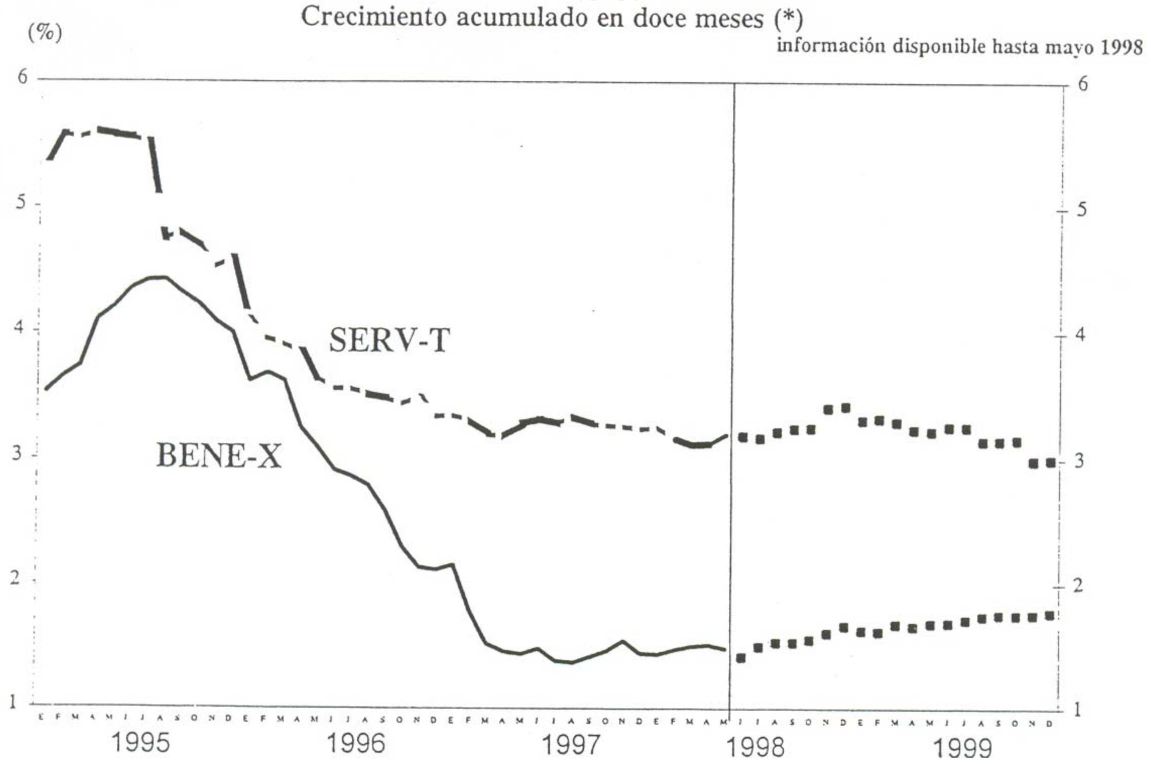
Tasas de variación anual en %

	Media anual			Dic. 03	Dic. 04	Ene. 05	Mar. 05	Jun. 05	Ago. 05(2)
	03	04	05(1)						
IPC: Total	3,0	3,0	3,3	2,6	3,2	3,1	3,4	3,1	3,3
IPSEBENE (3)	2,9	2,7	2,7	2,5	2,9	2,8	2,9	2,5	2,4
IPC sin alimentos ni energía	2,9	2,4	2,4	2,5	2,6	2,5	2,6	2,4	2,4
IPC no energético	3,2	2,9	2,7	2,9	2,8	2,8	2,9	2,6	2,4
IPC alimentación	4,0	3,9	3,4	3,9	3,3	3,5	3,6	3,3	2,7
- No elaborada	6,0	4,6	3,0	6,4	1,8	2,3	2,9	3,4	2,7
- Elaborada	3,0	3,6	3,6	2,7	4,1	4,2	4,0	3,2	2,8
IPC no alimentación	2,7	2,7	3,2	2,2	3,2	2,9	3,3	3,1	3,5
- Bienes industriales	1,9	1,9	2,7	0,9	2,6	2,2	2,7	2,5	3,3
- Energía	1,4	4,8	8,7	-0,1	7,6	6,0	8,2	8,2	11,5
- Bienes industrial. sin energía	2,0	0,9	0,9	1,2	1,2	1,0	1,0	0,8	0,7
- Servicios totales	3,7	3,7	3,8	3,6	3,8	3,8	4,0	3,7	3,7
IPC manufacturas (4)	2,4	1,9	1,9	1,7	2,2	2,2	2,1	1,7	1,5
IPRI: Total	1,4	3,4	4,7	1,1	5,0	4,8	5,1	4,4	4,6
Bienes de consumo	2,3	2,5	2,7	2,4	2,8	3,2	2,8	2,2	2,0
- Alimentación	2,1	3,8	1,8	3,1	2,9	3,2	2,0	0,8	0,7
- No alimentación	2,4	0,9	3,8	1,5	2,6	3,1	3,9	4,0	3,8
Bienes de equipo	1,2	1,5	2,0	1,3	1,6	1,8	2,0	2,1	1,9
Bienes intermedios	0,8	4,5	4,2	1,0	6,2	6,2	4,9	3,1	3,0
Energía	1,3	5,3	12,5	-1,2	10,7	8,8	13,1	13,5	15,7
IVU: Importación	-1,4	2,5	4,9	-2,9	5,8	5,0	5,3	5,3	8,2
- Bienes de consumo	0,0	0,4	1,2	-1,8	4,2	3,4	2,6	3,6	0,6
Exportación	-1,5	1,0	4,3	0,1	2,2	5,1	4,8	3,2	5,7
Precios percibidos por agricultores	5,5	0,9	3,9	9,8	2,5	8,4	13,2	-11,7	-
Deflactor del PIB	4,0	4,1	4,2	-	-	-	-	-	-

(1) Media del período del que se dispone de datos sobre igual período del año anterior. El dato del deflactor del PIB incluye el segundo trimestre.
(2) Los datos del IPRI y de los IVUS corresponden a julio.
(3) IPC general sin alimentación no elaborada y sin energía.
(4) Alimentos elaborados y bienes industriales no energéticos.
Fuentes: INE, MAPYA y SGAM.



CPI and price index of non elaborated produced goods and services excluding fats, tobacco and touristic packs.



Price index of non elaborated produced goods and services excluding fats and tobacco (BENE-X), and price index of services excluding touristic packs (SERV-T).

CPI vs. GDP deflator

1. GDP deflator measures the prices of all goods and services produced.
CPI measures prices of goods and services in the representative consumption bundle.

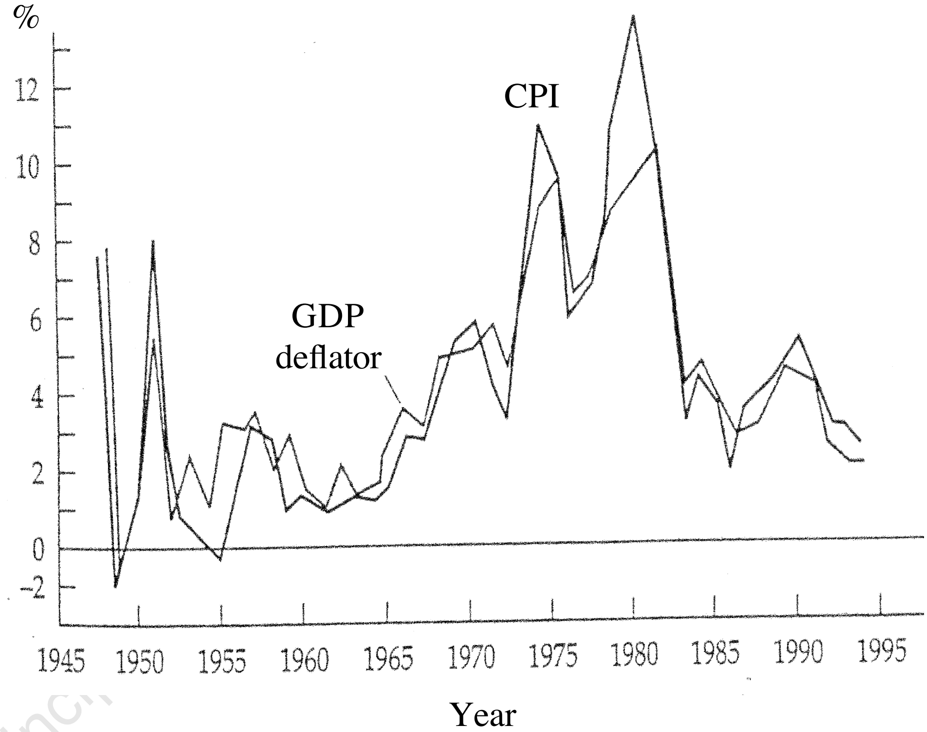
2. GDP deflator considers only goods and services produced inside the country.

3. CPI is computed for a fixed consumption bundle; GDP deflator allows for variations of the bundle along time in accordance with the variation in the composition of the GDP.

4. CPI does not measure possibility of consumers to alter the composition of the bundle (neither substitution nor income effects.

Although CPI may differ from GDP, both convey the same info on the *rhythm* of price increase. See next figure.

Illustration:



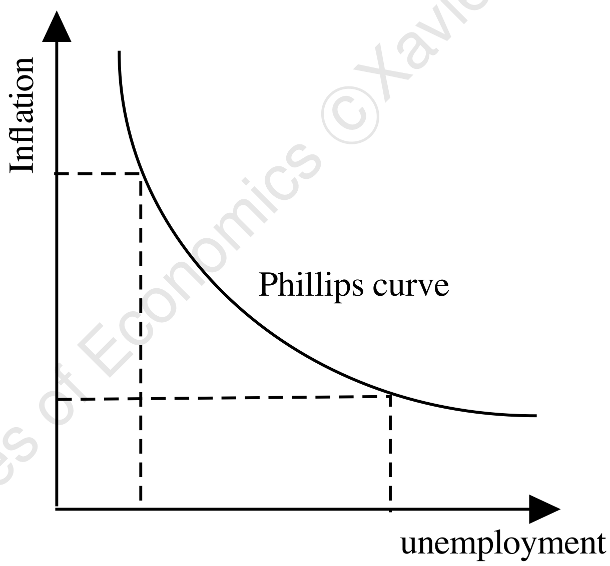
Source: US Department of Commerce, Department of Labor.

The Phillips curve.

Inverse relationship between inflation rate and unemployment rate. Controversial!!!

Reductions of unemployment rate against increases in inflation rate;

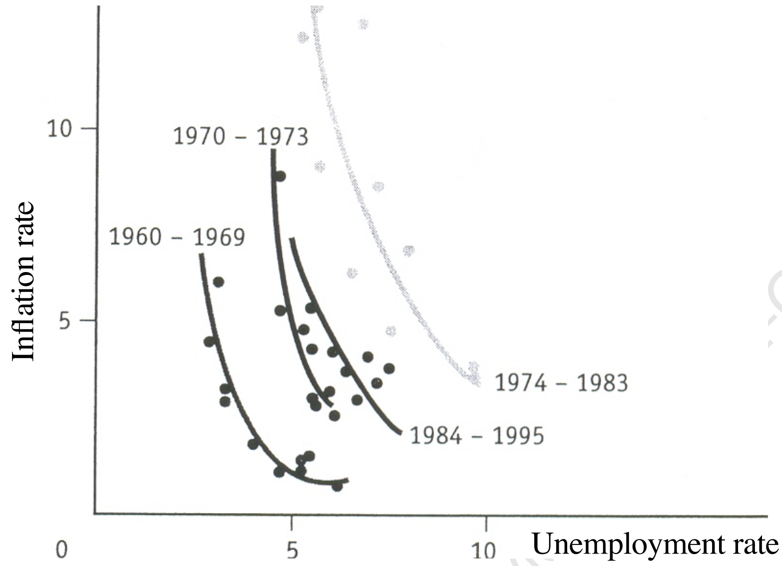
If prices moderate their increment, will yield an increase in unemployment.



The Natural Unemployment Rate

In the long term the economy tends towards an unemployment rate independent of the implementation of fiscal and/or monetary policies (with only short run effects).

Illustration: US 1960-1995.



∗ 1960-1969: good fit (increasing inflation). Average inflation 2.5%, unemployment 4.8%

⋆ 1970-1973: change in expectations (curve shifts). Average inflation and unemployment 5.2%

∘ 1974-1983: oil shock. Worse fit. Average inflation 8.2%, unemployment 7.5%

• 1984-1995: improve expectations. Average inflation 3.7%, unemployment 6.2%

Controversy: curve shifts vs. existence of the curve.

Macroeconomics of the health care market

Variables: 4 groups

⋆ population health status
- Life expectation at birth
- Mortality rate
- other: quality of life, morbidity, ...

⋆ Life style and behavior
- consumption of tobacco, alcohol and other drugs
- other: education rate, ...

⋆ Level of health services
- health expenditure per capita
- other: % hospital and pharma expenditure, ...

⋆ Health promotion
- % health care over GDP
- other: number physicians, nurses, ...

Relation between macro and health variables

★ Economic growth

⊙ Positive effects on health:

- Life expectancy at birth: Spain 1960-97. △ in 8 years (70 to 78, both sexes)

- Child mortality rate: Spain 1975-1997.
♢ neonatal + postneonatal: ▽ 21/1000 to 6/1000
♢ perinatal: ▽ 19/1000 to 5/1000

⊙ Negative effects on health:

- Suicide and selfinjuries rate: Spain 1960-97. △ smooth since 1975

- tobacco consumption: Spain 1960-97. △ 1000 ciggarettes/inhab/year. →

- Lung cancer mortality rate: △ $21/10^5$ to $69/10^5$ (males)

Source: Corugedo et al. (1999, p. 273-276)

★ Economic development and health expenditure

Positive relation and more than proportional:

$$\frac{\triangle\text{Health expenditure}}{\triangle GDP} > 1$$

★ Health expenditure and effects on health

Ambiguous effect. Decreasing returns of Health function $\longrightarrow$

Initial stages of a health system, big impact; Mature health systems modest impact.