


Kosmas Marinakis, Ph.D.

Lecture 1

Cost



microeconomics II

first module

Important notes

1. It is not possible to upload slides before the lectures
I **change the slides** even right before the lecture
2. If you have **slides from previous years** do not use them
 - ◆ Slides will be **different**
 - ◆ Their **numbers** will change
 - ◆ They will **confuse** you

Keep notes on your notebook – you do not need the slides now ^^

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Purpose of this lecture

- ★ This lecture intends to **remind** you important aspects of cost analysis suitable for the **study of markets**
- ★ Cost, as a notion, is very important for the **equilibrium** of a market
- ★ Equilibrium in every market will be **affected** by the cost structure of firms
 - in almost every **equilibrium condition**, one side involves the cost and the other the revenue.

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Opportunity Cost

- ★ **Opportunity Cost** is defined as the cost of the **next best** alternative
- ★ “My two most favorite things for my Sunday morning are: go for a **run** at the park or **ride** my motorbike”
 - the opportunity cost of running is the total units of **utility I forgo** from riding
- ★ If you are doing A and the opportunity cost of not doing B is higher than the benefit of doing A, you are doing the **wrong thing!**
 - once, I met an Uber driver who was a PhD in sociology, I never met one who was a PhD in economics!_

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Economic Cost

- ★ The **difference** between an economist and an accountant is that the economist takes in account the **opportunity cost** along with the other costs
 - ◆ Your opportunity cost is **not actually paid** to anyone
 - ◆ There are **no receipts** or invoices
 - ◆ The accountant **cannot measure** it
- ★ Economic decisions **should always involve** the opportunity cost ^^

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Sources of cost for the firm

- ★ The **cost of production** for a firm is affected by **two factors**
- 1. The available **technology**
 - technology determines all the **feasible** and **efficient** combinations of production factors for each production level
- 2. The **prices** of production factors
 - prices of factors yield the ruble amount of **cost per production level**_

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Technology

- ★ Technology determines the **optimal combination** of inputs for production
- ★ For **example**, to produce a mojito, you need:
 - ◆ 50ml of white rum
 - ◆ 20ml of sugar cane syrup
 - ◆ 5ml of lime juice
 - ◆ 100ml of sparkling water
 - ◆ 9.5 leaves of fresh mint
 - ◆ 1 bar-tender, who knows what is doing

Production function for the perfect mojito

- ★ Based on the recipe, the **production function** is

$$M = \min \left(\frac{1}{50}R, \frac{1}{20}S, \frac{1}{5}J, \frac{1}{100}W, \frac{1}{9.5}M, 30L \right)$$

of Mojitos
ml of syrup
ml of water
work hours

ml of rum
ml of lime
mint leaves

- ★ Ice is **not scarce**
- ★ Notice that **proportions** in this function are **fixed** you **cannot alter** the recipe that easy

Technical substitution

- ★ Imagine that you run a **print shop** you need workers (L) and printers (K) to produce prints (q)
- ★ In your production you may have **technical substitution**
- ★ You can produce 10,000 prints in a day with **either way**:
 - ◆ 1 worker and 3 printers (in one shift per day)
 - ◆ 3 workers and 1 printer (in three shifts per day)
- ★ If the quantity of prints produced every month **varies**, your production factors should be **adjusted**

The cost function

- ★ Cost is a mathematical function relating
 - ◆ Cost in monetary units
 - ◆ Efficient amount of inputs and their prices
- ★ Cost is **derived from** the production function
- ★ For example, the production function

$$q = A \cdot L^\beta \cdot K^{1-\beta}$$

where L is the amount of **labor**; K the amount of **machines** used in production; β is a positive fraction
- ★ For each level of q there is an **optimal combination** of L, K multiplying by the **prices** of L, K , we derive the **cost function**

Short Run and Long Run

- ★ Some factors can be adjusted **easier than others** it may be **easier** to hire/fire labor than buy/sell equipment
- ★ The distinction between S-R and L-R has to do **less with time** and more with the **adjustment flexibility** of the factor
 - ◆ If you are thinking to adjust **not easily adjustable factors** (machines, buildings etc.) you are thinking in the L-R
 - ◆ If you are thinking to adjust **easily adjustable factors** (labor, materials etc.) you are thinking in the S-R
- ★ For example adjusting **how hard** I work is S-R, changing my **workplace** is a L-R decision

Adjustment of factors

- ★ Adjusting **labor hours** is relatively easy and flexible ask your employees to work overtime or hire / fire workers relatively easily and fast
- ★ Adjusting the amount of **machines** is not that easy
 - ◆ It takes **time** to sell / buy machines
 - ◆ **Leasing contracts** may bind you for some time period
- ★ Factors that can be easily adjusted in the S-R period are treated as **variable cost**
- ★ Factors that cannot be adjusted in the S-R are treated as **fixed cost**

Fixed vs. Variable Cost

- ★ **Fixed costs** include everything that cannot be changed in the S-R period
 - ◆ Costs of factors that are set by **long-term contracts**
 - ◆ Factors that take a **long time** to be changed / created / delivered
- ★ Fixed costs are **constant** and **independent** of the level of S-R production (q)
- ★ **Variable costs** can be adjusted easy and fast
labor hours, raw materials, energy
- ★ Variable costs **vary** with the level of S-R production and can also be **avoidable**.

Fixed vs. Sunk Cost

- ★ Some fixed costs are also **sunk**
an expense is sunk when it **cannot be recovered** after it is paid
- ★ **Examples**
training an employee; apply for a non-transferable permit
- ★ **Not all** fixed costs are sunk
 - ◆ The cost of a **machine** is a **fixed** cost but may not be **sunk**
 - ◆ You can **liquidate** it and **recover part** of the expense
- ★ **Should** sunk costs affect economic decisions? $_$

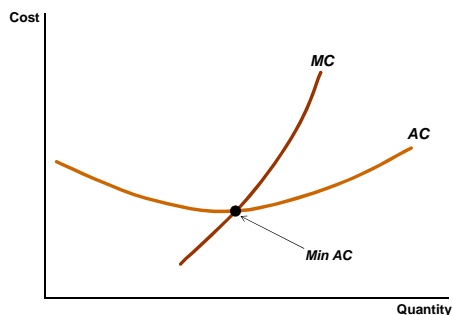
Cost in the S-R

- ★ Total Cost: $C = C(q)$
 - ◆ **Relates** cost of total production to the amount of production
 - ◆ Total cost must be an **increasing** function
- ★ Average Cost $AC = C(q)/q$
 - ◆ **Cost per unit** of production
 - ◆ Average cost may be a **non-monotonic** function
- ★ Marginal Cost $MC = \partial C(q)/\partial q$
 - ◆ The cost of **each additional unit** of production
 - ◆ Marginal cost may be **non-monotonic**, too $_$

Cost properties

- ★ $C(q)$ is increasing – and that's all
- ★ AC is usually “U-shaped”
decreasing in the beginning, reaches a **minimum**, then is *increasing*
- ★ When the AC is U-shaped, MC **intersects** AC at AC's **minimum**, while the MC is **increasing**
- ★ In this module, we will be using the AC and MC curves as a **system**
the “cost system” of the firm or the market $_$

AC and MC in the S-R



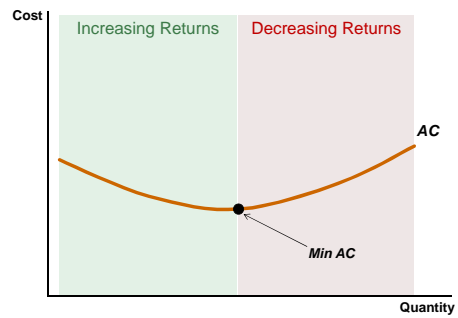
The cost system

- ★ AC is U-shaped (almost) **always**
- ★ Sometimes AC appears **monotonic**
because the minimum may be for very high or very low q
- ★ Sometimes AC looks **constant**
because the ‘U’ is soooooooooooooo wide $_$

Efficiency

- ★ The firm is **most efficient** when operates at the min AC
 - *operates = produces q
- ★ That is, produce q^* **so that** $\partial AC(q^*)/\partial q = 0$
- ★ For quantities below q^* , AC is **decreasing**
 - ◆ This is due to “**increasing returns to scale**” – Fixed factors are used **towards** their most efficient scale
- ★ For quantities above q^* , AC is **increasing**
 - ◆ This is due to “**decreasing returns to scale**” – Fixed factors are **overused** and drive costs up

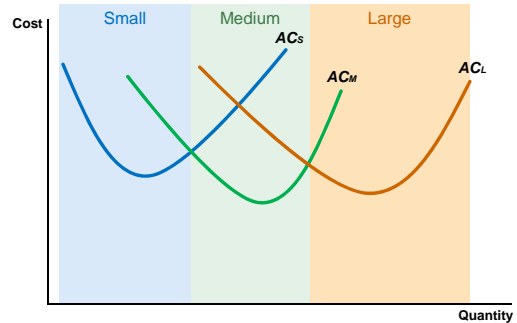
S-R cost and returns



Scale

- ★ When you make a **decision on the capital** you have to think about your **expected scale** of production
- ★ Let's get back to the **print shop** example
 - ◆ Expected output 10,000 copies/day → Small scale
 - ◆ Expected output 20,000 copies/day → Medium scale
 - ◆ Expected output 30,000 copies/day → Large scale
- ★ You **may be able** to produce 30,000 with the small scale but **AC will be high**
- ★ You **may** produce 10,000 with the large scale but **fixed costs will be high**

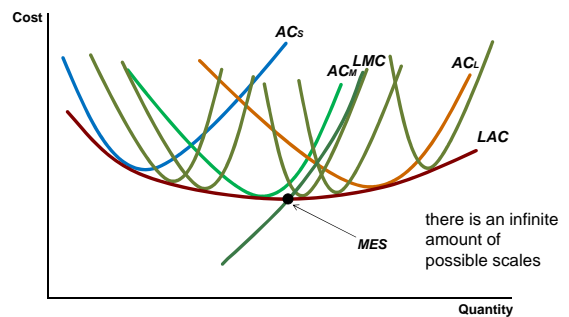
The right scale



Cost in the L-R

- ★ In the S-R, I am **stuck** with the scale I have chosen in the beginning of the period
- ★ In the L-R, I can **adjust** the scale because **all** production factors are adjustable
 - that is, I can **jump** from scale to scale
- ★ The shape of the LAC is then the **envelope curve** beneath the S-R AC of each scale

From S-R to L-R



Cost in the S-R

The shape of LAC

- ★ The LAC is **also U-shaped** (as the S-R AC is)
- ★ However, the reasons are **not the same**
- ★ Before the MES the LAC is decreasing because of **"Economies of Scale"**
larger scale machines are **more efficient** in massive production
- ★ After the MES the LAC is decreasing because of **"Dis-Economies of Scale"**
over-sized firms pay the toll of **inflexibility** and other **inefficiencies**
- ★ Economies of Scale and Returns to Scale are two **entirely different concepts**

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Cost in the S-R

L-R cost and economies

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Cost in the S-R

Economies vs. returns

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Cost in the S-R

Reasons for economies of scale

- ★ Economies of scale can be due to **several reasons**
 - ◆ **Specialization:** Producing at a large scale allows acquiring specialized machines or workers
 - ◆ **Engineering:** The square-cube law (surface increases by the square of dimensions but volume by the cube) for buildings, factories, pipelines, ships and airplanes
 - ◆ **Quantity discounts** when buying inputs
 - ◆ **Risk handling:** The law of large numbers
 - ◆ Requirement of **high fixed costs** to entry
 - ◆ **Indivisibilities**

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Cost in the S-R Economies of Scale

Indivisibilities

- ★ Some factors **cannot be scaled down**, so firms that want to use them must have the **sufficient size**
- you can't own half a horse!
- ★ It is not worth to buy a **tractor** if you only plant a small garden; it is not possible to buy 5% of a tractor!
- ★ It is **possible to do** things on a large scale that cannot be done on a small scale
small firms cannot **advertise** on national TV

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Thank you!

Kosmas Marinakis
 www.kmarinakis.org
 kmarinakis@hse.ru