# Economics 203: Intermediate Microeconomics I Lab Exercise #4

# **Section 1: Discussion:**

As the electronics industry has grown more mature and new technologies have been developed, the costs of many electronic products have fallen dramatically. Is this evidence that the long-run average cost curve slopes downward to the right?



# Not necessarily. The long run average\_cost curve may have shifted <u>downward</u>.



Fig. 19.15. Downward Shift in the Cost Curves due to Extertrnal diseconomies



Fig. 19.18. Shifting down of LAC due to Technology Progress

#### **Cost curves shift in response to changes in two factors:**

#### 1. Technology.

A technological change that increases productivity shifts the product curves upward and the cost curves downward. If a technological change results in the firm using more capital, the average fixed cost curve shifts upward and at low levels of output, the average total cost curve may shift upward. At large output levels, average total cost decreases.

#### 2. Prices of factors of production.

An increase in the price of a factor of production increases costs and shifts the cost curves upward. An increase in fixed cost does *not* affect the variable cost or marginal cost curves (*TVC*, *AVC*, and *MC* curves). An increase in variable cost does *not* affect the fixed cost curves (*TFC* and *AFC*). The total cost curves (*TC* and *ATC* curves) are affected by a price change for any factor of production.

Long run average cost is the cost per unit of output feasible when all factors of production are variable

### **Economies of Scale and Long Run Average Cost (LRAC)**

In the long run **all costs are variable** and the scale of production can change (i.e. no fixed inputs)

Economies of scale are the cost advantages from expanding the scale of production in the long run. The effect is to reduce average costs over a range of output.

These lower costs represent an improvement in **productive efficiency** and can give a business a **competitive advantage** in a market. They lead to lower prices <u>and higher profits</u> – this is called a **positive sum game** for producers and consumers (i.e. the welfare of both will improve)

We make no distinction between fixed and variable costs in the long run As long as the long run average total cost curve (LRAC) is declining, then internal economies of scale are being exploited.

The table below shows a numerical exam	nple of falling LRAC
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Long Run Output (Units)	Total Costs (£s)	Long Run Average Cost (£ per unit)
1000	12000	12
2000	20000	10
5000	45000	9
10000	80000	8
20000	144000	7.2
50000	330000	6.6
100000	640000	6.4
500000	3000000	6

#### **Returns to Scale and Costs in the Long Run**

The table below shows how changes in the scale of production can, if **increasing returns to scale** are exploited, lead to lower average costs.

	Factor Inputs			Production	Costs	
	(K)	(La)	(L)	(Q)	(TC)	(TC/Q)
	Capital	Land	Labour	Output	Total Cost	Average Cost
Scale A	5	3	4	100	3256	32.6
Scale B	10	6	8	300	6512	21.7
Scale C	15	9	12	500	9768	19.5
Costs: As	sume the	cost of	each unit	of capital = $\pounds 60$	$00, Land = \pounds 80$	) and Labour = $\pounds 200$

Because the % change in output exceeds the % change in factor inputs used, then, although total costs rise, the average cost per unit falls as the business expands from scale A to B to C

## **Examples of Increasing Returns to Scale**

Much of the new thinking in economics focuses on the **increasing returns** available to growing businesses: An example of this is the software and computer gaming industry.

1.The **overhead costs** of developing new software programs or computer games are huge - often running into hundreds of millions of dollars

2. The **marginal cost** of one extra copy for sale is close to zero, perhaps just a few cents or pennies

3.If a company can establish itself in the market, positive feedback from consumers will **expand the installed customer base**, raise demand and encourage the firm to increase production

4.Because marginal cost is low, the extra output reduces average costs creating **economies of scale** 

# **Capacity Utilization, Fixed Costs and Profits**

Lower costs normally mean **higher profits** and increasing financial returns for the shareholders. What is true for software developers is also important for telecoms companies, airlines, music distributors and cinema operators

We find across many different markets that, when a high percentage of costs are fixed the higher the level of production the lower will be the average cost of production

Strong demand means **capacity utilization** rates are high and this lowers the unit cost of supply

#### **Internal Economies of Scale in the Long Run**

Economies of scale arise from increasing returns to scale



The long run average cost curve with economies and diseconomies of scale

#### Long Run Average Cost Curve

The **long run average cost curve** (LRAC) is known as the **'envelope curve'** and is drawn on the assumption of their being an infinite number of plant sizes – hence its smooth appearance in the next diagram on the next page.

The **points of tangency** between LRAC and SRAC curves <u>do not occur</u> at the minimum points of the SRAC curves except at the point where the minimum efficient scale (MES) is achieved.

If LRAC is falling when output is increasing then the firm is experiencing **economies of scale**. For example a doubling of factor inputs might lead to a more than doubling of output.

Conversely, When LRAC eventually starts to rise then the firm experiences **diseconomies of scale**, and, If LRAC is constant, then the firm is experiencing constant returns to scale

The working assumption is that a business will choose the **least-cost method of production** in the long run. Moving down the LRAC means there are cost advantages from a bigger scale of supply

# . Cost curves in reality

- Evidence shows that cost curves are not typically U-shaped. In a survey by Wilford J. Eiteman and Glenn E. Guthrie in 1952 managers of 334 companies were shown a number of different cost curves, and asked to specify which one best represented the company's cost curve. 95% of managers responding to the survey reported cost curves with constant or falling costs.
- Alan Blinder, former vice president of the American Economics Association, conducted the same type of survey in 1998, which involved 200 US firms in a sample that should be representative of the US economy at large. He found that about 40% of firms reported falling variable or marginal cost, and 48.4% reported constant marginal/variable cost.

# **Section 2: Applications**

1) Suppose that a firm's short-run total cost function is as follows:

Output (number of units	Total Cost per Year (\$)
per year)	
0	20,000
1	20,100
2	20,200
3	20,300
4	20,500
5	20,800

a) What are the firm's total fixed costs? 20,000

b) What are its total variable costs when it produces 4 units per year?

TC=20,500 TVC=TC-FC TVC= 20500-20,000=500

c) What is the firm's marginal cost when between 4 and 5 units are produced per year?

TC(5)-TC(4)=MC(5,4)

20800-20500=300

- d) Does marginal cost increase beyond some output level? Yes from 3 to 4 units.
- e) What is the firm's average cost when it produces 1 unit per year? AC=TC/Q AC=(20,100/1)=20,100
- f)What is the firm's average cost when it produces 2 units per year? (20,200/2)=10100
- g) What is the firm's average cost when it produces 3 units per year? (20,300/3)=6766.67

# 2) Fill in the blanks below:

Total	TFC	TVC	ATC	AFC	AVC
output					
0	500				
1		20			
2			300		
3					1331/3
4		1,100			

# 2) Fill in the blanks below:

Total	TFC	TVC	ATC	AFC	AVC
output					
0	500	0	0	0	0
1	500	20	520	500	20
2	500	100	300	250	50
3	500	400	300	166 <sup>2/3</sup>	1331/3
4	500	1,100	400	125	275

# **MC Practice**

- 1. Total cost can be broken down into two components:
- A) average cost and marginal cost.
- B) average cost and fixed cost.
- C) variable cost and marginal cost.
- D) variable cost and fixed cost.

Ans: D



2. Once we enter the region of continuously diminishing returns,

- A) variable cost increases at a decreasing rate.
- B) variable cost increases at an increasing rate.
- C) variable cost decreases at a decreasing rate.
- D) variable cost decreases at an increasing rate.
- E) variable cost decreases at an indeterminate rate.

## Ans: B



- 3.) The fixed cost curve:
- A) varies with the level of output.
- B) is negatively sloped.
- C) is simply a horizontal line.
- D) is simply a rectangular hyperbola.
- E) B and D.



4). The short run total cost of zero output is equal to

- A) zero.
- B) fixed cost.
- C) variable cost.
- D) total revenue.

Ans: B



5). The vertical distance between the total variable cost and total cost curves necessarily A) is everywhere equal to zero.B) is everywhere equal to marginal cost.C) is everywhere equal to fixed cost.D) decreases at a decreasing rate.

## Ans: C



# 6). If the total cost function is $TC = 10Q^3 - 50Q^2 + 1000Q + 500$ , what is the equation for ATC?



# Ans: $ATC = 10Q^2 - 50Q + 1000 + 500/Q$

7). Sketch the long run average cost curve and the short run average total cost curve of a plant that is too small to produce at the point of minimum long run average cost. Put the two curves on the same graph and include the marginal cost curves for both average cost functions. Ans: Note that SMC = LMC at the level of output where SAC = LAC, and that the SMC curve cuts the LMC curve from below.

