

Production and Cost Analysis, Long Run

We will now consider the kind of considerations that might or would be pertinent in a firm's long run decision. Recall that in the long run everything is variable. A firm is no longer bound by its location decision and hence can change its size. It can also choose the machines and technology to augment its labor. Is the decision straight forward, that is use the best available technology that would give it the greatest output, on a site that is central to its market that would minimize its distribution cost? Well things are not simple, recall that economics is about the allocation of scarce resources. A firm does not have limitless resources, so it has to make use of them with prudence given its expected cost, that is how fast new technology might be changing, or how it foresees its market share would be evolving given its competitors might be exiting and entering the market at anytime. What could guide their decision?

Technical versus Economic Efficiency

In the long run, what a firm needs is technology that is most cost efficient, that is a technology that would allow it to manufacture its product quickly to meet its demand, at the least cost. To this extent we need to differentiate between **Technical** and **Economic Efficiency**.

- **Technical Efficiency** refers to the technology that uses the least inputs to produce a given output.
- **Economic Efficiency** refers to the use of methods that produces a given level of output at the lowest possible cost.

Examples:

- Why different firms may use different processes and different combination of inputs when technically, there is only one that is technically efficient.
- The simplest parallel is the production of "traveling" from Antigonish to Halifax.
 - Rich: Someone from a well-to-do family would be able to afford the best car to travel that distance in the shortest time. The sole input is the good car.
 - Average Joe: How about someone to who cannot afford a car? The best available technology would be to the bus service. It is not the most technically efficient mode, and it requires other a bus driver, and you would have to abide by the bus company's schedule, but it will get the job done given the amount of resources the individual has.
 - Down-but-not-out: What if the individual in question has neither car, nor the means to get a ticket, while he could walk all the way there, if he has the time, or he could hitch a ride, and his best available technology is chance, and divine intervention for efficiency.

Determinants of the Shape of the Long-Run Cost Curve

In the short-run, a firm is bound by its choices it made on technology, and other capital choices, which hence gives us the shape of the marginal and average cost curves, as well as the marginal and average product curves. However, in the long run because all inputs

are variable the shape of the firm's total cost curve is determined by other reasons. The main reason is economies and diseconomies of scale.

1. When a firm enjoys **economies of scale** or **increasing returns to scale** in the long-run their average total costs decrease as they increase their output.

→ Consider the minimum setup of a firm to get it started, such as accounting, sales, human resource personnel etc who are required in a firm. Once these positions are setup, as we increase output due to the size of demand the product, these personnel cost are spread among all of them, and the rate of hires for these personnel do not typically exceed the rate of growth of output, and we get the incidence of total cost falling as output increases.

→ Another way to think about this is when a firm is working well within its means, and it enjoys productivity and efficiency gains as they produce more. That is a **doubling of inputs lead to more than doubling of output**.

A firm would hence want to choose a level of production such that it spreads cost around sufficiently for a firm to undertake production profitably. This is typically referred to as the minimum efficient level of production, and is when the long run average total cost is at its minimum. At this point, as long as price of the firm's product is above its long run average total cost, it would be making positive profits. Why?

$$\begin{aligned}\Pi_{LR} &= PQ - TC \\ \Rightarrow \frac{\Pi_{LR}}{Q} &= P - \frac{TC}{Q} = P - ATC_{LR}\end{aligned}$$

From the above, it then simply means that the lower the firm can get their long run average total cost, given price of their product, the greater their profit would be.

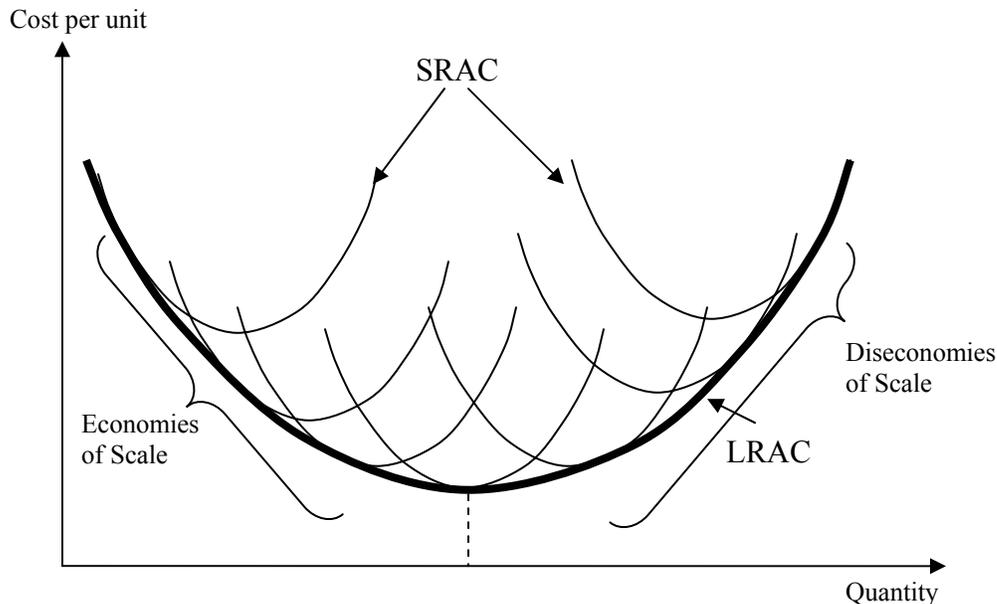
Food for thought: Is it then necessarily true that a firm chooses that point as their optimal output choice?

2. When a firm faces rising average total cost as it raises its production, it implies that the firm has arrived at the limit of the market, where the market cannot support any additional increase in production. We typically refer to this as **Diseconomies of Scale** or **Decreasing Returns to Scale**. Another way to think about this is that of falling productivity, or a **doubling of input leads to a less than doubling of output**. This might also occur when a firm grows too large for management to effectively control all facets of its production network. Consider all the coordination concerns that go into the production of a car, since no one plant manufactures all parts of a vehicle. The more the various components are broken up to perhaps gain quality from specialization there will come a point where coordination may be difficult.
3. **Constant Returns to Scale** by extension is the point or set of levels of production where there will not be any increase in average cost as the firm raises production levels. So at this juncture, **a doubling of input doubles output**.

Long and Short Run Cost Curves

By extension of our prior discussion, it must then be true that Long Run Total and Average Cost (LRAC & LRATC) curve is always below Short Run Total and Average Cost (SRATC & SRAC) curve since all inputs are variable in the long run, recall as well our discussion on capacity constraints in the short-run.

Diagrammatically, each SRAC must be tangent (Just touches) to the LRAC at one and only one point.



Using Cost Analysis

As with much of what we have studied so far, the above manner in which economist went about understanding production is an abstraction of reality, that is we stripped reality to its barest minimum that would allow us to understand some pertinent observation about firms' choices. However, reality as usual has its quirks that does not always allow this simple translation.

1. **Economies of Scope** is when the costs of production of two different products are interdependent, so that when a firm produces one, it would be cost effective to produce the other as well. Consider a motorbike helmet manufacturer. Since the technology for this helmet, and bicycle helmets are similar, it would be cost efficient for it to manufacture and sell bicycle helmets as well.
2. In most firms, the key assets are the employees, be they white or blue collar. What our description of long run cost does not describe the idea that the more a worker performs their task, the better they become and this will reduce cost as well in the long run. This is referred to as **Learning-by-doing**. Further, technology in the past 2 decades has been advancing at such a pace that most firms are constantly facing decreasing cost as production increases. Consider automation of bike

building, which has made changing of specification an easy as opposed to daunting task, which might have included building new jigs. This is referred to as **Technological Change**.

3. **Dimensions of a product:** There is more to a production than just output choice. Because different qualities of a product appeals to different types of consumers, firms will vary those qualities that best describe the preferences of their most consumer type.
4. **External Economies:** The location of related or complementary firms may benefit other client firms located around the firm's vicinity. Consider having a software company next to a computer manufacturer, example Silicon Valley.
5. **Unmeasured Opportunity Cost:** Consider the following: The digital music equipment industry was dominated for the longest time by Creative Technologies, and still is. Nonetheless, consider the possible consequences if Steve Jobs had not redirected some of Apple's energy into this market segment.