Economics 326: Profit Maximization and Production

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Outline

1. Profit Maximization

2. Production

1 Profit Maximiztion

- What is profit maximization?

- Firms decide how many inputs to purchase in order to produce:
  - K for Kapital
  - L for Labor

- Give capital and labor decisions, firms produce output:

$$Y = F(K, L)$$

- This function is called the production function.

- Revenue is quantity of output (number of goods produced and sold) times price:

$$R = pY = pF(K, L)$$

- What are the costs that the producer faces?

  - Labor costs: wage bill which is just the number of worker hours times the wage

$$wL$$

  - Capital costs: rental rate on capital times the amount of capital used

$$rK$$

- So total costs are:

$$C = wL + rK$$

- Profits are revenues minus costs

$$\begin{aligned} \Pi(K, L) &= R - C = pF(K, L) - (wL + rK) \\ &= pF(K, L) - wL - rK \end{aligned}$$

- Similar to Utility Maximization
  - Maximize benefits minus costs rather than Benefits subject to cost constraints
  - Why this differences? Benefits are in dollars and costs are in dollars
- What are the endogenous variables? What are the exogenous parameters?
- So firms choose inputs to maximize profits.

- What are the analogues of Marshallian Demand? Input Demand.

2 Production

- The production function is like the utility function of the supply side of the economy.

- The simples interesting choices are for two inputs (capital and labor) but that means 3 dimensional graphs (output, capital labor) as with utility functions.

- So, we graph the level sets of production function - the analogue of indifference curves. They are called isoquants. An isoquant (iso = same, quant = quantity) is a combination of labor and capital inputs that gives the same production level.

- Different from indifference curves, isoquants have cardinal not just ordinal meaning.

  – Indifference curves: the indifference curve $\bar{U}(X, Y) = 5$ is the set of all commodities X and Y such that utility is 5. Here utility being 5 has no meaning. Just the order of utility has meaning.

  – Isoquants: $\bar{F}(K, L) = 5$ is the set of all input pairs (K, L) such that output is 5.

- Besides Isoquants, the returns to scale of production are a very important property. The returns to scale will be very important for the theory of monopoly.

$$\begin{aligned} F(\lambda K, \lambda L) &< \lambda F(K, L) : \text{ Decreasing Returns} \\ F(\lambda K, \lambda L) &= \lambda F(K, L) : \text{ Constant Returns} \\ F(\lambda K, \lambda L) &> \lambda F(K, L) : \text{ Increasing Returns} \end{aligned}$$

- How do we interpret these three possible returns to scale?

- Decreasing Returns: As you produce more, you become less productive.

  * Example: suppose one unit of labor and capital produce 5 units of output. moreover lets say that if you double the inputs (2 units of labor and capital), you get 8 units of output.

$$
\begin{aligned}
F(1,1) &= 5 \\
F(2,2) &= 8 < 10 = 2 * F(1,1)
\end{aligned}
$$

  * So then 1 unit of capital costs r and one unit of labor costs w, the costs of producing 5 units is $r + w$. However if I double the costs by doubling the inputs ($2r + 2w$ costs), I less than double the output.

  * Firms which have decreasing returns to scale tend to be small.

- Constant Returns: As you produce more, your productivity stays the same

* Example: suppose one unit of labor and capital produce 5 units of output. moreover lets say that if you double the inputs (2 units of labor and capital), you get 10 units of output.

$$F(1,1) = 5$$
$$F(2,2) = 10 = 10 = 2 * F(1,1)$$

* So then 1 unit of capital costs r and one unit of labor costs w, the costs of producing 5 units is $r + w$. However if I double the costs by doubling the inputs ($2r + 2w$ costs), I exactly double the output.

* Firms which have constant returns to scale can be of any size.

– Increasing Returns: As you produce more, your productivity increases

  * Example: suppose it one unit of labor and capital produce 5 units of output. moreover lets

say that if you double the inputs (2 units of labor and capital), you get 8 units of output.

$$\begin{aligned} F(1,1) &= 5 \\ F(2,2) &= 14 > 10 = 2 * F(1,1) \end{aligned}$$

* So then 1 unit of capital costs r and one unit of labor costs w, the costs of producing 5 units is $r + w$. However if I double the costs by doubling the inputs ($2r + 2w$ costs), I lmore than double the output!

* Firms which have decreasing returns to scale tend to be large. They tend to be monopolists or oligopolists (more on this later in the course).