Microeconomics (Cost, Ch 7)

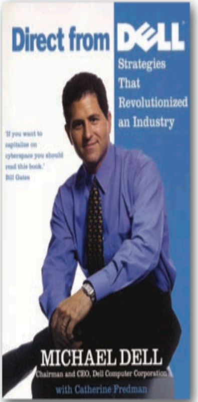
Lectures 10-11-12

Feb 09/13/16, 2017

Michael Dell began selling personal computers out of his dorm room as an undergraduate at the University of Texas at Austin. In 1984, with $1,000 in start-up funds, he founded Dell Computer Corporation.

Dell saw great inefficiencies in the operations of giant rivals like IBM and Compaq. In response, he pioneered direct-to-consumer marketing of computers. Cutting out middlemen such as wholesalers and retailers, he pushed his company to produce PCs at the lowest possible cost. This strategy required some gutsy and insightful decisions, which we'll examine later in the chapter.

Today, success in the PC market requires high-quality manufacturing at costs that are at or below those of competitors. Because Dell understood this point early on, his company profited handsomely. In 2004 Dell Computer Corporation's sales totaled $49.2 billion, and Michael Dell's personal net worth was more than $14 billion.



Michael Dell

7.1 MEASURING COST: WHICH COSTS MATTER?

Economic Cost versus Accounting Cost

- **accounting cost** Actual expenses plus depreciation charges for capital equipment.
- **economic cost** Cost to a firm of utilizing economic resources in production, including opportunity cost.

Opportunity Cost

- **opportunity cost** Cost associated with opportunities that are forgone when a firm's resources are not put to their best alternative use.

7.1 MEASURING COST: WHICH COSTS MATTER?

Sunk Costs

- **sunk cost** Expenditure that has been made and cannot be recovered.

Because a sunk cost cannot be recovered, it should not influence the firm's decisions.

For example, consider the purchase of specialized equipment for a plant. Suppose the equipment can be used to do only what it was originally designed for and cannot be converted for alternative use. The expenditure on this equipment is a sunk cost. *Because it has no alternative use, its opportunity cost is zero*. Thus it should not be included as part of the firm's economic costs.

7.1 MEASURING COST: WHICH COSTS MATTER?

Fixed Costs and Variable Costs

- **total cost (TC or C)** Total economic cost of production, consisting of fixed and variable costs.
- **fixed cost (FC)** Cost that does not vary with the level of output and that can be eliminated only by shutting down.
- **variable cost (VC)** Cost that varies as output varies.

The only way that a firm can eliminate its fixed costs is by shutting down.

7.1 MEASURING COST: WHICH COSTS MATTER?

Fixed Costs and Variable Costs

Shutting Down

Shutting down doesn't necessarily mean going out of business.

By reducing the output of a factory to zero, the company could eliminate the costs of raw materials and much of the labor. The only way to eliminate fixed costs would be to close the doors, turn off the electricity, and perhaps even sell off or scrap the machinery.

Fixed or Variable?

How do we know which costs are fixed and which are variable?

Over a very short time horizon—say, a few months—most costs are fixed. Over such a short period, a firm is usually obligated to pay for contracted shipments of materials.

Over a very long time horizon—say, ten years—nearly all costs are variable. Workers and managers can be laid off (or employment can be reduced by attrition), and much of the machinery can be sold off or not replaced as it becomes obsolete and is scrapped.

7.1 MEASURING COST: WHICH COSTS MATTER?

Fixed versus Sunk Costs

Sunk costs are costs that have been incurred and *cannot be recovered*.

An example is the cost of R&D to a pharmaceutical company to develop and test a new drug and then, if the drug has been proven to be safe and effective, the cost of marketing it.

Whether the drug is a success or a failure, these costs cannot be recovered and thus are sunk.

Amortizing Sunk Costs

- **amortization** Policy of treating a one-time expenditure as an annual cost spread out over some number of years.

7.1 MEASURING COST: WHICH COSTS MATTER?

EXAMPLE 7.2 Sunk, Fixed, and Variable Costs: Computers, Software, and Pizzas

It is important to understand the characteristics of production costs and to be able to identify which costs are fixed, which are variable, and which are sunk.

Good examples include the personal computer industry (where most costs are variable), the computer software industry (where most costs are sunk), and the pizzeria business (where most costs are fixed).

Because computers are very similar, competition is intense, and profitability depends on the ability to keep costs down. Most important are the variable cost of components and labor.

A software firm will spend a large amount of money to develop a new application. The company can try to recoup its investment by selling as many copies of the program as possible.

For the pizzeria, sunk costs are fairly low because equipment can be resold if the pizzeria goes out of business. Variable costs are low—mainly the ingredients for pizza and perhaps wages for a couple of workers to help produce, serve, and deliver pizzas.

7.1 MEASURING COST: WHICH COSTS MATTER?

Marginal and Average Cost

Marginal Cost (MC)

- **marginal cost (MC)** Increase in cost resulting from the production of one extra unit of output.

Because fixed cost does not change as the firm's level of output changes, marginal cost is equal to the increase in variable cost or the increase in total cost that results from an extra unit of output.

We can therefore write marginal cost as

$$\mathrm{MC} = \Delta\mathrm{VC}/\Delta q = \Delta\mathrm{TC}/\Delta q$$

7.1 MEASURING COST: WHICH COSTS MATTER?

Marginal and Average Cost

Average Total Cost (ATC)

- **average total cost (ATC)**
  Firm’s total cost divided by its level of output.

- **average fixed cost (AFC)**
  Fixed cost divided by the level of output.

- **average variable cost (AVC)**
  Variable cost divided by the level of output.

7.1 MEASURING COST: WHICH COSTS MATTER?

Marginal and Average Cost

Marginal Cost (MC)

TABLE 7.1 A Firm's Costs

Rate of Output (Units per Year)	Fixed Cost (Dollars per Year)	Variable Cost (Dollars per Year)	Total Cost (Dollars per Year)	Marginal Cost (Dollars per Unit)	Average Fixed Cost (Dollars per Unit)	Average Variable Cost (Dollars per Unit)	Average Total Cost (Dollars per Unit)
	(FC) (1)	(VC) (2)	(TC) (3)	(MC) (4)	(AFC) (5)	(AVC) (6)	(ATC) (7)
0	50	0	50	--	--	--	--
1	50	50	100	50	50	50	100
2	50	78	128	28	25	39	64
3	50	98	148	20	16.7	32.7	49.3
4	50	112	162	14	12.5	28	40.5
5	50	130	180	18	10	26	36
6	50	150	200	20	8.3	25	33.3
7	50	175	225	25	7.1	25	32.1
8	50	204	254	29	6.3	25.5	31.8
9	50	242	292	38	5.6	26.9	32.4
10	50	300	350	58	5	30	35
11	50	385	435	85	4.5	35	39.5

7.3 COST IN THE LONG RUN

The Isocost Line

- **isocost line** Graph showing all possible combinations of labor and capital that can be purchased for a given total cost.

To see what an isocost line looks like, recall that the total cost *C* of producing any particular output is given by the sum of the firm's labor cost *wL* and its capital cost *rK:*

$$C = wL + rK \qquad \textbf{(7.2)}$$

If we rewrite the total cost equation as an equation for a straight line, we get

$$K = C/r - (w/r)L$$

It follows that the isocost line has a slope of $\Delta K/\Delta L = -(w/r)$, which is the ratio of the wage rate to the rental cost of capital.

7.3 COST IN THE LONG RUN

The Isocost Line

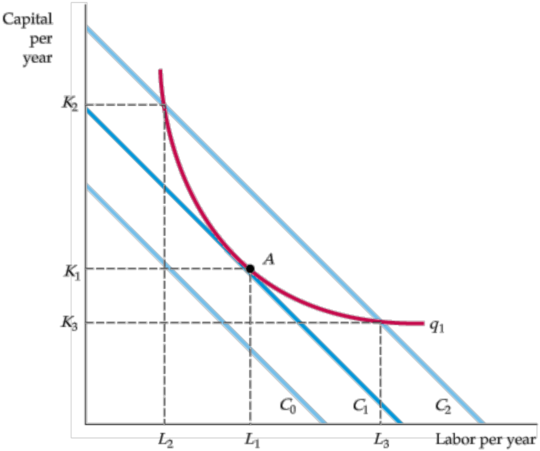
Figure 7.3

Producing a Given Output at Minimum Cost

Isocost curves describe the combination of inputs to production that cost the same amount to the firm.

Isocost curve C_1 is tangent to isoquant q_1 at A and shows that output q_1 can be produced at minimum cost with labor input L_1 and capital input K_1.

Other input combinations–L_2, K_2 and L_3, K_3–yield the same output but at higher cost.



7.3 COST IN THE LONG RUN

Choosing Inputs

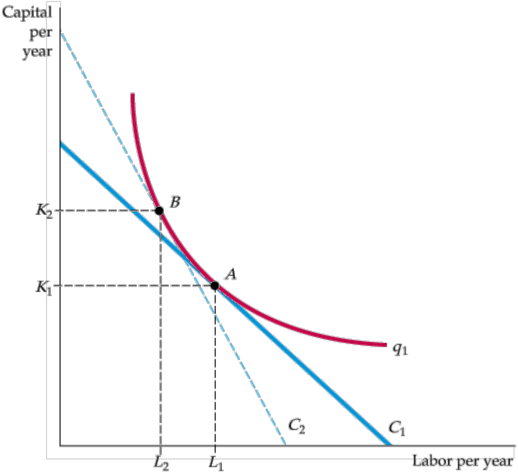
Figure 7.4

Input Substitution When an Input Price Changes

Facing an isocost curve C_1, the firm produces output q_1 at point *A* using L_1 units of labor and K_1 units of capital.

When the price of labor increases, the isocost curves become steeper.

Output q_1 is now produced at point *B* on isocost curve C_2 by using L_2 units of labor and K_2 units of capital.



7.3 COST IN THE LONG RUN

Choosing Inputs

Recall that in our analysis of production technology, we showed that the marginal rate of technical substitution of labor for capital (MRTS) is the negative of the slope of the isoquant and is equal to the ratio of the marginal products of labor and capital:

$$\mathrm{MRTS} = -\Delta K / \Delta L = \mathrm{MP}_L / \mathrm{MP}_K \qquad \textbf{(7.3)}$$

It follows that when a firm minimizes the cost of producing a particular output, the following condition holds:

$$\mathrm{MP}_L / \mathrm{MP}_K = w / r$$

We can rewrite this condition slightly as follows:

$$\boxed{\mathrm{MP}_L / w = \mathrm{MP}_K / r \qquad \textbf{(7.4)}}$$

7.3 COST IN THE LONG RUN

Cost Minimization with Varying Output Levels

- **expansion path** Curve passing through points of tangency between a firm's isocost lines and its isoquants.

The Expansion Path and Long-Run Costs

To move from the expansion path to the cost curve, we follow three steps:

1. Choose an output level represented by an isoquant. Then find the point of tangency of that isoquant with an isocost line.
2. From the chosen isocost line determine the minimum cost of producing the output level that has been selected.
3. Graph the output-cost combination.

7.3 COST IN THE LONG RUN

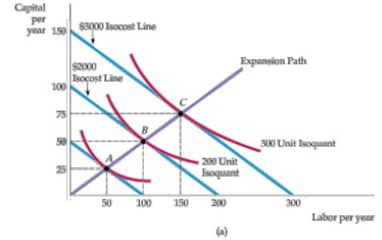
Cost Minimization with Varying Output Levels

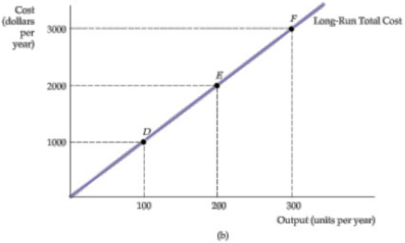
Figure 7.6

A Firm's Expansion Path and Long-Run Total Cost Curve

In **(a)**, the expansion path (from the origin through points *A*, *B*, and *C*) illustrates the lowest-cost combinations of labor and capital that can be used to produce each level of output in the long run— i.e., when both inputs to production can be varied.

In **(b)**, the corresponding long-run total cost curve (from the origin through points *D*, *E*, and *F*) measures the least cost of producing each level of output.





7.4 LONG-RUN VERSUS SHORT-RUN COST CURVES

The Inflexibility of Short-Run Production

Figure 7.7

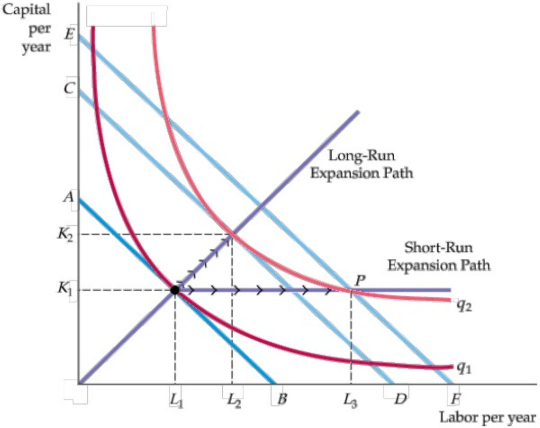
The Inflexibility of Short-Run Production

When a firm operates in the short run, its cost of production may not be minimized because of inflexibility in the use of capital inputs.

Output is initially at level q_1.

In the short run, output q_2 can be produced only by increasing labor from L_1 to L_3 because capital is fixed at K_1.

In the long run, the same output can be produced more cheaply by increasing labor from L_1 to L_2 and capital from K_1 to K_2.



7.4 LONG-RUN VERSUS SHORT-RUN COST CURVES

Economies and Diseconomies of Scale

- **economies of scale** Situation in which output can be doubled for less than a doubling of cost.
- **diseconomies of scale** Situation in which a doubling of output requires more than a doubling of cost.

Increasing Returns to Scale:	Output more than doubles when the quantities of all inputs are doubled.
Economies of Scale:	A doubling of output requires less than a doubling of cost.

*7.6 DYNAMIC CHANGES IN COSTS—THE LEARNING CURVE

Learning versus Economies of Scale

TABLE 7.3 Predicting the Labor Requirements of Producing a Given Output

Cumulative Output (N)	Per-Unit Labor Requirement for Each 10 Units of Output (L)*	Total Labor Requirement
10	1.00	10.0
20	.80	18.0(10.0 + 8.0)
30	.70	25.0(18.0 + 7.0)
40	.64	31.4(25.0 + 6.4)
50	.60	37.4(31.4 + 6.0)
60	.56	43.0(37.4 + 5.6)
70	.53	48.3(43.0 + 5.3)
80	.51	53.4(48.3 + 5.1)

*The numbers in this column were calculated from the equation $\log(L) = -0.322 \log(N/10)$, where L is the unit labor input and N is cumulative output.

*7.6 DYNAMIC CHANGES IN COSTS—THE LEARNING CURVE

Graphing the Learning Curve

The learning curve is based on the relationship

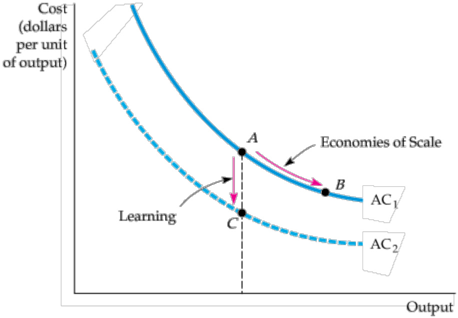
$$L = A + BN^{-\beta} \tag{7.8}$$

Learning versus Economies of Scale

Figure 7.12

Economies of Scale versus Learning

A firm's average cost of production can decline over time because of growth of sales when increasing returns are present (a move from *A* to *B* on curve AC_1),
or it can decline because there is a learning curve (a move from *A* on curve AC_1 to *C* on curve AC_2).



- Suppose the learning curve is:

$$L = A + BN^{-\beta}$$

L: Labour input per unit of output; N: Total output produced.
- A, B are positive constant
- Question: If output gets double and $\beta = 0.31$, at what percentage rate does the input requirement changes?

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- Ans: Input requirement falls by approximately 20 percent.

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L: Labour input per unit of output; N: Total output produced.

- A, B are positive constant
- Question: If output gets double and $\beta = 0.31$, at what percentage rate does the input requirement changes?
- Ans: Input requirement falls by approximately 20 percent.
- Because, $(L - A) = BN^{-0.31}$. Check that $B(2N)^{-0.31} \approx 0.8(L - A)$. (verify this!)

*7.6 DYNAMIC CHANGES IN COSTS—THE LEARNING CURVE

Learning versus Economies of Scale

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*7.6 DYNAMIC CHANGES IN COSTS—THE LEARNING CURVE

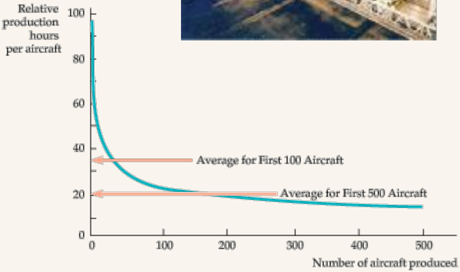
EXAMPLE 7.6 The Learning Curve in Practice

Figure 7.13

Learning Curve for Airbus Industrie

The learning curve relates the labor requirement per aircraft to the cumulative number of aircraft produced.

As the production process becomes better organized and workers gain familiarity with their jobs, labor requirements fall dramatically.



Thank You