

9

DIMINISHING RETURNS

OVERVIEW

1. The short run is a period of time in which at least one factor of production is fixed. In the long run, all factors are variable.
2. Total product tells the amount of output produced for each quantity of a variable input. The marginal product tells the change in the total product when the variable factor changes by one unit.
3. The law of diminishing returns states that as an increasing amount of a variable factor is added to a fixed factor, the marginal product of the variable factor may at first rise but must eventually fall.
4. The law of diminishing returns applies in the short run because only then is some factor fixed. The source of the law is that resources are not perfect substitutes. To get an additional unit of output, only the variable input can be increased. But the variable input is an imperfect substitute for the fixed input so we obtain less and less extra output for each additional unit of the variable input. Thus marginal product must fall.

MATCHING

- | | | | | |
|-------|----|----------------------------|----|--|
| _____ | 1. | short run | a. | the change in total product due to a change in the variable input by one |
| _____ | 2. | fixed factor | b. | the amount of output produced at each input level |
| _____ | 3. | variable factor | c. | a period of time in which all inputs can vary |
| _____ | 4. | long run | d. | an input that cannot be changed in the short run |
| _____ | 5. | total product | e. | a period of time in which some input cannot be varied |
| _____ | 6. | marginal product | f. | the marginal product must eventually diminish |
| _____ | 7. | law of diminishing returns | g. | a factor that can be varied in the short run |

True-False

- | | | |
|-------|----|--|
| _____ | 1. | The law of diminishing returns sets in when output begins to fall as the variable input rises. |
| _____ | 2. | The law of diminishing returns is true even in the long run. |
| _____ | 3. | The law of diminishing returns depends on a fixed factor. |
| _____ | 4. | If the marginal product decreases when the variable input rises, so must the total product. |
| _____ | 5. | When the total product falls, the marginal product is negative. |

PROBLEMS

1.

Labor	Total Product	Marginal product
1	20	-
2	46	
3	75	
4	92	
5	100	
6	96	

- a. Complete the table.
 - b. At what use of labor does diminishing returns set in?
 - c. At what use of labor does the marginal product become negative? _____
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2. Fill in the following table

Labor	MP	Total Output
0	---	0
1	25	
2	75	
3	150	
4		375
5	100	
6		550
7	50	
8		625
9	-10	

IN THE NEWS

1. It is not easy to add new electrical generating capacity. Utilities report that it takes nearly ten years to build and receive permission to operate a new coal-burning electrical generating plant.

If the fixed factor is the amount of generating capacity for an electric utility, how long is the short run in this industry? Explain. _____

2. Brick laying is a labor intensive activity. Generally, one hod carrier can provide mortar for two brick layers. If brick laying could be made more efficient, more brick buildings would be built. Efforts have been made to train

more brick layers. But more brick layers are not the only answer.

- a. What will happen to output as more brick layers are added while holding all other inputs fixed?
- b. Why does the law of diminishing returns hold true?

3. Companies building stagecoaches understood the marginal concept. After experimentation, it was decided to design coaches to utilize four horses. It was clear that horses could be used in pairs. one pair was not enough to provide speed and endurance. Control became more difficult with more than two pairs, and neither speed nor endurance was much improved.

- a. What factor is fixed?
- b. What economic principle did stagecoach manufacturers encounter? Explain.

4. City planners in Centerville are planning a subway. The question that concerns them most is how far to extend the subway out of the center of town.

- a. What would you expect to happen to the number of passengers the subway carries as the line gets longer?
- b. Would you expect an extra mile of subway further from town to have more or fewer passengers than the previous mile?
- c. What economic principle is illustrated here?
- d. What would you expect to happen in the long run?

PRACTICE TEST

Circle the correct answer.

1. The major distinction between the short run and the long run is:
 - a. fixed factors.
 - b. variable factors.
 - c. the number of days.
 - d. the opinion of economists.
2. The marginal product can be:
 - a. increasing or decreasing.
 - b. positive or negative.
 - c. zero.
 - d. all of the above.

3. As five units of variable input are applied one at a time to a productive process, the total product is 6, 10, 17, 20, and 22 respectively. What is the marginal product of the third unit of input?
 - a. 7
 - b. 10
 - c. 16
 - d. 17

4. Find the law of diminishing returns.
 - a. As a fixed factor is added to variable factors, eventually the marginal product increases.
 - b. As variable factors are added to fixed factors, eventually the marginal product increases.
 - c. As fixed factors are added to variable factors, eventually the marginal product decreases.
 - d. As variable factors are added to fixed factors, eventually the marginal product decreases.

5. Find the situation where the law of diminishing returns fails to apply.
 - a. The chef is given more pots and pans.
 - b. More workers are hired in more factories.
 - c. More fertilizer is added to the garden.
 - d. More painters are hired to paint the house.

ANSWERS

Matching

1. e
2. d
3. g
4. c
5. b
6. a
7. f

True-False

1. F
2. F
3. T
4. F
5. T

Problems

1. a.

Labor	Total product	Marginal product
1	20	-
2	46	26
3	75	29
4	92	17
5	100	8
6	96	-4

- b. Diminishing returns sets in with the fourth unit of labor.
- c. The marginal product becomes negative with the sixth unit of labor.

Labor	MP	Total Output
0	---	0
1	25	25
2	75	100
3	150	250
4	125	375
5	100	475
6	75	550
7	50	600
8	25	625
9	-10	615

In the News

1. The long run here is the length of time needed to add more generating capacity. In this case it is ten years. Any time less is the short run.
2.
 - a. By adding only brick layers, the number of bricks laid will increase for a time, but after awhile, the number of bricks laid will fall.
 - b. The reason for diminishing returns is the existence of fixed factors. In this case hod carriers are fixed. Eventually, when one more brick layer is added, he/she will not be able to lay more bricks than the previous brick layer because he/she will not be able to get the mortar needed.
3.
 - a. The size of the stagecoach is fixed. Otherwise a larger stagecoach would require more pairs of horses to maintain speed.
 - b. The economic principle is diminishing returns. The output of the stagecoach line is the passenger service in terms of the time it takes to get from one destination to another. What the stagecoach firms discovered was that by adding pairs of horses after the second pair, the

added pair did not add as much to the output as the previous pair. Thus diminishing returns had set in.

4. a. As the line extends further out of the city, the total number of passengers will probably go up.
- b. As the line extends further out of the city, each added mile will probably have fewer passengers than the previous mile.
- c. Diminishing returns is illustrated by this example.
- d. In the long run, we would expect that the city would expand along the subway line. Thus the existence of the subway would encourage growth. Also, there would probably be a need for more subway lines to be built in the long run.

Practice Test

1.a., 2.d., 3.a., 4.d., 5.b.