corporatefinanceinstitute.com

Point of Diminishing Returns

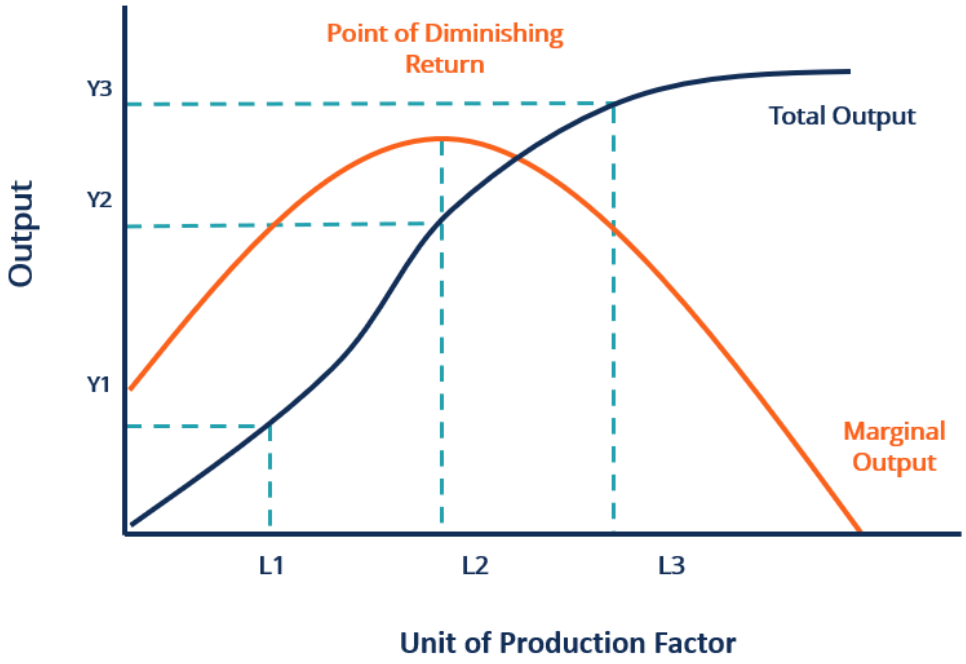
Corporate Finance Institute

5-6 minutes

The optimal level of capacity, which is the inflection point of a return or production function

What is the Point of Diminishing Returns?

The point of diminishing returns refers to a point after the optimal level of capacity is reached, where every added unit of production results in a smaller increase in output. It is a concept used in the field of microeconomics.



According to the law of diminishing marginal returns, increasing a factor of production does not always lead to increased marginal

productivity. The point of diminishing returns can be identified by taking the second derivative of the production function.

Summary

- **The point of diminishing returns refers to the optimal level of capacity, which is the inflection point of a return or production function.**
- **The law of diminishing returns states that beyond the optimal level of capacity, every additional unit of production factor will result in a smaller increase in output while keeping the other production factors constant.**
- **The point of diminishing returns appears where the marginal return (or output) is maximized and can be identified by taking the second derivative of the return (or output) function.**

What is the Law of Diminishing Returns?

In a production process, as a production factor increases, the amount of total output increases, but will reach an optimal output level before it begins to decrease or diminish. Production factors include inputs such as labor, machine hours, and raw materials.

Assuming a constant level of other production factors, every additional unit of a production factor leads to a greater increase in total output (marginal output) initially. After reaching a certain optimal production level, every additional unit of the production factor will result in a smaller increase in total output with a diminishing marginal output, as the efficiency is limited by the other production factors.

Assuming the production factor considered in the diagram above is labor, the labor force increases from L1 to L2 by the same units as from L2 to L3. Yet, the increase in total output units from Y1 to Y2 is much higher than the increase from Y2 to Y3. Without increasing

other production factors, the marginal return will eventually decrease to zero, which means the total output cannot be increased anymore by merely putting extra laborers into the production line.

Understanding the Point of Diminishing Returns

Since adding extra units of a production factor is not always as efficient as it is initially, an optimal production level can be determined. It is the point where the marginal return starts to diminish, and it becomes more difficult to increase the output. It is known as the point of diminishing returns.

At such a point, the marginal output is maximized but will decrease if the units of a production factor continue to increase. As the diagram above shows, the point of diminishing return is at L2. Before reaching an L2 number of laborers, putting additional laborers into the production process can efficiently increase the output.

With an L2 number of laborers, the production line achieves its highest efficiency. It is the optimal level of production, as well as the point of diminishing return. Beyond that point, the marginal output starts to decrease, and each additional unit of added labor will result in a smaller increase in output.

In such a case, in order to efficiently allocate its capital after reaching the point of diminishing return, the company should not invest in extra labor but improve other production factors instead – for example, by increasing capacity through adding more machines or building another factory.

How to Find the Point of Diminishing Returns?

The point of diminishing returns refers to the inflection point of a return function or the maximum point of the underlying marginal

return function. Thus, it can be identified by taking the second derivative of that return function.

For example, the return function is:

$R = -2x^3 + 24x^2 + 50;$

Thus, the first and second derivatives are:

$R' = -6x^2 + 48x$, and $R'' = -12x + 48;$

The inflection point locates where the second derivative equals zero:

$-12x + 48 = 0$, so $x = -48 / (-12) = 4$.

Therefore, the point of diminishing returns for the function is at $x = 4$ with a return of 306 $[-2(4)^3 + 24(4)^2 + 50]$.

More Resources

CFI offers the Commercial Banking & Credit Analyst (CBCA)™ certification program for those looking to take their careers to the next level. To keep learning and developing your knowledge base, please explore the additional relevant resources below:

- Efficient Frontier
- Labor Force KPIs
- Marginal Cost
- Working Capital Management