

Question If Output Sells For \$20 Per Unit, What Is The Marginal Revenue Product Of The Fifth Worker?

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Understanding the marginal revenue product (MRP) of a worker is fundamental in labor economics, particularly when analyzing how employment decisions are made in a competitive market. When the selling price per unit of output is known, calculating the MRP involves understanding the additional revenue generated by hiring an additional worker. In this context, the question becomes: if each unit of output sells for \$20, what is the MRP of the fifth worker? To answer this, we need to explore the concepts of marginal product, marginal revenue, and how these combine to determine the MRP.

Defining Marginal Revenue Product (MRP)

What Is Marginal Revenue Product?

The Marginal Revenue Product of labor is the additional revenue generated from employing one more unit of labor, holding other factors constant. It essentially measures the contribution of an additional worker to the firm's total revenue. Mathematically, it can be expressed as:

- $MRP = \text{Marginal Product of Labor (MP)} \times \text{Marginal Revenue (MR)}$

Where:

- Marginal Product (MP) is the increase in output resulting from hiring an additional worker.
- Marginal Revenue (MR) is the additional revenue from selling that additional output.

Importance in Employment Decisions

Firms use the MRP to determine the optimal level of employment. Typically, a firm will hire workers up to the point where the MRP equals the wage rate. If the MRP exceeds the wage, hiring additional workers is profitable; if it's less, the firm should not hire more workers.

Understanding the Components: Marginal Product and Marginal Revenue

Marginal Product (MP)

The marginal product of the fifth worker depends on the firm's production function and the current level of output. It can be measured either in physical units (e.g., units per worker) or in terms of the change in total output when the fifth worker is hired.

Marginal Revenue (MR) in a Competitive Market

In perfectly competitive markets, the price per unit remains constant regardless of output levels. Therefore, the marginal revenue equals the selling price per unit:

- $MR = Price = \$20$

This simplifies the calculation because the additional revenue from selling one more unit is always \$20, regardless of the quantity produced.

Calculating the Marginal Revenue Product of the Fifth Worker

Step 1: Determine the Marginal Product of the Fifth Worker

To find the MRP, the first critical piece of information needed is the marginal product of the fifth worker. Typically, this data is derived from the firm's production data, which might look like:

Number of Workers Total Output (Units)	
----- -----	
4	Q ₄
5	Q ₅

The marginal product of the fifth worker (MP₅) is:

- $MP_5 = Q_5 - Q_4$

Without specific data, we can consider hypothetical values to illustrate the calculation.

Step 2: Calculate the Marginal Revenue Product

Once the MP of the fifth worker is known, the MRP is calculated as:

$$\text{- } \text{MRP}_5 = \text{MP}_5 \times \text{MR}$$

Since in a competitive market, MR equals the price per unit (\$20):

$$\text{- } \text{MRP}_5 = \text{MP}_5 \times \$20$$

Example Calculation:

Suppose:

- Total output with 4 workers (Q_4) = 100 units
- Total output with 5 workers (Q_5) = 115 units

Then:

$$\text{- } \text{MP}_5 = 115 - 100 = 15 \text{ units}$$

Thus:

$$\text{- } \text{MRP}_5 = 15 \text{ units} \times \$20 = \$300$$

This means that hiring the fifth worker adds approximately \$300 to the firm's revenue, assuming the marginal product is 15 units.

Implications for the Firm's Hiring Decision

Wage Rate and Marginal Revenue Product

The firm will compare the MRP of the fifth worker to the wage rate to decide whether to hire or keep the worker:

- If $\text{Wage} < \text{MRP}_5$: Hiring the fifth worker is profitable.
- If $\text{Wage} > \text{MRP}_5$: Hiring the fifth worker would not be profitable.

Suppose the wage rate is \$250:

- Since $\text{MRP}_5 = \$300$, the firm should hire the fifth worker.

If the wage rate is \$320:

- Since $\text{MRP}_5 = \$300$, the firm should not hire the fifth worker.

Optimal Employment Level

The point where the MRP equals the wage rate determines the optimal number of workers. The firm continues to hire until the additional revenue from the last worker hired no longer exceeds the cost.

Factors Affecting the Marginal Revenue Product

Changes in Output Price

If the selling price per unit changes, the MR component in the MRP calculation also changes:

- Higher prices increase the MRP, incentivizing more employment.
- Lower prices decrease the MRP, reducing the incentive to hire additional workers.

Variations in Marginal Product

The law of diminishing returns often means that the marginal product decreases as more workers are employed:

- Early hires tend to have higher MP.
- Additional workers may contribute less to output, lowering the MRP.

Production Technology

Advancements in technology can increase the marginal product of workers, thereby increasing the MRP and affecting employment decisions.

Conclusion

Calculating the marginal revenue product of the fifth worker when output sells for \$20 per unit hinges primarily on understanding the marginal product of that worker. The general formula:

$$\text{MRP} = \text{MP} \times \text{Price}$$

becomes straightforward in a perfectly competitive market because MR equals the price (\$20). By substituting the marginal product of the fifth worker into this formula, the firm can determine the additional revenue generated by hiring that worker.

For example, if the marginal product of the fifth worker is 15 units, then:

$$\text{MRP} = 15 \times \$20 = \$300$$

This value helps the firm make informed employment decisions—hiring the fifth worker is profitable if the wage rate is less than \$300, and unprofitable if it is higher.

Ultimately, understanding the MRP in relation to market conditions and production data ensures that firms optimize their labor employment, balancing costs with the additional revenue contributed by each worker. This analytical approach underscores the importance of detailed data and market understanding in making sound economic decisions related to employment and production.

Frequently Asked Questions

What is marginal revenue product (MRP) in the context of labor economics?

The marginal revenue product (MRP) of a worker is the additional revenue generated by employing one more unit of labor, calculated as the marginal product of labor multiplied by the price of the output.

Given the output sells for \$20 per unit, how do you calculate the marginal revenue product of the fifth worker?

To calculate the MRP of the fifth worker, multiply the additional units of output produced by the fifth worker (marginal product) by the selling price of \$20 per unit.

If the marginal product of the fifth worker is 10 units, what is the MRP?

The MRP is $10 \text{ units} \times \$20 = \$200$.

Why is understanding the MRP of the fifth worker important for a firm?

It helps the firm determine whether hiring the fifth worker is profitable by comparing the MRP to the worker's wage; if MRP exceeds wage, hiring is beneficial.

How does the concept of marginal revenue product relate to the firm's decision to hire additional workers?

Firms will continue to hire additional workers as long as the MRP exceeds or equals the wage rate, ensuring each new worker adds at least as much revenue as the cost.

What happens to the MRP as more workers are hired?

Typically, the MRP decreases due to the law of diminishing returns, meaning each additional worker adds less revenue than the previous one.

Can the MRP be equal to the marginal product of labor?

Yes, when the output price remains constant, the MRP equals the marginal product of labor multiplied

by the output price, which is the marginal revenue product.

If the output price drops from \$20 to \$15, how does this affect the MRP of the fifth worker?

The MRP decreases proportionally; for example, if the marginal product is 10 units, the MRP becomes $10 \times \$15 = \150 , reflecting the lower selling price.

Additional Resources

Question If Output Sells For \$20 Per Unit, What Is The Marginal Revenue Product Of The Fifth Worker?

Understanding how businesses determine the value of additional workers is essential for making informed hiring and production decisions. Among the key concepts in microeconomics is the Marginal Revenue Product (MRP), a metric that helps firms assess the contribution of each additional worker to total revenue. Today, we explore a common yet important question: If output sells for \$20 per unit, what is the marginal revenue product of the fifth worker? Through a detailed analysis, we'll illuminate how to compute the MRP, interpret its significance, and understand its role in managerial decision-making.

What Is Marginal Revenue Product (MRP)?

Before delving into calculations, it's crucial to grasp what MRP signifies. Marginal Revenue Product measures the additional revenue generated by employing one more unit of a specific input—in this case, a worker—while holding other inputs constant.

Key points about MRP:

- Definition: MRP equals the marginal physical product (MPP)—the extra units produced by the last worker—multiplied by the price per unit of output.
- Purpose: It helps determine the value of an additional worker to the firm, guiding decisions on whether to hire or lay off workers.
- Relation to Marginal Cost: A firm compares MRP to the marginal cost (MC) of hiring an extra worker; hiring continues until MRP equals MC.

Mathematically, the formula is:

$$\text{MRP} = \text{MPP} \times \text{Price per unit}$$

Where:

- MPP: Marginal physical product of the worker (additional units produced)
- Price per unit: Selling price of each product (given as \$20 in our scenario)

The Context: Setting the Stage

Imagine a manufacturing firm that produces gadgets. Each unit sells for \$20, and the firm employs workers to increase output. The question at hand is: What is the MRP of the fifth worker? To answer this, we need two pieces of information:

1. The marginal physical product (MPP) of the fifth worker—how many additional units does he/she produce?
2. Confirmation that the price per unit is \$20, as specified.

Once we have MPP, calculating the MRP is straightforward: multiply MPP by \$20.

How to Determine the Marginal Physical Product of the Fifth Worker

The critical part of this question lies in understanding the marginal physical product. Typically, this data is derived from the firm's production function or from production data.

Sources of information:

- Production Data: The firm's output before and after hiring the fifth worker.
- Production Function: A mathematical representation of how inputs translate into output.

Suppose the firm provides the following data:

Number of Workers	Total Output (Units)
4	200
5	240

From this, we can compute:

$$\text{MPP of 5th worker} = \text{Total Output with 5 workers} - \text{Total Output with 4 workers}$$

$$\text{MPP of 5th worker} = 240 - 200 = 40 \text{ units}$$

This indicates that adding the fifth worker increases production by 40 units.

Calculating the Marginal Revenue Product

Having established the MPP (40 units), calculating the MRP becomes a matter of simple multiplication:

$$\text{MRP of 5th worker} = 40 \text{ units} \times \$20 \text{ per unit} = \$800$$

This means the fifth worker's employment adds an estimated \$800 to the firm's revenue, assuming all units produced are sold at \$20.

Interpreting the MRP in Business Decision-Making

The MRP figure is not just a number; it's a crucial indicator for managerial decisions.

Implications include:

- Hiring Decisions: If the marginal cost (e.g., wage rate) of hiring the fifth worker is less than \$800, then hiring is profitable.
- Resource Allocation: The firm should continue hiring as long as the MRP exceeds the wage cost.
- Product Pricing: Since the product sells for \$20, the MRP directly reflects the revenue contribution of the worker, making it easier to evaluate labor productivity.

For example, if the wage for the fifth worker is \$700, the firm benefits from hiring him/her because the revenue generated (\$800) exceeds the wage cost (\$700). Conversely, if the wage is \$900, hiring would decrease profits.

Limitations and Real-World Considerations

While the calculation appears straightforward, real-world scenarios involve complexities:

- Variable Output: MPP may decrease as more workers are hired due to diminishing returns.
- Pricing Fluctuations: The selling price per unit can change, affecting MRP.
- Additional Costs: Marginal cost involves more than wages; overheads and other expenses also matter.
- Market Conditions: Demand and supply dynamics influence how much output can be sold at the given price.

Firms often analyze MRP alongside marginal cost to optimize labor employment.

Broader Context: Marginal Revenue Product and Marginal Cost Equilibrium

In economic theory, firms maximize profit where:

$$MRP = \text{Marginal Cost}$$

This equality guides optimal employment levels. If the MRP of the fifth worker is \$800, and the wage (cost per worker) is less than \$800, hiring the fifth worker is profitable. If wages are higher, the firm should reconsider.

Example:

- Wage per worker: \$700 → Hire the fifth worker.
- Wage per worker: \$900 → Do not hire the fifth worker.

This explains the importance of MRP in practical hiring decisions and labor market analyses.

Final Thoughts

Understanding the marginal revenue product of an additional worker is vital for efficient resource allocation. When output sells for \$20 per unit, calculating the MRP hinges on knowing the additional output that worker produces. In our example, the fifth worker's MPP is 40 units, leading to an MRP of \$800.

Firms use this metric to determine whether hiring an extra worker adds sufficient revenue to justify the associated costs. It embodies the fundamental economic principle of marginal analysis—comparing marginal revenue to marginal cost to make optimal decisions.

By mastering the concept of MRP, managers and entrepreneurs can enhance productivity, optimize employment levels, and ultimately improve profitability. This understanding underscores the delicate balance between input costs and output revenue, guiding strategic business decisions in competitive markets.

In summary:

- The marginal revenue product quantifies the additional revenue generated by an extra worker.
- It is calculated as marginal physical product times the price per unit.
- Knowing the MPP of the fifth worker and the selling price (\$20) allows precise calculation of the MRP.
- The decision to hire depends on comparing MRP to the worker's wage.

With this knowledge, businesses can better evaluate their labor force contributions, ensuring they make data-driven, profitable employment choices in an increasingly competitive marketplace.

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