Derived Demand and Marginal Revenue Product

AP Microeconomics | Unit 5 | MRP, the hiring rule, and labor demand

1. Derived demand

Derived demand

The demand for a resource (labor, land, capital) comes from the demand for the **product** that resource makes. If the price of bread rises, each baker is worth more to the firm, and the demand for bakers rises.

2. Marginal revenue product

$$MRP = MP \times P_{\text{product}}$$

the extra *revenue* from hiring one more worker. (In a perfectly competitive product market the price is the marginal revenue; in general $MRP = MP \times MR$.)

Example. Bread sells for \$20 a loaf.

workers	total product	marginal product	MRP
1	10	10	\$200
2	18	8	\$160
3	24	6	\$120
4	28	4	\$80
5	30	2	\$40

MRP falls because marginal product falls (diminishing marginal returns).

3. How many workers to hire

Hiring rule

Hire a worker as long as they bring in at least what they cost. The firm stops where

$$MRP = \text{wage}$$

(in general, $MRP = MRC$, the marginal resource cost).

At a wage of \$120 the firm hires **3** workers (the 4th would bring in \$80 and cost \$120). At a wage of \$80 it hires **4**.

At every wage the MRP curve shows how many workers the firm wants, so **the MRP curve is the firm's demand curve for labor**. It slopes down.

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4. What shifts the demand for labor

1. The **price of the product**. At \$30 a loaf the 4th worker's MRP is $4 \times \$30 = \$120$: the curve shifts right, and at a \$120 wage the firm hires 4.
2. **Productivity**: technology, training, more capital per worker.
3. The **price of another input** (a substitute or a complement for labor).

A change in the **wage** is a movement *along* the curve, not a shift.

5. Beyond the bakery

- In general $MRP = \dfrac{\Delta TR}{\Delta L}$: total revenue \$500 → \$590 with the 6th worker means $MRP = \$90$.
- A **monopolist** seller must cut its price to sell more, so $MR < P$ and $MRP = MP \times MR$: lower and falling faster. Its labor demand curve is **steeper**, and it hires fewer workers than a price taker with the same MP.
- **Capital**: rent machines until the MRP of capital equals the rental price.
- Cheaper **complementary** equipment raises each worker's MP and MRP: labor demand shifts right. Cheaper **substitute** equipment (a machine replacing workers) can shift it left.
- MP can rise for the first few workers (specialization), then diminishing returns: MRP first rises, then falls.

Where students lose points

1. Multiplying MP by the wage: MRP is MP times the *product* price.
2. Using total product instead of marginal product.
3. Hiring where MRP is highest: hire until MRP equals the wage.
4. Shifting labor demand when the wage changes.
5. Forgetting derived demand: a product price change shifts labor demand.

Now practise it

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