

Factor Markets

Preliminary Mathematical Note:

In our dealing with factor markets, we will mainly focus on the labour market. There the equilibrium level of employment is determined. Consider the following identity that we saw a few weeks ago:

$$MC = \frac{w}{MP_L}$$

If a firm is profit maximising, then $MC = MR$. Hence, we can rewrite it as:

$$MR = \frac{w}{MP_L} \Rightarrow w = MR \times MP_L$$

This is the key equation that defines the equilibrium in a competitive labour market. Notice that in this equation, wage (which is set equal to the marginal revenue product) is taken as a given by the firm. This “assumption” is violated in the case where the firms that are hiring workers have monopsony power. In such a situation, the firm can use its monopsony power to minimise its total expenditure on workers and achieve a lower equilibrium wage.

For example, suppose that a firm is a monopsony faced with a supply function of $L = 10 + w$. Suppose also that the firm has the following demand function for labour: $L = 50 - 2w$. The monopsony wishes to minimise its expenditure on labour, while operating on its demand curve. Hence, it will equate marginal expenditure with marginal value (demand). To work this out, we follow some simple steps.

Step 1 – Find Total Expenditure (TE)

$$L = 10 + w \Rightarrow w = L - 10$$

Now “total expenditure” in this case, is how much money will be spent on labour costs:

$$TE = wL = L^2 - 10L$$

Step 2 – Find Marginal Expenditure (ME)

In this case, we simply differentiate the total expenditure equation with respect to labour:

$$ME = \frac{dTE}{dL} = 2L - 10$$

Step 3 – Equate MV=D and ME

To solve for the equilibrium, we simply need to equate the marginal expenditure with demand (needs to be rearranged as $w=f(L)$):

$$ME = D \Rightarrow 2L - 10 = 25 - 0.5L \Rightarrow 2.5L = 35 \Rightarrow L = 14; w = 4$$

Notice how this procedure is like what we were doing with the monopoly. The difficult bit is to figure out exactly what total expenditure is in the given context.

Practice Problems

1. For following firms operating in a competitive labour market, work out the number of workers the firms would hire.
 - a. $w = 5, p = 10, Q = 2L^{0.5}$
 - b. $w = 10, MC = 5, Q = 30L^{\frac{1}{3}}$

2. Work out the labour demand curve for the following monopoly firms.
 - a. $p = Q^{-2}, Q = L^{0.5} + \frac{1}{L}$
 - b. $p = 100 - Q^2, Q = 2L^{0.5}$

3. Work out the equilibria for the following monopsony markets.
 - a. $p = Q_s - 2; p = -2Q_d + 10$
 - b. $Q_s = 3p - 12; Q_d = -3p + 30$

4. Consider a monopolist facing an inverse demand curve of $p = 150 - Q$. Suppose further that the firm uses the simple production function $Q = \sqrt{L}$ and the monopoly hires workers from a perfectly competitive labour market with an equilibrium wage rate of $w = 5$.
 - a. What is the equilibrium quantity and price in the product market?
 - b. How many workers does the monopoly hire at the prevailing wage rate?
 - c. Now work out the equilibrium output, price, and employment if the product market was perfectly competitive.
 - d. Comment on the differences between these two equilibria and explain why they arise.

5. The employment of PGATAs in many universities can be characterized as a monopsony. Suppose the demand for PGATAs is given by $w = 30,000 - 100L$. The supply of PGATAs is given by $w = 1500 + 50L$.
 - a. If universities take advantage of their monopsonist position, how many PGATAs will be hired? What will be the equilibrium wage?
 - b. Find the equilibrium if the market was perfectly competitive.
 - c. Suppose that universities face an infinite supply of PGATAs at the annual wage level of $w = 10,000$. How many will be hired at this wage?

6. Consider some industry with a perfectly competitive labour market. Suppose that in this case, the labour supply curve is upward sloping such that $w = L + 2$. Suppose further than the marginal product of labour is given by: $MP_L = 10 - 0.5L$, and that the product market price is $p = 2$.
 - a. Find the equilibrium wage and the level of employment. Is there unemployment?
 - b. Suppose that the demand in the product market increased, comment on what the effect that would have on the labour market.
 - c. Now suppose that there is a monopsony in the labour market. What is the equilibrium wage and employment.

- d. (**Challenge**) The government being dissatisfied with the monopsony decides to strike a deal. It proposes to give workers a monetary reward to join the labour market. What should the per worker reward be so that the new equilibrium is the same as the one you found in part (a).
7. (**Challenge**) Suppose that a monopsony faces a supply curve of the form $p = p(Q)$, where $p(Q)$ is some function of quantity supplied.
- a. By applying the product rule of differentiation, show that marginal expenditure can be written as:

$$ME = AE + \frac{dp}{dQ} Q$$

- b. Now show that this equation can be rewritten as:

$$ME = p \left(1 + \frac{1}{\varepsilon} \right)$$

- c. Comment on whether the elasticity in the above equation is positive or negative. Why?