The Labor Market

The labor market represents the largest (renewable) productive factor market we have in the economy. We use labor, along with other factors, to produce our output of goods and services. Labor is measured as labor hours and not people. Actually, we use this type of hourly measurement for every type of productive factor including capital. An empty building is unemployed capital, as is an unused machine, or an airport temporarily closed for the night. You should be able to create many examples of physical capital temporarily unused and therefore in a state of temporary unemployment. The extent that we use physical capital is called the degree of capacity utilization. There are data kept on this variable at least for the manufacturing sector.

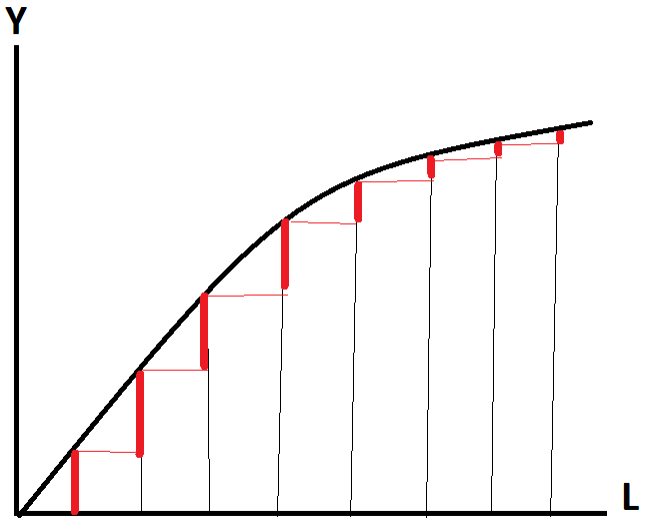
In looking at the labor market we will need to construct from fundamental elements the demand for and supply of labor. We may begin by looking at the demand for labor.

The Demand for Labor

In the short run for the firm, it will not be wrong to set all factors constant or fixed except for labor. We can easily vary the amount of labor we use in a firm. Thus, in the short run, changes in output will change only with movements in labor hours utilized. All other factors will be held constant. We can therefore write this as a very simple production function.

$$Y = f(L; K_o, \text{Technology}_o, Energy_o, etc)$$

where, except output, Y, and the level of labor, L, everything else is held constant. As we proceed to the long run, we will allow these *other* variables to change along with the level of labor. We can draw this production relation between labor and output. Figure 1 shows this relation.



The red spikes represent the marginal physical product of labor (MPP_L) or $\Delta Y/\Delta L$. This shows how much output increases when labor increases by one unit. These heavy red spikes in Figure 1can be broken off and placed on a separate graph as shown in Figure 2.

The problem that the firm is trying to solve is to decide what level of labor it wishes to use. Naturally, it will seek the level of labor that generates maximum profit.

Consider now the expression for (above normal) profit. This can be written as

$$\pi = \text{Profit} = \text{TR - TC} = P_o Y - \{w_o L + TFC_o\}$$

Of course, we must remember that Y is a function of L.

Figure 2 The marginal physical product of labor, MPP_L

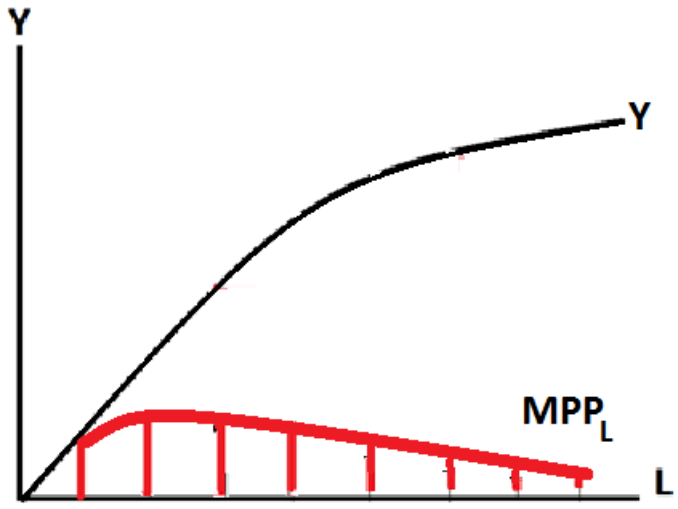


Figure 2 shows the MPP_L which is a curve showing additions to output, Y, as we add additional levels of labor, L. In general it is downward sloping. We call this the law of diminishing marginal productivity. Thus, greater amounts of labor, L, result in greater levels of output, Y, but these increases fall off as L increases.[1] The definition of MPP_L is $\Delta Y/\Delta L$.

The firm is expected to choose the level of labor, L , that maximizes profit. This means that the firm searches for the optimum L^* such that $\Delta\pi/\Delta L = 0$. If profit is maximized, this condition will be met, since we are symbolically at the top of the profit hill and the slope on top of the hill is zero. This level L^* is the demand for labor by the firm. We can see what this is by considering the following.

$$\begin{aligned} 0 = \Delta\pi &= \Delta TR - \Delta TC \\ &= P_o \frac{\Delta Y}{\Delta L}\Delta L - \{w_o \Delta L + \Delta TFC_o\} \\ &= \{P_o MPP_L - w_o\}\Delta L \end{aligned}$$

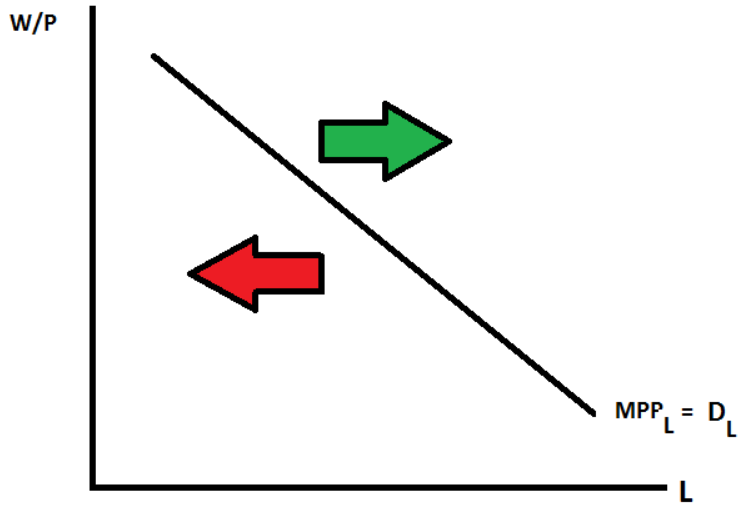
[1] The classic explanation of diminishing marginal productivity is that if it were not true we could grow the entire food supply in a flower pot. Here is a nice reference - https://www.quora.com/If-the-law-of-diminishing-marginal-product-did-not-hold-the-worlds-food-supply-could-be-grown-in-a-flowerpot-Why-is-this-true

which implies

$$(\frac{w_o}{P_o}) = MPP\,.$$

and this shows that the MPP_L is the demand for labor. We can draw this demand as in Figure 3.

Figure 3 MPP_L as the Demand for Labor



Naturally, there are variables that can shift the demand either right or left. If the demand shifts to the right it signals an increase in the demand for labor. Conversely, a leftward shift indictaes a decrease in the demand for labor. This MPP_L is exactly the same as the MPP_L in Figure 2. Note how that the MPP_L is downward sloping due to the law of diminishing marginal productivity. As L increases, the MPP_L decreases in size.

What can shift this MPP_L and thus the demand for labor?

There are many variables that can shift the demand for labor to the right or left. The first is the level of capital. With greater capital we woud expect that the demand for labor would increase since we feel these two are complementary. This is not always true, but it is a good approximation for large labor markets. Of course, it is possible that machines replace people also. But, generally speaking, increasing the *size* of a firm requires an increase in the workforce of that firm and thus boosts the demand for labor. Another variable that increases the demand for labor is productivity. If labor becomes more productive it becomes more valuable to the firm. Indeed, the MPP_L is exactly productivity measured on the margin. The usual meaure of productivity is average productivity of labor (i.e. Y/L) or output per worker hour. If average productivity increases by 5% at all levels of labor usage, then MPP_L will also increase by 5% at all levels of labor usage. Increases in productivity are usually thought to increase labor demand. Yet, another variable that affects the labor demand is the regulation of industry. These regulations may be involved with securing a safe and healthy workplace. Such regulations may restrict how long the firm can employ the

worker or how workers are to be compensated for working overtime. Regulation is usually intended to protect the worker and not the firm. The more effort the firm must undertake to satisfy these regulations, the less effort can be spent making the product for sale. This is an additional cost (which may have a social benefit) and therefore very likely reduces the demand for labor.

The Supply of Labor

On the other side of the market lies the supply of labor. This is determined by the individual or the household. We now turn to the basic factors influencing how much labor time the household supplies to the firm.

To begin with, we assume that the decision on how to use one's limited time is a choice between labor and leisure. Labor supply is really just the mirror image of leisure demand. In our daily life, we work to make an income so as to buy goods and services; whereas we enjoy leisure when we are not working. If we choose only leisure, we do not work and have no income. If we choose only work, we have no leisure to enjoy. Somewhere between these two extremes is the right amount of work and leisure. This is our demand for leisure time and thus our supply of work time. Let T_o be the total number of hours in a month, or a year, or whatever period we choose to consider. Thus, it follows that this total fixed number of hours can be divided into labor and leisure. We can write this as

$$T_o = L + l$$

where $L = labor$ and where $l = leisure$. Our income is determined by how much we work and we can write this as

$$Income = w_o L = w_o (T_o - l)$$

Now, assume that our utility is determined entirely by two variables $C = real\ consumption$ and $l = leisure\ time$, and we write this as

$$U = U(C, l)$$

We are nearly done setting up the decision problem of the household. All that needs to be finished is to create a reasonable budget constraint. This is easily done, since we are assuming that

$$w_o (T_o - l) = P_o C$$

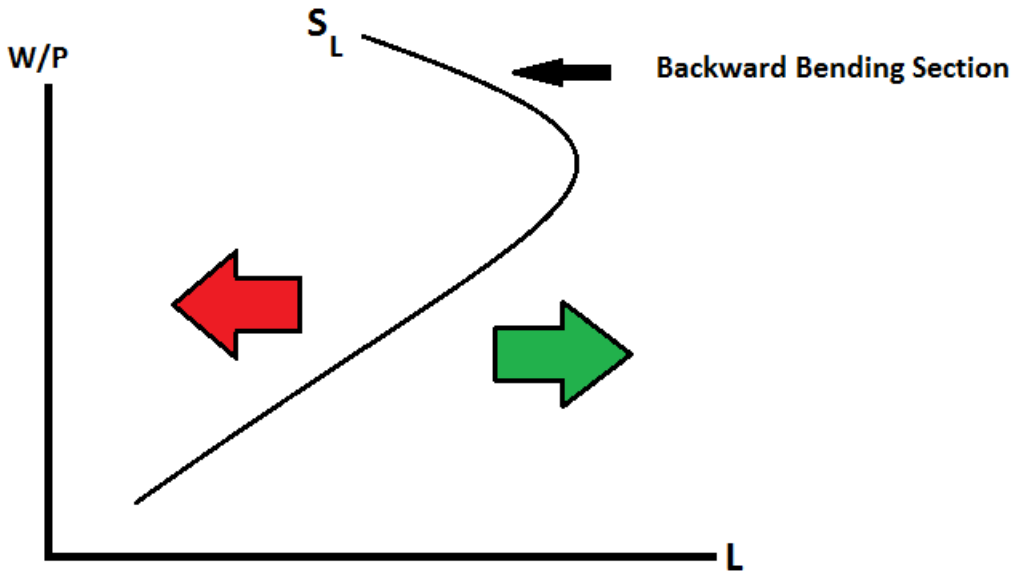
where $P_o = price\ level.$ Solving this equation for C and substituting into the utility function we see that we maximize utility by choosing leisure, l, only. This "concentrated" utility function can be written as

$$U = U(\frac{w_o (T_o - l)}{P_o}, l)$$

which is a function of leisure only. From this utility function we can see that the only thing that can affect the choice of equilibrium leisure is the variable $\frac{w_o}{P_o}$ = real wage. Generally speaking, a rise in the real wage, $\frac{w_o}{P_o}$, will cause the household to supply a greater quantity of labor and cut back on the quantity of leisure demanded. This will generate an upward sloping supply of labor, as shown in Figure 4. Note that it is entirely possible that there is a backward bending part of the supply of labor. That is, as the real wage rises above some level, the quantity supplied of labor begins to fall. Clearly such a level must exist. Imagine if you were offered $2 billion / hour to work. Most would gladly be willing to work a minute or two and retire for the rest of your life. The question of a backward bending supply curve is essentially an empirical question; it is not a theoretical issue, but an argument over relevant magnitudes.

The supply curve for labor is shown in Figure 4. We also note that like demand there are shifters that shift the supply curve to the right or left. These shifters would include such things as taxes on income, increases in government aid for the unemployed, changes in population or immigration, significant reduction in the goods and services associated with leisure, and changes in health.

Figure 4 The Supply of Labor



The supply of labor is now deterrmined by the demand for leisure. If the real wage continues to rise there will be some point at which the supply curve becomes negatively sloped. This is the backward bending section. Individuals react to rise in the real wage by reducing their labor effort. For most people, this will not occur. A higher wage will cause them to work more, but for the very highly paid, a rise in the hourly wage may cause them to work less.