Chapter Four: Determination of Wage and Employment

4.1 Market Determination of Wage

Workers prefer to work when the wage is high, and firms prefer to hire when the wage is low. Various numbers of employees are engaged in a wide range of occupations in which wage rates are different. The questions are what determine the variation in number of workers in each occupation and what determines the differences in the wage rates. Labor market equilibrium "balance out" the conflicting desires of workers and firms and determines the wage and employment observed in the labor market. Hence the answers for each question rely on the characteristics of the labor & product markets. To get it easily understood the discussion on the following sub-sections centers on three important issues, i.e. the type of labor market, the hiring decision by firm and allocative efficiency.

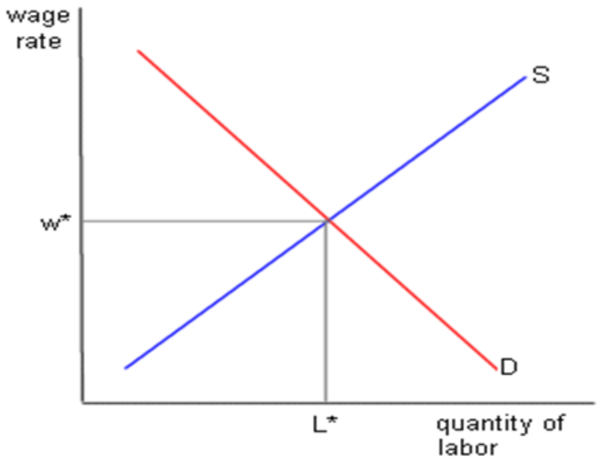
A. Perfectly Competitive Product & Labor market

The labor market has two interacting components, namely the demand for labor, which reflects the behavior of employers; and the supply of labor, which represents the workers' behavior. This section analyzes the properties of equilibrium in a perfectly competitive market. Perfectly competitive labor market has the following characteristics:

1. Large number of firms competing with one another for a specific type of labor.
2. Large number of qualified people with identical skill and supply their labor hour independently.
3. "Wage tacking" behavior, that is neither workers nor firms exert control over the market wage.
4. Costless information & free labor mobility

I. Labor Market Equilibrium

The supply curve gives the total number of hours that workers in the economy allocate to the market at any given wage level. The demand curve gives the total number of hours those firms in the market demand at that wage. Equilibrium occurs in a labor market at the combination of wages and employment at which market demand equals supply, generating the competitive wage w * and employment L *. Figure 4-1 illustrates the familiar graph showing the intersection of labor supply (S) and labor demand (D) curves in a competitive market. The wage w * is the market-clearing wage because any other wage level would create either upward or downward pressures on the wage; there would be too many jobs chasing the few available workers or too many workers competing for the few available jobs.



For example; if the wage rate is above the equilibrium, the quantity of labor supplied exceeds the quantity demanded and a surplus occurs. In this case, the existence of unemployed workers result in downward pressure on the wage rate until equilibrium is restored. On the other hand, if the wage rate is below the equilibrium, a labor shortage will occur. Competition among firms for workers is expected to result in increases in the wage until equilibrium occurs.

Figure 4-1: Labor market equilibrium

Once the competitive wage level is determined in this fashion, each firm in this industry hires workers up to the point where the value of marginal product of labor equals the competitive wage. The total number of workers hired by all the firms in the industry must equal the market's equilibrium employment level, L*.

How shifts in demand and supply affect the equilibrium condition?

The effects of shifts in demand and supply curves have been covered extensively in your principles of microeconomics course, so there's no need to discuss these concepts in great detail here (if you are not comfortable with this, you may wish to review those materials). Let's just note that:

- an increase in labor demand results in an increase in both the equilibrium wage and the equilibrium level of employment,
- a reduction in labor demand results in a decrease in both the equilibrium wage and the equilibrium level of employment,
- an increase in labor supply results in a lower equilibrium wage, but a higher equilibrium level of employment, and
- a reduction in labor supply results in a higher equilibrium wage, but a lower equilibrium level of employment.

II. Hiring Decision by a Firm

In a perfectly competitive labor market, where the wage rate is determined in the industry, rather than by the individual firm, each firm is a wage taker. This means that the actual equilibrium wage will be set in the market, and each firm decision on how many workers to employ does not affect the market wage (because a firm is one of the many firms in the labor market). Hence, the supply of labor to the individual firm is perfectly elastic at the market rate.

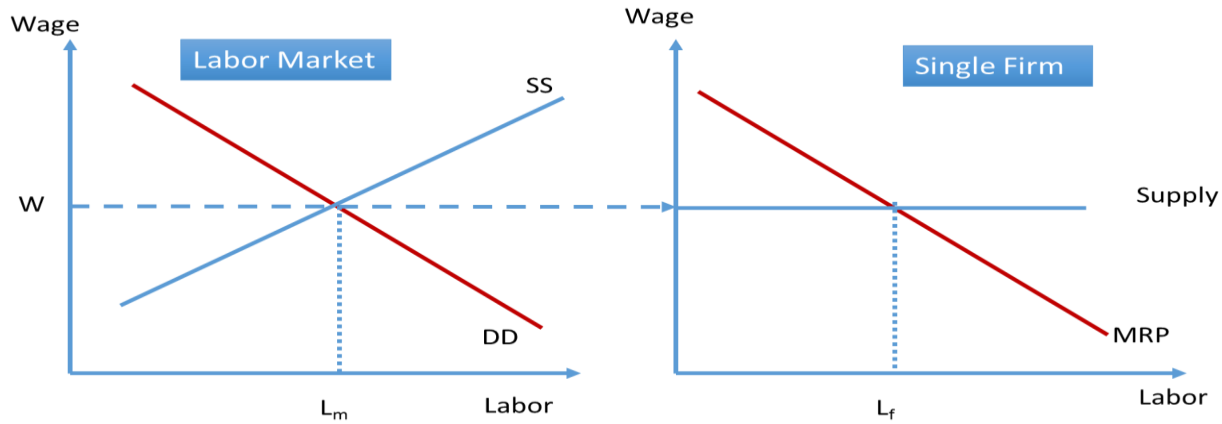


Figure 4-2: Equilibrium wage rate and employment under perfectly competitive market

As indicated in the graph above a firm has no incentive to pay a wage rate which is more than the market equilibrium wage. Because, at this wage the firm can get many units of labor as it wants. Therefore, there is no need to offer a wage rate higher than the market wage rate. On the other hand, if a firm offers a wage rate less than the equilibrium level, it cannot attract any worker. It is on account of the fact that workers who possess this skill face the opportunity cost of the market wage rate, they can get the market wage in an alternative firm. Consequently, the supply curve facing a firm becomes perfectly elastic.

To determine the profit maximizing level of employment, the firm considers the value of marginal product of labor (marginal revenue product of labor) and the corresponding marginal cost of labor (wage). At the optimal level of employment, VMPL equals to MCL (VMPL= MRPL=MCL=W). Thus, as we see from the above graph (Figure 4.2) firms hire Q quantity of labor.

III. Allocative Efficiency

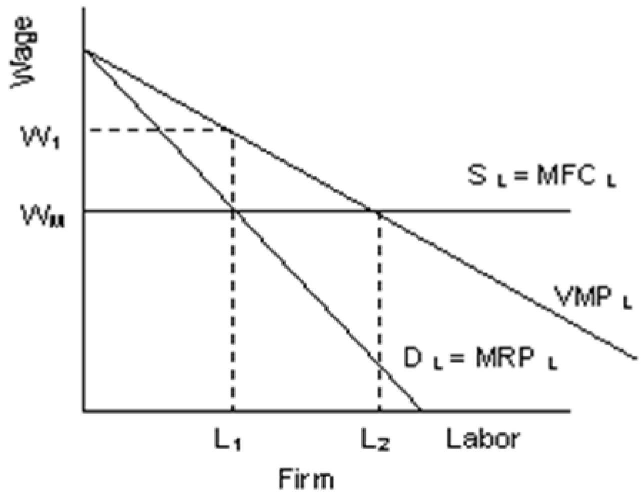
The allocation of workers to firms that maximizes the total gains from trade in the labor market is called an efficient allocation. It is realized when workers are directed to their highest valued use or when the society obtains the largest amount of output from the given amount of labor available. This occurs when its value of marginal product is the same in all alternative employment. For example, assume that labor type A is used for the production of the commodities X&Y. The values of the commodities X and Y produced by the last labor are 14 and 10 respectively (VMP_L for X = 14 and VMP_L for Y

= 10). In this example, the labor is not allocated efficiently because it is not making the maximum possible contribution to the total output. By shifting the labor from the production of commodity Y (in which it is less productive) to the production commodity X (in which it is more productive), the level of output will be increased by 4 birr (the amount that would have been forgone if the labor had been producing commodity Y). This reallocation of labor causes, VMP_L for X to decreases and VMP_L for Y to increase. This adjustment continues until VMP_L for X equals to VMP_L for Y. If we expand from production of two commodities to any number of product that labor may produces allocation will be efficient when VMPL for X = VMP_L for Y = VMP_L for Z = …... =VMP_L for N = P_L=W. Under perfectly competitive product and factor market allocative efficiency condition is satisfied. Therefore, competitive equilibrium generates an efficient allocation of labor resource.

B. Imperfect Product Market & Perfect Labor Market

So far, we have assumed that firms hiring labor in a perfectly competitive labor market are price-takers in the product market too; that is, they do not possess monopoly power in the product market. Since under perfect competition the demand curve of the product facing an individual firm is perfectly elastic and therefore price and marginal revenue are equal, the value of marginal product (VMP) and marginal revenue product (MRP) will be equal to each other.

But in monopoly or in other forms of imperfect competition in the product market, a firm faces a down ward-slopping product demand curve. Increase in output will require price reductions, and its MR will be less than its price. Then, marginal revenue product of labor (MP*MR) will fall below the value of marginal product of labor (VMP_L= P*MP), as price is greater than marginal revenue. Hence, one can always tell whether a firm is perfectly competitive or a monopolist in the output market by checking whether or not MRP equals VMP; if MRPL = VMPL then the output market is competitive; if MRPL < VMPL then the output market is a monopoly. Firms consider marginal revenue product of labor and the marginal cost of labor (wage, if factor market is competitive) to decide the profit maximizing amount of employment and it occurs at the point where marginal revenue product of labor equals marginal cost of labor (MRP_L=MC_L).

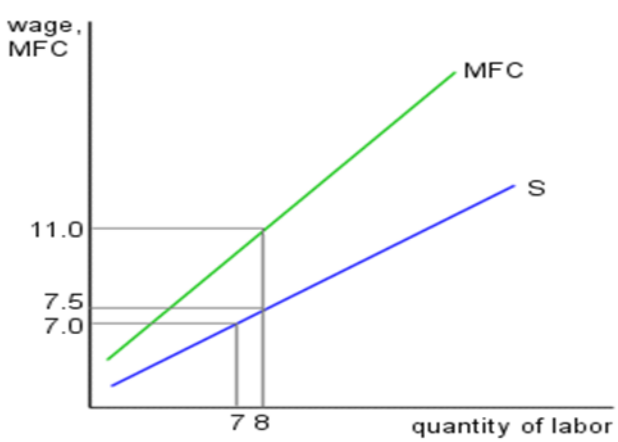


Therefore, as we can see from Figure 4.3, firm's profit maximizing level of employment is at L1 where VMPL (W1) is greater than the market wage (WM), indicating too few labor resources are being allocated to this employment and therefore, too many labor resources are allocated somewhere else. In this case, the total gain from trade in the labor market is not maximized, indicating that there is inefficient allocation of resources.

C. Competitive Product Market and Imperfect Labor Market

In the real world labor markets are rarely perfectly competitive. This is because workers or firms usually have the power to set and influence wages and therefore wages may be set to levels different than anticipated by perfect market theory. The situation is a bit more complex when there is imperfect competition in the labor market. Let us examine the case of a monopsony to illustrate this situation. In the case of a labor market, a monopsony occurs when there is only one firm that hires workers in a given labor market. A small "company town" is a classic example of a monopsony labor market. A hospital in many communities may also serve as a monopsony in the market for nurses, lab technicians, and radiologists. While there are few pure monopsonies, many firms have some degree of monopsony power. Let us examine what this entails.

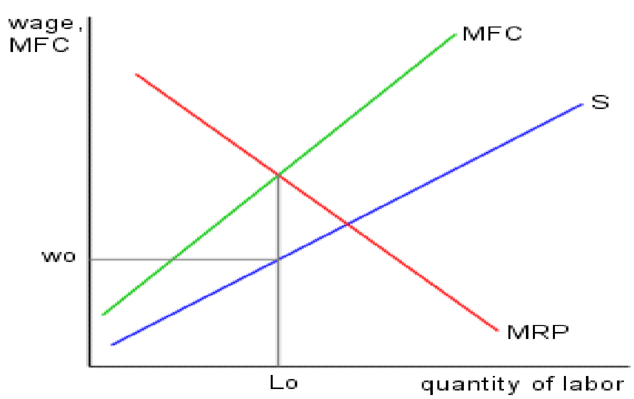
Figure 4-4: Marginal factor cost of a monopsony



A monopsony firm faces the entire market labor supply curve. The labor supply curve in the diagram represents such a possibility. In this example, the firm must pay a wage of $7.00 an hour when 7 workers are hired and must raise the wage to $7.50 an hour to induce an 8th worker to work for the firm. Of course, when the 8th worker is hired at this higher wage, the firm will have to raise the wages of the first 7 workers to $7.50 an hour. Because of this, the additional cost of adding the 8th worker is the $7.50 an hour paid to the 8th worker plus a $.50 increase in the wage of the first 7 workers (costing the firm $3.50 an hour in wage increases for these 7 workers). In this case, the marginal factor cost of adding the 8th worker is $11 (= $7.50 + $3.50).

Since the cost of an additional labor will always be greater than the wage in a monopsony market, the MFC curve lies above the labor market supply curve (since the supply curve provides the wage rate that must be paid at each level of labor use). Note that the vertical distance between the MFC and the labor supply curve rises as the level of labor usage increases since pay raises must be given to a larger number of workers as the initial level of employment increases.

Figure 4-5: Equilibrium wage rate and employment under imperfect labor market



As in any profit-maximizing firm, an optimal level of employment occurs at the level of labor use where MRP = MFC. In this diagram, this occurs at a level of employment equal to Lo. The wage, however, must equal the rate that must be paid to attract Lo workers to this firm.

As noted above, this wage is determined by the supply curve. To employ Lo level of quantity of labor, the firm needs to pay a wage equal to Wo. Note that the intersection between the MRP_L and MFC curves determines the level of employment while the supply curve determines the wage that must be paid in a monopsony market.

Compensating Wage Differentials

So far, our discussion on the theory of demand and supply has relied on the assumption of homogeneity of jobs and job seekers; thereby workers will be paid the same level of wage rate. However, when we see the real situation, employers and employees are not homogeneous. Some jobs require much more education or training than others. Some jobs are in clean, modern offices, and others are noisy, dusty or dangerous factories. Some permit the employee some discretion over the pace of work at various points throughout the day while some involve highly rigid assembly line work. Some are challenging and call for decision making by the employee, others are monotonous. Here, under theory of compensating wage differentials, we will discuss the way variations in the job characteristics influence individual choice and how the worker and the firm determine the market value of this characteristic of a job. This theory suggests that wage differentials exist, in part, to compensate workers for non-pecuniary characteristics of alternative types of employment. The theory of compensating wage differentials was first expressed in detail in 1776 by Adam Smith in the Wealth of Nations.

Let's consider an example to illustrate this concept. Suppose that two occupations (X and Y) are initially perceived as being equivalent in all attributes (*e.g.*, educational requirements, job stress, working conditions, and other characteristics). In this case, it would be expected that labor demand and supply adjustments would equate wages between these two occupations (as illustrated below).

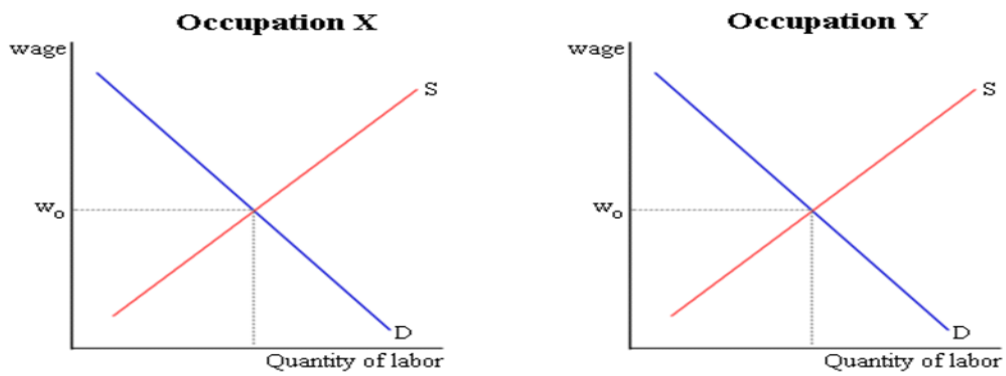


Figure 4-6: Market for equivalent jobs

Suppose, though, that it is discovered that workers in occupation Y face a greater risk of suffering a fatal on-the-job injury than workers in occupation X (a perfectly safe occupation). This will induce some workers to migrate from occupation Y to occupation X. Migration continues until the wage difference between the two jobs is large enough to induce workers to stay in their current occupations. The diagram below illustrates this possibility.

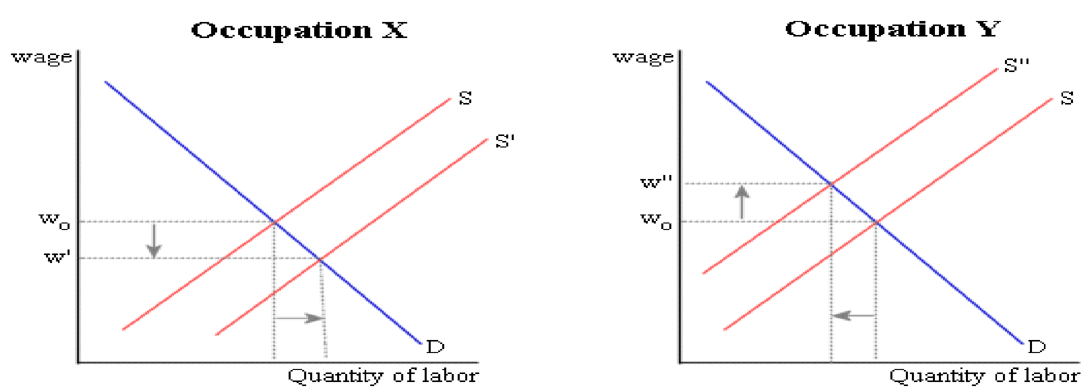


Figure 4-7: Market adjustment of wage rate for heterogeneous occupations

The wage differential w"-w′ is the amount that a worker must be compensated to accept the additional risk associated with employment in the risky occupation. This compensating wage differential can be thought of as the risk premium associated with employment in occupation Y. The left-side diagram below illustrates the magnitude of this compensating wage differential.

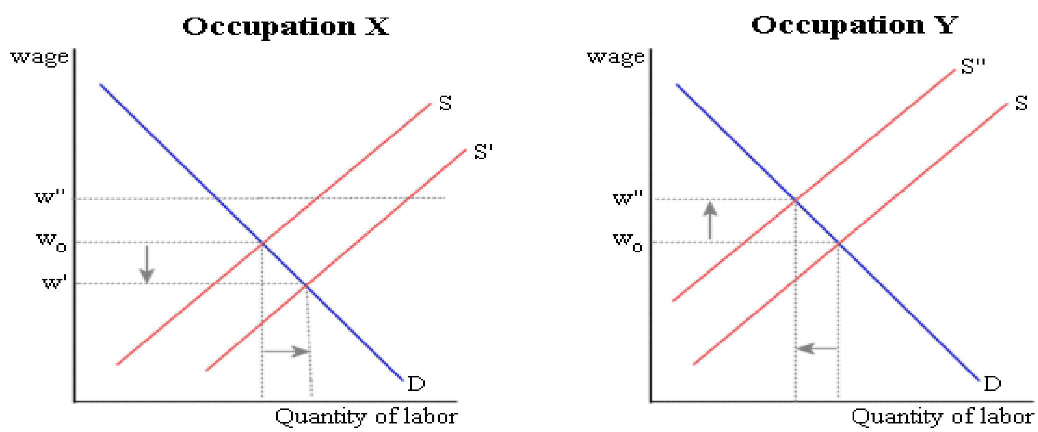


Fig.4.8. Compensating wage differential

Ceteris paribus, it would be expected that a similar compensating wage differential would exist for differences in working conditions, job stress, educational requirements, and other characteristics of jobs that make them either more or less desirable. It is expected that more pleasant jobs will offer lower wages than less pleasant jobs, holding all other job characteristics constant.

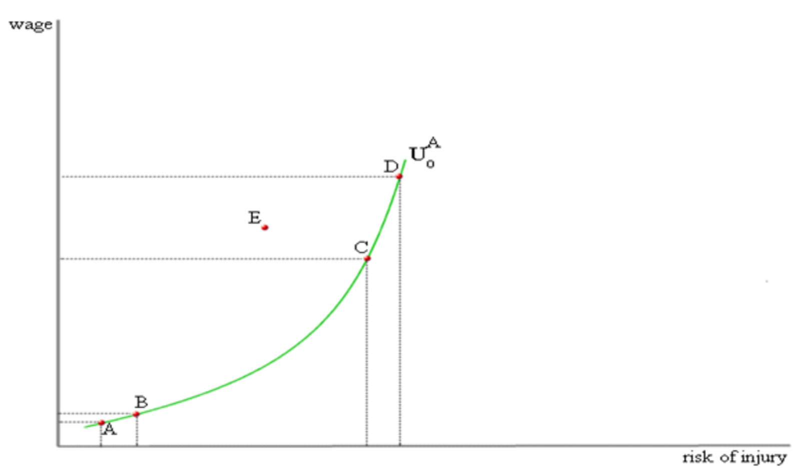
Compensating wage differentials will reflect the market value of non-wage job characteristics if:

1. Workers attempt to select an occupation that maximizes their utility levels, not their income,
2. Workers have perfect information about all job characteristics, and
3. Sufficient labor mobility exists.

In the labor market, each job can be described as consisting of a set of characteristics (e.g., the level of education required, the amount of risk associated with the job, the level of job stress,) and an associated wage offer. As noted earlier, it is assumed that wage differentials across jobs (under the conditions listed above) compensate for differences in non-wage job characteristics. Let's examine how firms and workers may jointly establish a market value for differences in the risk of injury on alternative jobs.

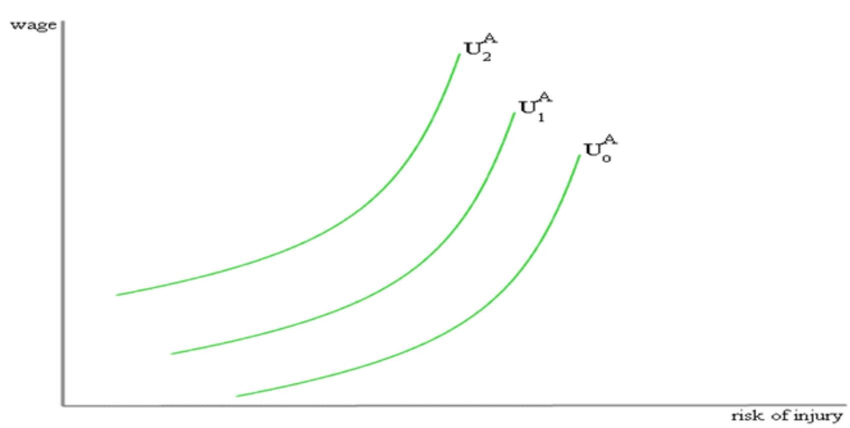
Indifference curves

The diagram below contains a representative indifference curve relating alternative levels of the wage and the risk of a work-related injury for individual A. The convex shape of this indifference curve indicates that this individual must receive progressively larger wage increases to compensate for additional risk as the level of risk rises. Points that lie on an indifference curve (such as points A, B, C, and D) provide the same level of utility. Points that lie above and to the left of the indifference curve (such as point E) are preferred to points on the indifference curve. The reason for this is that utility raises when the wage rises and/or the level of risk declines.



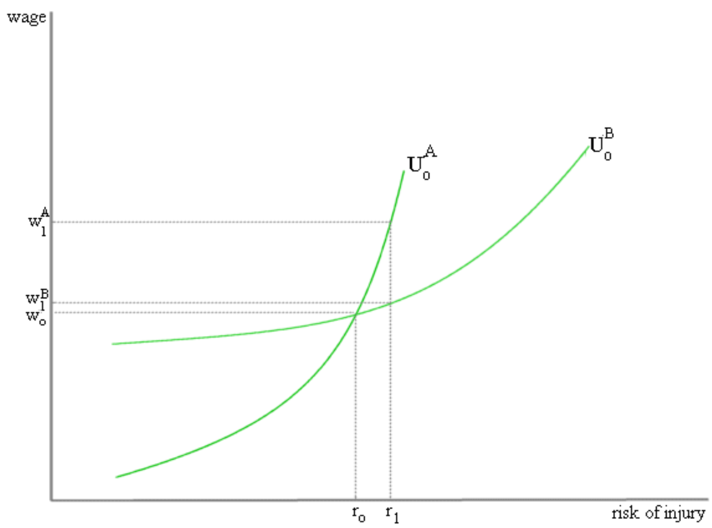
U=u(r, w); where r is risk of injury and w is wage rate. As the level of utility is directly related to wage rate and inversely related to level of risk, to make utility constant, when level of risk increases the wage rate must also be increased to compensate the loss of utility due to this change in level of risk, that is why this indifference curve is upward sloping.

Fig.4.9. Indifference curve of a worker for wage and risk



An indifference curve passes through each possible combination of wage rate and level of risk. In the diagram below, the highest level of utility for person A occurs on the indifference curve labeled U2.

Fig.4.10. Indifference map



Individuals with steeper indifference curves are more "risk averse" than individuals with flatter indifference curves. In the example below, person A is more risk averse than person B since person A requires a larger wage increase to compensate for an increase in risk (as can be seen when the level of risk rises from ro to r1).

Fig.4.11. Indifference curves with different slopes (risk taking or aversion behaviors)

Iso-profit curves

To understand the tradeoff between wages and risk that faces firms, it is useful to introduce the concept of an iso-profit curve. In the model that we are examining, an iso-profit curve is a graph of all combinations of wage rates and levels of risk that result in a given level of economic profits.

An iso-profit curve slopes upward because a reduction in risk (a leftward movement along the curve) raises a firm's cost; wages must be reduced to offset the cost of risk reduction if profits are to be held constant. The diagram below contains a zero-profit iso-quant for firm X. The concave shape of the iso-profit curve indicates that the marginal cost of reducing risk rises as the level of risk is reduced.

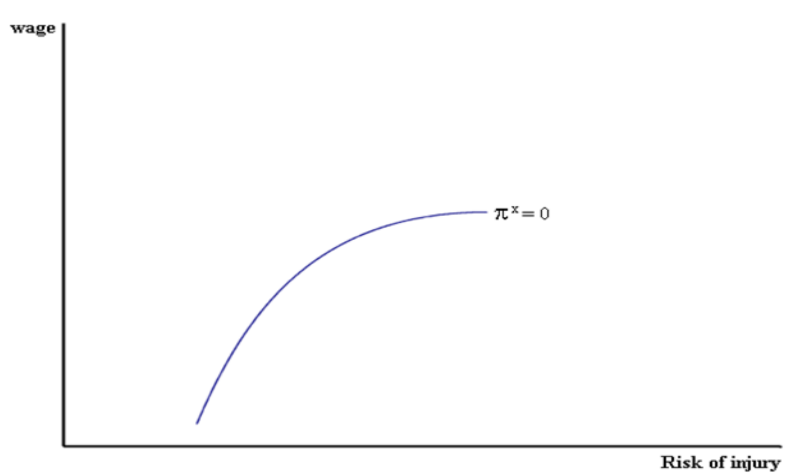


Fig.4.12. Iso-profit curve

The diagram below contains a set of three iso-profit curves for Firm X. Notice that an iso-profit curve that lies above the zero-profit iso-profit curve corresponds to a negative level of profits (since wages are higher at each level of risk). Similarly, an iso-profit curve that lies below the zero-profit iso-profit curve corresponds to a positive level of profits.

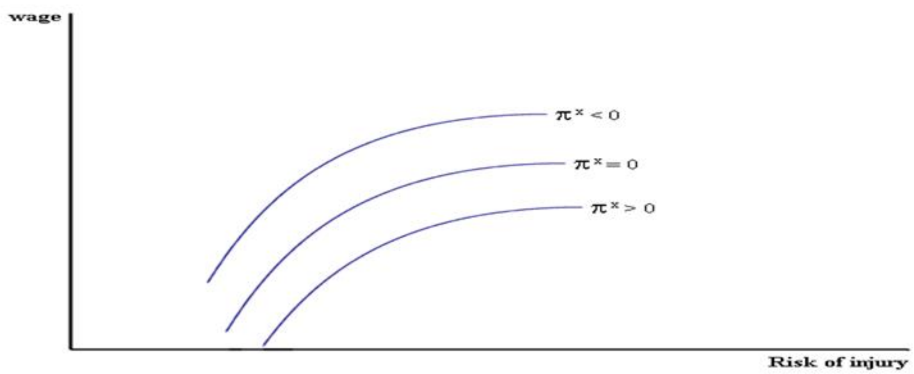
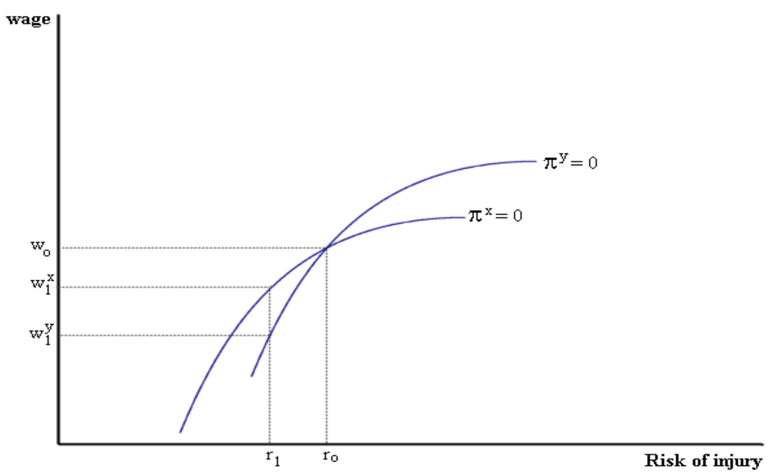


Fig.4.13. Iso-profit map



Economic profit, however, will equal zero in a long-run equilibrium in any market in which there are no substantial barriers to entry. Thus, the long-run equilibrium tradeoff between wage rates and job risk must occur along the zero-profit iso-profit curve. Firms that face a higher marginal cost of reducing risk (at any given level of risk) will have a steeper iso-profit curve. In the example below, the marginal cost of reducing risk is higher for firm Y than for firm X.

Fig.4.14. Iso-profit curves with different slopes (different values of marginal cost of reducing the risk)

Employer-Employee Matching

At any given level of risk, workers will always select the job that offers the highest wage rate, assuming that other job characteristics are held constant. In the simplified diagram below, a worker can choose to work at either firm X or firm Y. A worker who selects a level of risk of ro or r1 will choose to work at firm X (since firm X provides a higher wage at these levels of risk. A worker who is willing to accept higher levels of risk (such as r2 or r3), however, will choose to work at firm Y.

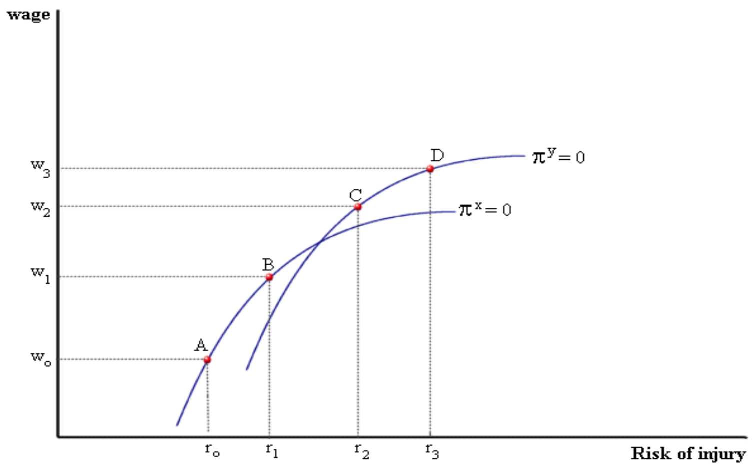


Fig.4.15. Workers' decision on which firm to be employed

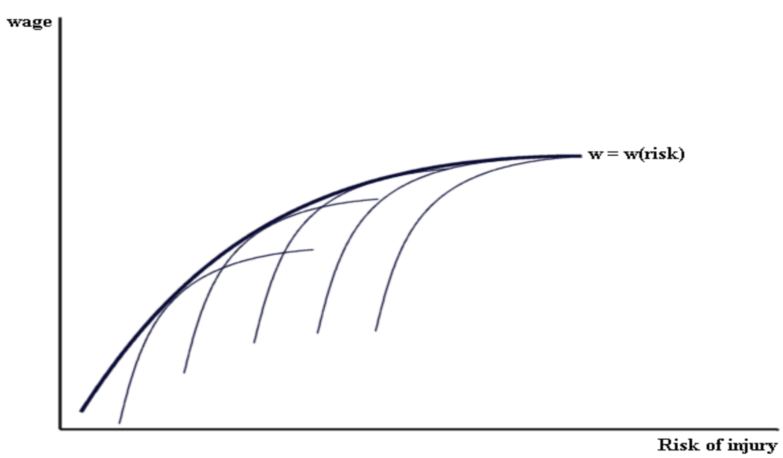


Fig.4.16. Wage-risk offer curve

In a more realistic environment in which there are a large number of firms, a wage-risk offer curve exists that serves as an envelope curve to the zero-profit iso-profit curves for all of the firms in a particular labor market. This curve traces out the highest wage offer that workers can receive at each possible level of job risk.

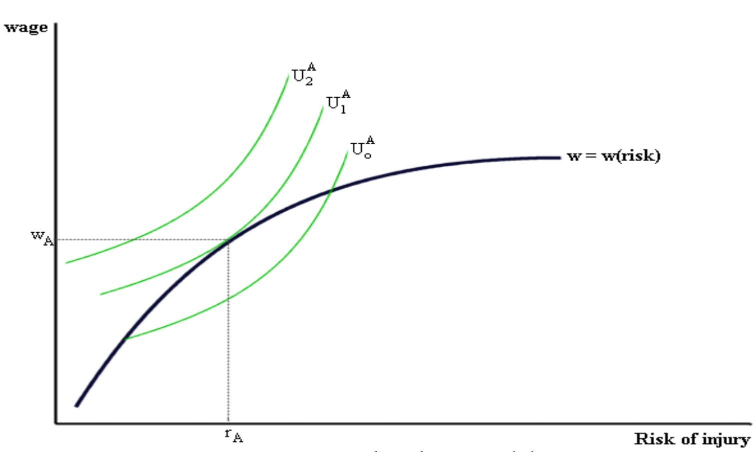


Fig.4.17. Worker's equilibrium

Under the assumptions of this model, workers will select the combination of wage rates and job risk that maximizes their utility levels, given the constraint that all available job offers lie on the wage-risk offer curve. As the diagram indicates, the optimal choice lies on a point of tangency between an indifference curve and the wage-risk offer curve. As the diagram below indicates, individuals who are less risk averse will select riskier jobs, that offer higher wages.

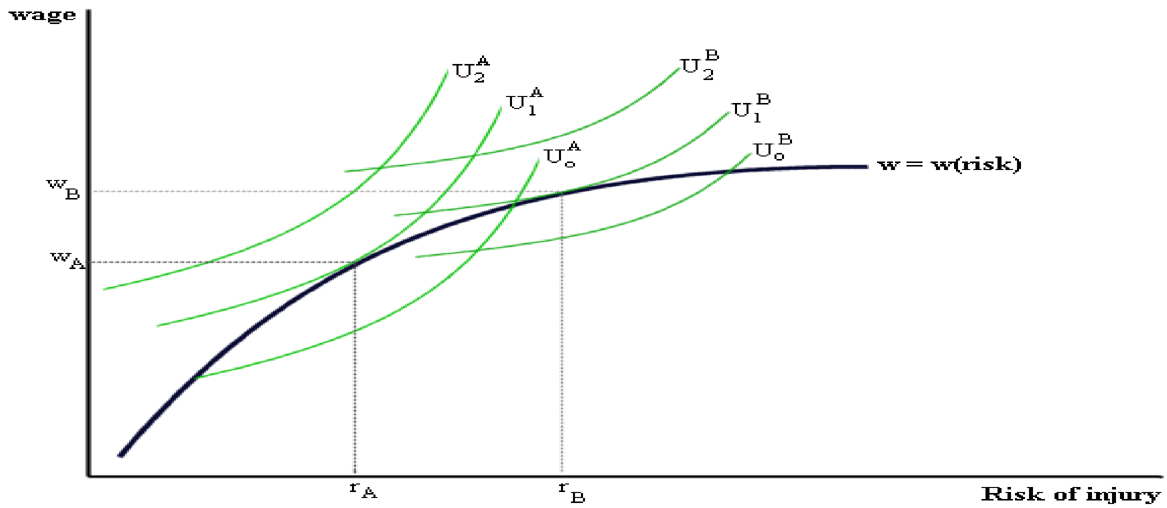


Fig.4.18. Optimal combination of wage and risk for workers with different risk taking behaviors

Notice also that, in this optimal sorting, the level of risk is the lowest in those firms in which the marginal cost of risk reduction is relatively low.

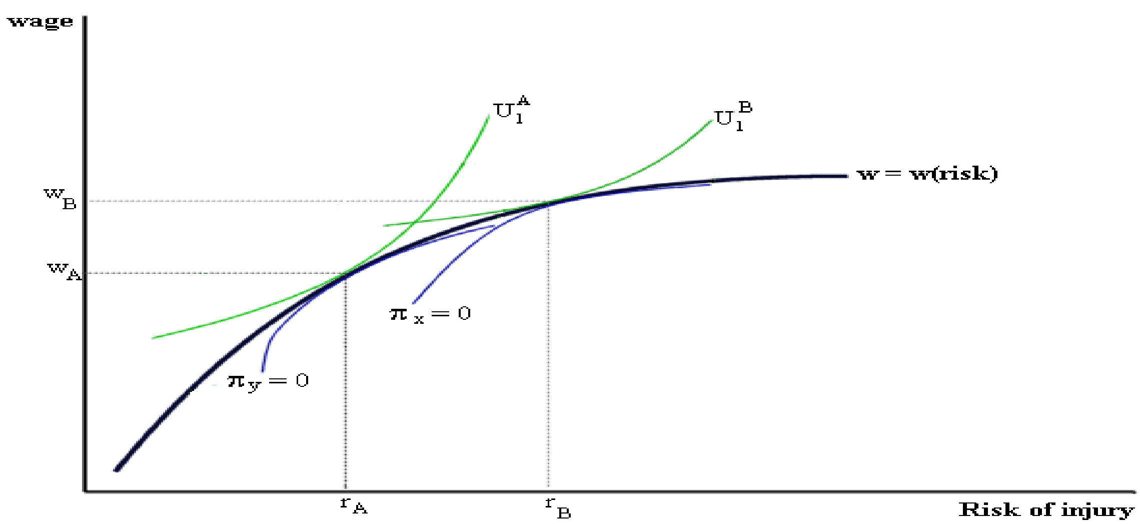


Fig.4.19. Employees-employer matching

4.2. None-market Determination of Wage

None market wage determination refers to the wage determination based on none labor market forces like government legislations and trade unions.

i. Minimum Wage Laws

It is not unusual that many countries throughout the world have been employing minimum wage law to ensure the workers to receive the minimum wage level that enables a full time worker to buy basic necessities of life.

Case 1: Minimum Wage and Competitive Labor Market

a. Completely Covered Labor Market

Each profit maximizing form is assumed to be able to hire all the labor it wishes at the competitive market wage rate. However, the introduction of a minimum wage law that covers all employees into a perfectly competitive labor market will be expected to result in a reduction in employment. In the figure below the market clearing wage rate is W^* with L^* level of employment. Suppose that the government imposes a minimum wage of W', which is greater than W^*. At the wage W', profit maximizing firm will employ only Q' workers and Q^*– Q' workers will lose their jobs. The number of workers who lose their jobs following the imposition of minimum wage depends on the elasticity of the labor demand curve the size of wage differential (W'-W^*).

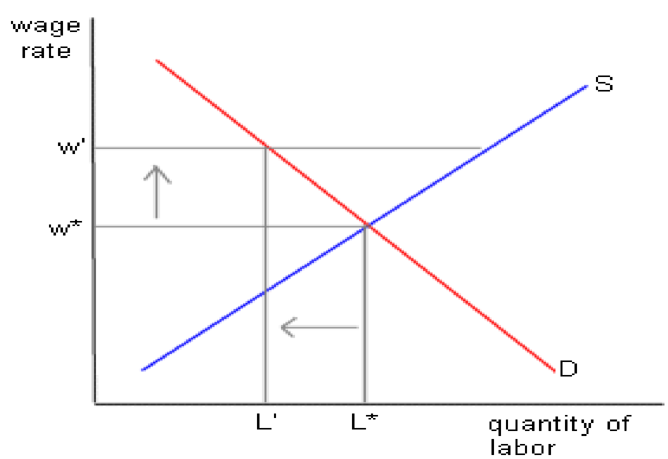


Fig.4.20. Effect of minimum wage on the level of employment

b. Partially Covered Labor Market

Let's examine the situation in perfectly competitive labor markets when some workers are not covered by the minimum wage law. The diagram below illustrates the effect of having a “non- covered” sector in the economy. In the absence of a minimum wage law, the equilibrium wage would equal Wo in both sectors. The introduction of a minimum wage in the covered firms result in an increase in the wage (to Wm) and a reduction of employment in the covered sector of the economy. Workers who cannot find work in the covered sector have the option of shifting to firms that are not covered by the minimum wage law. This will result in an increase in supply of labor in the non-covered sector. In response to this increase in supply of labor wages will decline and employment will increase in the non- covered sector.

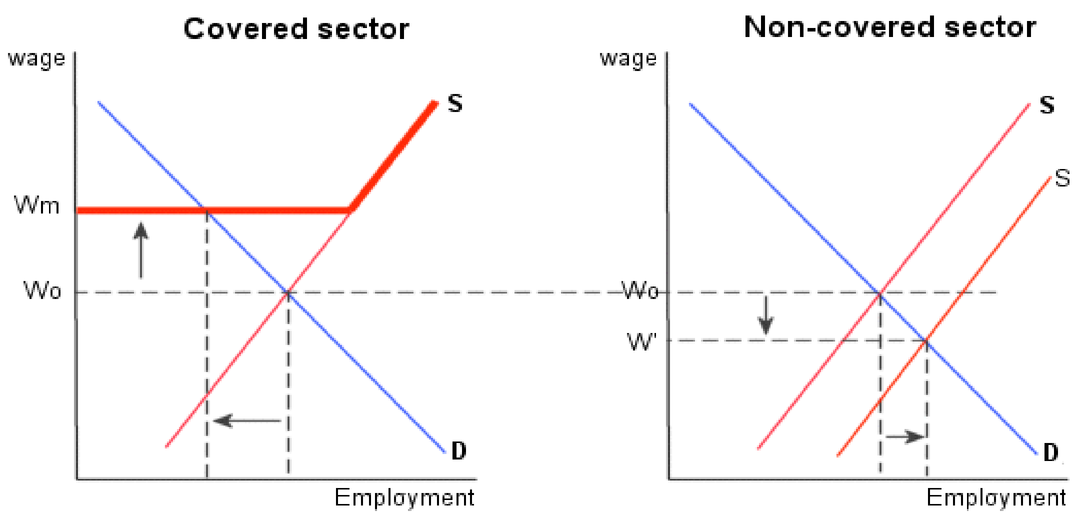


Fig.4.21. Effects of minimum wage on level of employment and wage rate

Notice that an increase in the minimum wage need not result in increased unemployment as long as the workers who lose their jobs in the covered sector are able to shift to work in non-covered firms. Despite this, however, there is still an efficiency cost for society since the marginal revenue product of the last worker hired in the covered sector will exceed the marginal revenue product of the last worker hired in the non-covered sector. Society would be able to produce more total output if the MRP were the same in both sectors.

An example might help to illustrate this efficiency cost. Suppose that the minimum wage is $5.10 and the wage in the non-covered sector is $4.50. The loss of one hour of labor in the non-covered sector results in a loss of $4.50 in output in this sector. If this hour was transferred to the covered sector, nearly $5.10 in additional output can be produced, resulting in a net gain to society of $.60 an hour. The analysis that was applied above to the effect of a minimum wage can also be used to explain the effects resulting from the introduction of an industrial union into some, but not all, of the firms in an industry.

Case 2: Minimum Wage under Monopsony Market

Let us examine what happens when a minimum wage law (or a union-negotiated wage agreement) is introduced into a monopsony market. The diagram below illustrates the effect of introducing a minimum wage (or a union-negotiated wage) equal to w′ in a monopsony market. The firm, without this intervention, would have paid a wage of wo and employed Lo workers. The minimum wage (or negotiated wage) of w′, however, alters the supply curve facing the firm so that it is horizontal at a wage of w' until it crosses the original supply curve (the reason for this is that the firm may pay wages above w', but never drop the wage below this level). In the range in which the supply curve is horizontal, however, the marginal factor cost of labor is just equal to this wage (since the firm doesn't have to raise any one's wage when another worker is employed). The MFC curve jumps up to its former location at the level of labor use at which the labor supply curve resumes its upward slope. This results in a discontinuous MFC curve (as illustrated below).

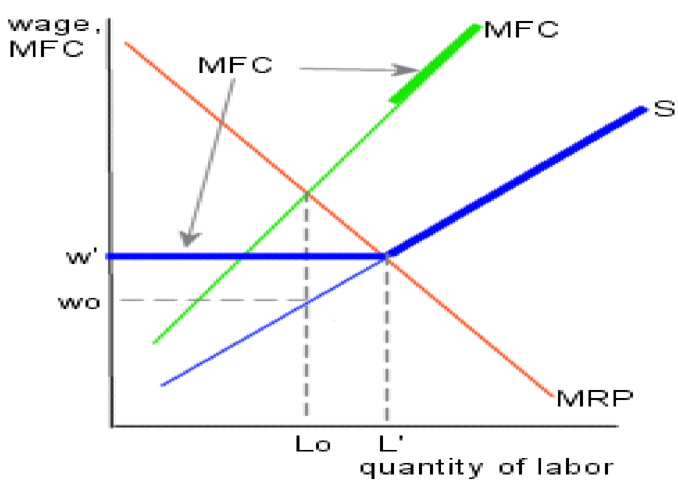


Fig.4.22. Minimum wage under monopsony market

When faced with these MRP, MFC, and labor supply curves, a profit-maximizing monopsonist will find it optimal to employ L' workers at the minimum wage (or negotiated wage) of w'. The firm's profits would be lower if it used either less or more labor than this level. This is a somewhat interesting result: the introduction of a minimum wage law (or a union) in a monopsony market may result in increased wages and increased employment!

The diagram below illustrates another possible outcome. In this case, the minimum wage (or union-negotiated wage) is set at w''. In this case, the optimal level of employment remains at Lo. So, it is also possible that the introduction of a minimum wage law may lead to an unchanged level of employment (and higher wages).

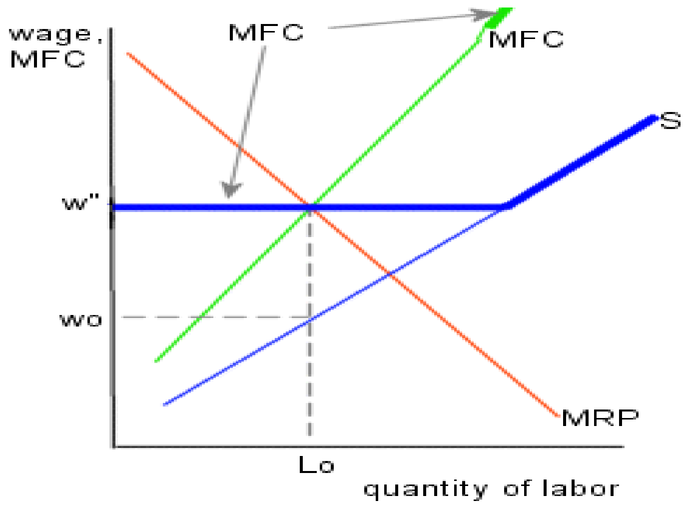


Fig.4.23. Minimum wage under monopsony market

More generally, if the minimum wage (or union-negotiated wage) is between wo and w", employment will increase when the minimum wage is introduced. If the new wage is set at w", employment remains unchanged. A minimum wage (or union-negotiated wage) above w" will result in a decline in employment in this labor market. In general, the theories that we have discussed suggest that a minimum wage law (or union) will result in:

- Unemployment and economic inefficiency if the labor market is perfectly competitive and there is complete coverage,
- Economic inefficiency if the labor market is perfectly competitive and there is a non- covered sector, and
- An ambiguous effect on the level of employment if firms possess some degree of monopsony power.

ii. Labor Union

Hicks-Marshall Laws and Union Strategy

Unions attempt to increase the incomes of their members. When labor demand is relatively inelastic, a given wage increase will result in a smaller impact on employment. If labor demand is relatively elastic, however, a wage increase results in a relatively large reduction in employment. Clearly, unions would prefer to be operating in a labor market in which labor demand is more inelastic. This leads to a few interesting results concerning union strategies:

- Unions will be more successful in receiving wage increases in markets in which labor demand is relatively inelastic,
- Unions will attempt to reduce the own-wage elasticity of demand for their workers, and
- Unions might prefer to organize those labor markets in which labor demand is relatively inelastic.

Let us see how each of the Hicks-Marshall laws applies to these strategies.

First Law and Union Strategy

Since labor demand is more inelastic when the demand for output is more inelastic, labor unions will receive larger wage increases when labor demand is more inelastic. Unions may attempt to apply this law by engaging in advertising campaigns to attempt to reduce the elasticity of demand for the final product. These campaigns, if successful, also have the desirable effect (from the union's viewpoint) of increasing the demand for union labor.

Second Law and Union Strategy

Unions consisting of skilled workers were historically the first successful unions. One of the reasons for this is that it is harder to replace skilled workers than unskilled workers in many production processes. An examination of a typical union contract indicates that a great deal of effort goes into negotiating job descriptions and job titles that carefully delineate job duties for each employee. One of the reasons for the use of such careful language in contracts is that this limits the ability of firms to substitute lower-cost workers for more highly paid workers. By reducing the ease of substitution among workers, unions are able to reduce the own-wage elasticity of demand for each type of worker.

Third Law and Union Strategy

Unions advocate child labor laws and laws restricting immigration. One of the reasons for this support is that firms use immigrant workers and children as low-cost substitutes to union workers. By raising the penalties associated with illegal immigration or with violations of child labor laws, the supply of these other sources of labor is reduced and unions are able create a more inelastic demand curve for labor.

Fourth Law and Union Strategy

The fourth Hicks-Marshall law states that elasticity of labor demand is relatively large when this category of labor accounts for a relatively large share of total costs. Therefore, although it is unlikely, unions will actively attempt to reduce the share of labor costs in total costs of production. Historically, unions have been relatively more effective in capital intensive industries in which labor costs are a relatively small share of total costs. One of the reasons for the limited success of unions in the service sector is that labor costs are a relatively large share of total costs in this sector.

Policy Application: Payroll Taxes and Subsidies

We can easily illustrate the usefulness of the supply and demand framework by considering a government policy that shifts the labor demand curve. In many countries some government programs are funded partly through a payroll tax imposed on employers. What happens to wages and employment when the government levied a payroll tax on employers? Fig.4.24 answers this question. Prior to the imposition of the tax, the labor demand curve is given by D_0 and the supply of labor to the industry is given by *S*. In the competitive equilibrium given by point *A*, E_0 workers are hired at a wage of W_0 dollars. Each point on the demand curve gives the number of workers that employers wish to hire at a particular wage. In particular, employers are willing to hire E_0 workers if each worker costs W_0 dollars. To simplify the analysis, consider a very simple form of payroll tax. Suppose, the firm will pay a tax of 1 birr for every employee-hour it hires. In other words, if the wage is 10 birr an hour, the total cost of hiring an hour of labor will be 11 birr (10 birr goes to the worker and 1 birr goes to the government). Because employers are only willing to pay a *total* of W_0 birr to hire the E_0 workers, the imposition of the payroll tax implies that employers are now only willing to pay a wage rate of W_0-1 birr to the workers in order to hire E_0 of them.

The payroll tax assessed on employers, therefore, leads to a downward parallel shift in the labor demand curve to D_1, as illustrated in Figure 4-24. The new demand curve reflects the wedge that exists between the *total* amount that employers must pay to hire a worker and the amount that workers actually receive from the employer. In other words, employers take into account the *total* cost of hiring labor when they make their hiring decisions—so that the amount that they will want to pay to workers has to shift down by1 birr in order to cover the payroll tax. The payroll tax moves the labor market to a new equilibrium (point *B* in the figure). The number of workers hired declines to E_1. The equilibrium wage rate—that is, the wage rate actually *received* by workers falls to W_1, but the *total* cost of hiring a worker rises to W_1+1.

What happens if the payroll tax is imposed on workers? In a competitive market, it does not matter whether the tax is imposed on workers or firms. The impact of the tax on wages and employment is the same regardless of who pay the tax. As we have discussed above, even though the payroll tax was exclusively imposed on employers, the labor market shifted part of the tax to the worker. The cost of hiring a worker rises at the same time that the wage received by the workers' declines. Therefore, firms and workers "share" the costs of the payroll tax.

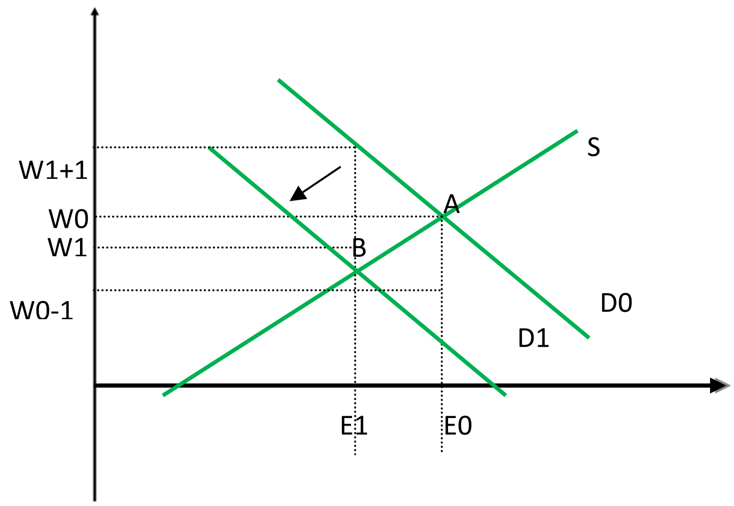


Fig.4-24. The impact of a payroll tax assessed on firms

When will the payroll tax be completely shifted to workers? In one extreme case, the payroll tax is shifted entirely to workers. Suppose that the tax is assessed on the firm and that the supply curve of labor is perfectly inelastic, as illustrated in Figure 4-25. A total of E_0 workers are employed in this market regardless of the wage. As before, the imposition of the payroll tax shifts the demand curve down by 1 birr. Prior to the tax, the equilibrium wage was W_0. After the tax, the equilibrium wage is W_0-1birr. The more inelastic the supply curve, therefore, the greater the fraction of the payroll taxes that workers end up paying.

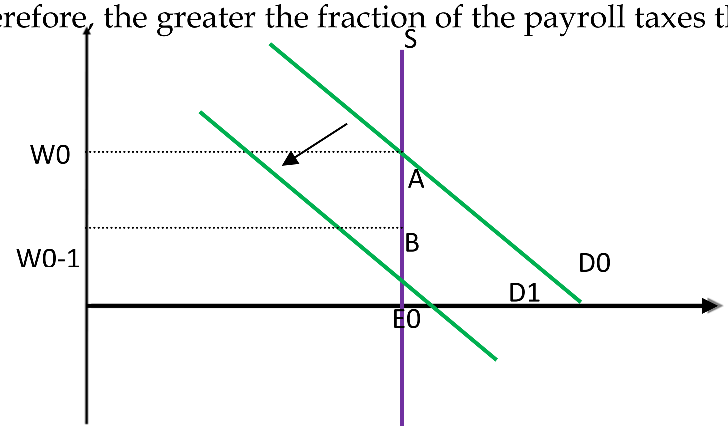


Fig.4-25. The impact of a payroll tax assessed on firms with inelastic supply

The labor demand curve is shifted not only by payroll taxes but also by government subsidies designed to encourage firms to hire more workers. An employment subsidy lowers the cost of hiring for firms. In the typical subsidy program, the government grants the firm a tax credit, say 1birr, for every person-hour it hires. Because this subsidy reduces the cost of hiring a person-hour by1 birr, it shifts the demand curve up by that amount, as illustrated in Figure 4-26. The new demand curve (*D*1) gives the price that firms are willing to pay to hire a particular number of workers after they take account of the employment subsidy. Labor market equilibrium shifts from point *A* to point *B.* At the new equilibrium, there is more employment (from *E*0 to *E*1). In addition, the subsidy increases the wage that workers actually receive (from *W*0 to *W*1), and reduces the wage that firms actually have to pay out of their own pocket (from *W*0 to *W*1-1). The labor market impact of these subsidies can be sizable and will obviously depend on the elasticities of the labor supply and the labor demand curve.

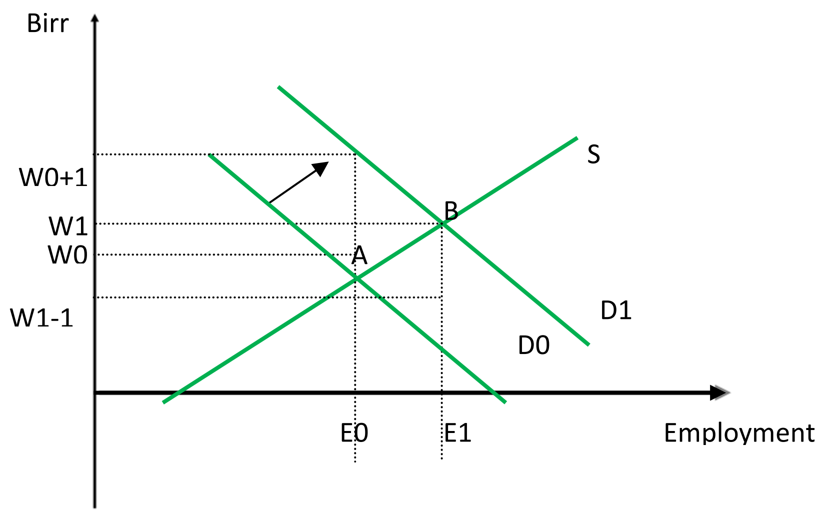


Fig.4-26. The impact of an employment subsidy