CHAPTER 4: LABOUR MARKET DECISIONS OF HOUSEHOLD AND FIRMS (SUPPLY AND DEMAND IN LABOUR MARKETS)

4.1 - INTRODUCTION TO LABOUR AND FINANCIAL MARKETS

Learning Objectives

- Learn to examine ways that supply and demand apply to labour and financial markets

So far in this module, you have examined applications of supply and demand and how these concepts explain shortages, surpluses, and allocative efficiency. In this section, we will look at a couple more examples of supply and demand, and instead of focusing on markets for goods and services, we will see how these same principles apply to labour and financial markets.

Attribution

4.2 - LABOUR MARKET EQUILIBRIUM AND WAGE DETERMINANTS

Learning Objectives

- Employ the marginal decision rule to determine the equilibrium cost of labor
- Describe the factors that determine the wage rate
- Describe nonmonetary factors that affect wage rates
- Identify the relationship between performance and wages
- Explain how wages are determines by marginal revenue productivity
- Discuss the factors that influence the shape and position of the labor supply curve
- Examine the role of unions and collective bargaining in labor-firm relations

Conditions of Equilibrium

Equilibrium in the labor market requires that the marginal revenue product of labor is equal to the wage rate, and that $\frac{MPL}{PL} = \frac{MPK}{PK}$.

The labor market differs somewhat from the market for goods and services because labor demand is a derived demand; labor is not desired for its own sake but rather because it aids in producing output. Firms determine their demand for labor through a lens of profit maximization, ultimately seeking to produce the optimum level of output and the lowest possible cost.

Labor Market Equilibrium

In order to find the equilibrium quantity and price of labor, economists generally make several assumptions:

- The marginal product of labor (MPL) is decreasing;
- Firms are price-takers in the goods market (cannot affect the price of output) as well as in the labor market (cannot affect the wage rate);
- The supply of labor is elastic and increases with the wage rate (upward sloping supply); and
- Firms are profit-maximizers.

The marginal revenue product of labor (MRPL) is equal to the MPL multiplied by the price of output. The MRPL represents the additional revenue that a firm can expect to gain from employing one additional unit of labor – it is the marginal benefit to the firm from labor. Under the above assumptions, the MRPL is decreasing as the quantity of labor increases, and firms can increase profit by hiring more labor if the MRPL is greater than the marginal cost of that additional unit of labor – the wage rate. Thus, firms will hire more labor when the MRPL is greater than the wage rate, and stop hiring as soon as the two values are equal. The point at which the MRPL equals the prevailing wage rate is the labor market equilibrium.

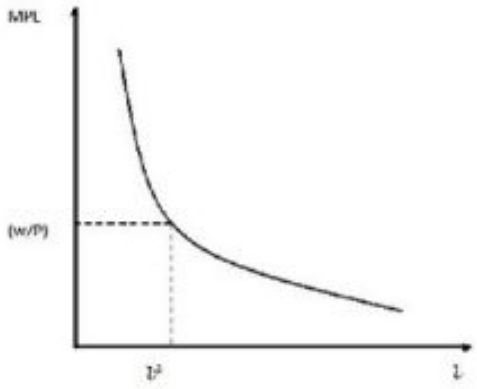

Figure 4.2a Graph by HpSSE licensed under CC BY-SA 3.0.

Optimal Demand for Labor: The optimal demand for labor is located where the marginal product equals the real wage rate. The curved line, sloping downward from left to right, represents the falling marginal product of labor, the y-axis is the marginal product/wage rate, and the x-axis is the quantity of labor.

Optimizing Capital and Labor

In the long run, firms maximize profit by choosing the optimal combination of labor and **capital** to produce a given amount of output. It's possible that an automobile company could manufacture 1,000 cars using only expensive, technologically advanced robots and machinery (capital) that do not require any human participation. It's also possible that the company could produce the same number of vehicles using only

employee work (labor), without any assistance from machines or technology. For most industries, however, relying solely on capital or solely on labor is more expensive than using some combination of the two.

Figure 4.2b Solar wafer manufacturing (https://www.flickr.com/photos/oregondot/3347740006/) by Oregon Department of Transportation licensed under CC-BY.

Factory Worker: Most firms need a combination of both labor and capital in order to produce their product.

Firms use the marginal decision rule in order to decide what combination of labor, capital, and other factors of production to use in the creation of output. The marginal decision rule says that a firm will shift spending among factors of production as long as the marginal benefit of such a shift exceeds the marginal cost. Imagine that a firm must decide whether to spend an additional dollar on labor. To determine the marginal benefit of that dollar, we divide the marginal product of labor (MP_L) by it's price (the wage rate, P_L): MP_L/P_L. If capital and labor are the only factors of production, then spending an additional $1 on labor while holding the total cost constant means taking $1 out of capital. The cost of that action will be the output lost from cutting back on capital, which is the ratio of the marginal product of capital (MP_K) to the price of capital (the rental rate, P_K). Thus, the cost of cutting back on capital is MP_K/P_K.

If the marginal benefit of additional labor, MP_L/P_L, exceeds the marginal cost, MP_K/PK, then the firm will be better off by spending more on labor and less on capital. On the other hand, if MP_K/P_K is greater than MP_L/P_L, the firm will be better off spending more on capital and less on labor. The equilibrium – the point at which the firm is producing the maximum amount of output at a given cost – occurs where $MP_L/P_L=MP_K/P_K$.

The Wage Rate

The wage rate is determined by the intersection of supply of and demand for labor.

When labor is an input to production, firms hire workers. Firms are demand labor and workers provide it at a price called the wage rate. Colloquially, "wages" refer to just the dollar amount paid to a worker, but in economics, it refers to total compensation (i.e. it includes benefits).

The marginal benefit of hiring an additional unit of labor is called the marginal product of labor: it is the additional revenue generated from the last unit of labor. In theory, as with other inputs to production, firms will hire workers until the wage rate (marginal cost) equals the marginal revenue product of labor (marginal benefit).

Changes in Supply and Demand

In competitive markets, the demand curve for labor is the same as the marginal revenue curve. Thus, shifts in the demand for labor are a function of changes in the marginal product of labor. This can occur for a number of reasons. First of all, you can imagine that a new product or company is created that represents new demand for labor of a certain type. There are also three main factors that would shift the labor demand curve:

1. Technology which affects the output of a unit of labor.
2. Changes in the price of the output which affect the value of the unit of labor.
3. Changes in the price of labor relative to other factors of production.

In the long run, the supply of labor is a function of the population. A decrease in the supply of labor will typically cause an increase in the wage rate. The fact that a reduction in supply tends to strengthen wages explains why **unions** and other professional associations have often sought to limit the number of workers in their particular industry. Physicians, for example, have a financial incentive to enforce rigorous training, licensing, and certification requirements in order to limit the number of practitioners and keep the labor supply low.

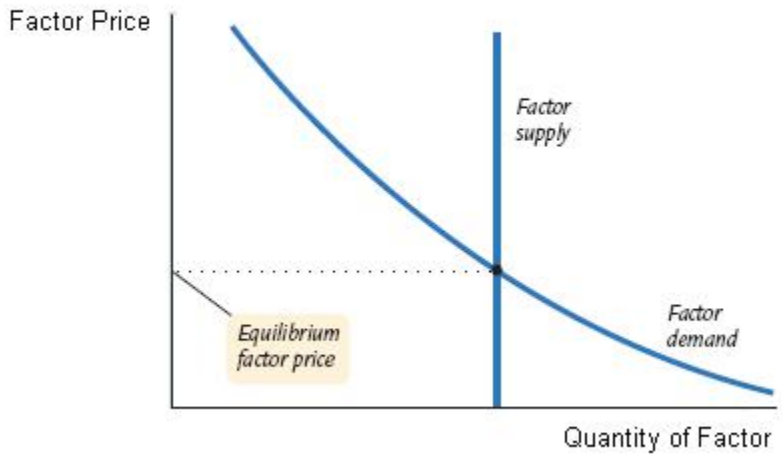

Figure 4.2c. Wage Rate in the Long Run: In the long run the supply of labor is fixed and demand is downward-sloping. The wage rate is determined by their intersection.Factor Compensation (https://en.wikipedia.org/wiki/File:Factor_compensation.jpg) by HpSSE under CC BY-SA 3.0.

Compensation Differentials

Some differences in wage rates across places, occupations, and demographic groups can be explained by compensation **differentials**.

According to the basic theory of the labor market, there ought to be one equilibrium wage rate that applies to all workers across industries and countries. Of course this is not the case; doctors typically make more per hour than retail clerks, and workers in the United States typically earn a higher wage than workers in India. These wage differences are called compensation differentials and can be explained by many factors, such as differences in the skills of the workers, the country or geographical area in which jobs are performed, or the characteristics of the jobs themselves.

Education Differentials

One common source of differences in wage rates is human capital. More skilled and educated workers tend to have higher wages because their **marginal product** of labor tends to be higher. Additionally, the differential pay for more education tends to compensate workers for the time, effort, and foregone wages from obtaining the necessary training. If all jobs paid the same rate, for example, fewer people would go through the expense

and effort of law school. The compensation differential ensures that individuals are willing to invest in their own human capital.

Figure 4.2d. Education Differentials: Workers seek increased compensation by attaining higher levels of education The Graduates (https://www.flickr.com/photos/sakeeb/4647211575) by Sakeeb Sabakka licensed under CC BY 2.0.

Geographic Compensation Differentials

If a certain part of a country is a particularly attractive area to live in and if labor mobility is perfect, then more and more workers will move to that area, which in turn will increase the supply of labor and depress wages. If the attractiveness of that area compared to other areas does not change, the wage rate will be set at such a rate that workers will be indifferent between living in areas that are more attractive but with a lower wage and living in areas which are more attractive with a higher wage. In this way, a sustained equilibrium with different wage rates across different areas can occur.

Discrimination and Compensation Differentials

In the United States, minorities and women make lower wages on average than Caucasian men. Some of this is due to historical trends affecting these groups that result in less human capital or a concentration in certain lower-paying occupations. Another source of differing wage rates, however, is **discrimination**. Several studies have shown that, in the United States, several minority groups (including black men and women, Hispanic men and women, and white women) suffer from decreased wage earning for the same job with the same performance levels and responsibilities as white males.

Compensating Differential

Not to be confused with a compensation differential, a compensating differential is a term used in labor economics to analyze the relation between the wage rate and the unpleasantness, risk, or other undesirable attributes of a particular job. It is defined as the additional amount of income that a given worker must be offered in order to motivate them to accept a given undesirable job, relative to other jobs that worker could perform. One can also speak of the compensating differential for an especially desirable job, or one that provides special benefits, but in this case the differential would be negative: that is, a given worker would be willing to accept a lower wage for an especially desirable job, relative to other jobs.

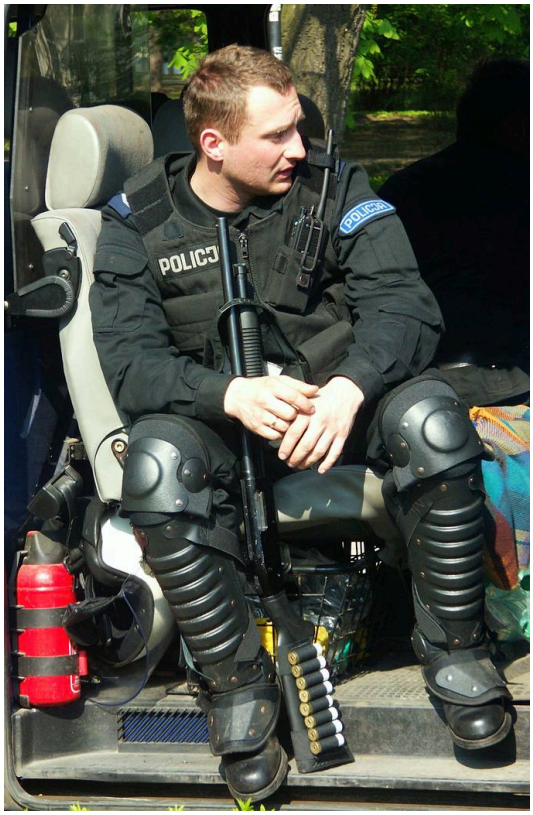

Figure 4.2e. Hazard Differential: Hazard pay is a type of compensating differential. Occupations that are dangerous, such as police work, will typically have higher pay to compensate for the risk associated with that job. Polish police (riot contol squad) (https://commons.wikimedia.org/wiki/File:Police_Poland_2_AB.jpg#/media/File:Police_Poland_2_AB.jpg) by Andrzej Barabasz (Chepry) licensed under CC BY-SA 3.0.

Performance and Pay

Theoretically there is a direct connection between job performance and pay, but in reality other factors often distort this relationship.

According to economic theory, workers' wages are equal to the **marginal revenue product** of their labor. If one employee is very productive he or she will have a high marginal revenue product: one additional hour of their work will produce a significant increase in output. It follows that more productive employees should have higher wages than less productive employees. Imagine if this were not true: a firm decides to pay a highly productive worker less than the marginal revenue product of his labor. Any other firm could make a profit by offering a higher salary to attract the productive employee to their company, and the worker's wage would rise. Theoretically, therefore, there is a direct relationship between job performance and pay.

We know that this is not always the case in reality. Wages are determined not only by one's productivity, but also by seniority, networking, ambition, and luck. It is very rare for an entry-level worker to make the same wage as an experienced member of the same profession regardless of their relative levels of productivity because the older worker has had time to receive pay raises and promotions for which the younger employee is simply not eligible. Discrimination is sometimes responsible for members of minority racial or gender groups receiving wages that are less than wages for the majority group even when productivity levels are the same. Finally, outside forces, such as unions or government regulations, can distort pay rates.

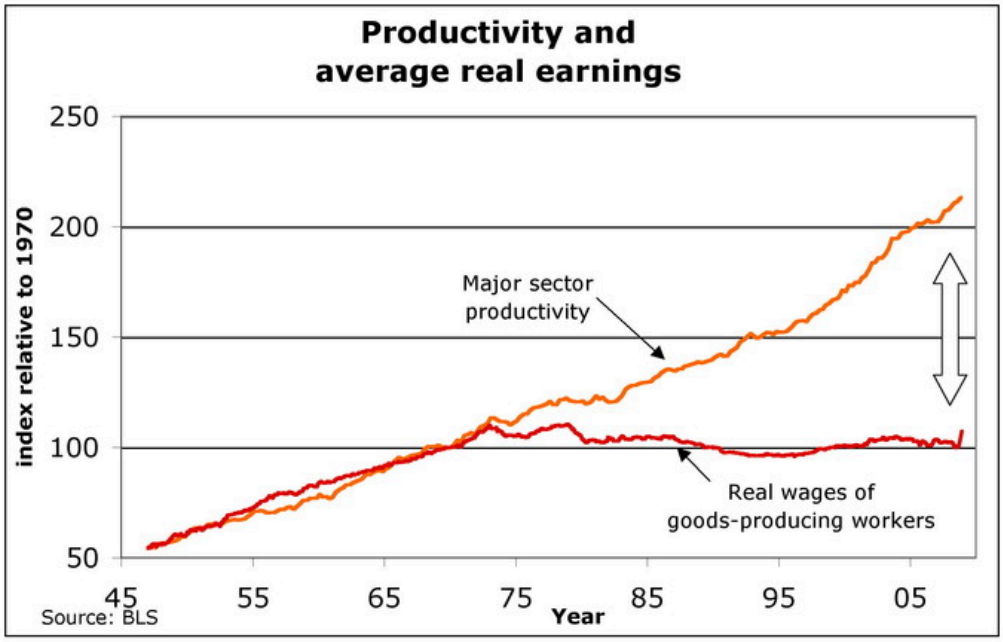

Figure 4.2f. Wages and Productivity in the U.S.: On a macroeconomic level, this graph shows the disconnect, beginning around 1975, between the productivity of labor and the wage rate in the U.S. If the economic theory were correct in the real world, wages and productivity would increase together. Graph by U.S. Department of Labor, Bureau of Labor Statistics falls under Public Domain.

Linking Performance and Pay

Some of the disconnect between performance and pay can be addressed with alternate pay schemes. While a salary or hourly pay does not directly take into account the quality of work, performance-related pay compensates workers with higher levels of productivity directly. One example is **commission**-based pay. In this type of pay scheme, workers receive some percentage of the profit that they generate for their company. This may be paid on top of a baseline salary or may be the only form of compensation. This type of system is very common among car salespeople and insurance brokers.

Another alternative is piece-work, in which employees are paid a fixed rate for every unit produced or action performed, regardless of the time it takes. This is common in settings where it is easy to measure the output of **piece work**, such as when a garment worker is paid per each piece of cloth sewn or a telemarketer is paid for every call placed.

Marginal Revenue Productivity and Wages

In a perfectly competitive market, the wage rate is equal to the marginal revenue product of labor.

Just as in any market, the price of labor, the wage rate, is determined by the intersection of supply and demand. When the supply of labor increases the equilibrium price falls, and when the demand for labor increases the equilibrium price rises. In the long run the supply of labor is a simple function of the size of the population, so in order to understand changes in wage rates we focus on the demand for labor.

To determine demand in the labor market we must find the **marginal revenue product** of labor (MRPL), which is based on the marginal productivity of labor (MPL) and the price of output. Conceptually, the MRPL represents the additional revenue that the firm can generate by adding one additional unit of labor (recall that MPL is the additional output from the additional unit of labor). Thus, MRPL is simply the product of MPL and the price of the output.

The MPL is generally decreasing: adding a 100th unit of labor will not increase output as much as adding a 99th. Since competitive industries are price takers and cannot change the price of output by changing their level of production, the MRPL curve will have the same downward slope as the MPL curve.

From the perspective of the firm, the MRPL is the **marginal benefit** to the firm of hiring an additional unit of labor. We know that a profit-maximizing firm will increase its factors of production until their marginal benefit is equal to the marginal cost. Therefore, firms will continue to add labor (hire workers) until the MRPL equals the wage rate. Thus, workers earn a wage equal to the marginal revenue product of their labor. For example, in a perfectly competitive market, an employee who earns $20/hour has a marginal productivity that is worth exactly $20.

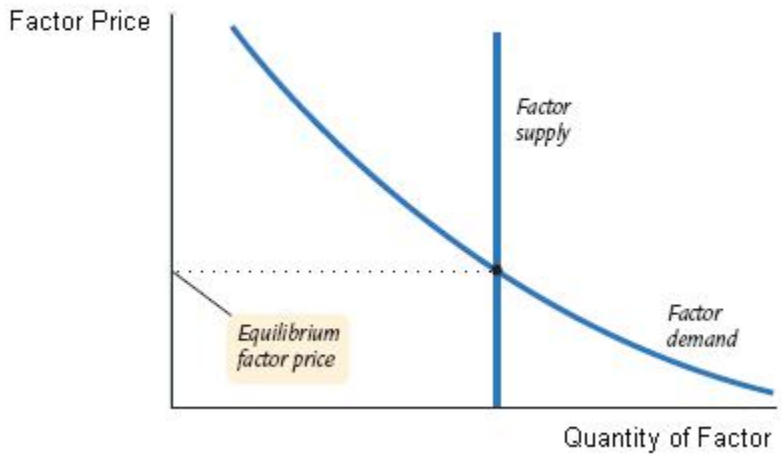

Figure 4.2g. Marginal Product and Wages: The graph shows that a factor of production – in our case, labor – has a fixed supply in the long run, so the wage rate is determined by the factor demand curve – in our case, the marginal revenue product of labor. The intersection of vertical supply and the downward sloping demand gives the wage rate. Factor Compensation (https://en.wikipedia.org/wiki/File:Factor_compensation.jpg) by HpSSE under CC BY-SA 3.0.

Changes in Equilibrium for Shifts in Market Supply and Market Demand

A shift in the supply or demand of labor will cause a change in the market equilibrium.

As in all competitive markets, the equilibrium price and quantity of labor is determined by supply and demand.

Labor Supply

Labour supply curves are derived from the 'labor-leisure' trade-off. More hours worked earn higher incomes but necessitate a cut in the amount of other things workers enjoy such as going to movies, hanging out with friends, or sleeping. The **opportunity cost** of working is leisure time and vis versa. Considering this tradeoff, workers collectively offer a set of labor to the market which economists call the supply of labor.

To see how changes in wages affect the supply of labor, suppose wages rise. This increases the cost of leisure and causes the supply of labor to rise – this is the *substitution effect*, which states that as the relative price of

one good increases, consumption of that good will decrease. However, there is also an *income effect* – an increased wage means higher income, and since leisure is a **normal good**, the quantity of leisure demanded will go up. In general, at low wage levels the substitution effect dominates the income effect and higher wages cause an increase in the supply of labor. At high incomes, however, the negative income effect could offset the positive substitution effect and higher wage levels could actually cause labor to decrease. A worker making $800/hour who receives a raise to $1200/hour may not have much use for the extra money and may choose to work less while maintaining the same standard of living, for example. This creates a supply curve that bends backwards, initially increasing with the wage rate but later decreasing.

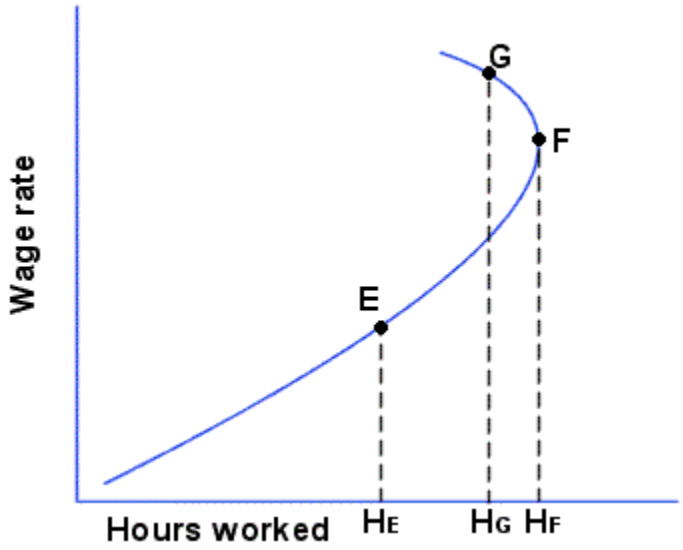

Figure 4.2h. Backward Bending Supply: While normally hours of labor supplied will increase with the wage rate, the income effect may produce the opposite effect at high wage levels. Graph (https://commons.wikimedia.org/wiki/File:Labour_supply_small.png) by Maksim licensed under CC BY-SA 3.0.

Figure 4.2h. Backward Bending Supply (Text Version)

The vertical axis is wage rate and horizontal axis is hours worked (H). The labour supply curve slopes upwards from left to right and curves backward. Three points occur progressively along the supply curve: Point E at H_E occurs on the the upward trend of the curve, furthest to the left along the horizontal axis ; Point F at H_F occurs next along the supply curve line in the bend, furthest to the right along the horizontal axis; and Point G at H_G occurs last along the supply curve line where the line has bent backwards, occurs between point H_E and H_F along the horizontal axis.

Backward Bending Supply: While normally hours of labor supplied will increase with the wage rate, the income effect may produce the opposite effect at high wage levels.

People supply labor in order to increase their utility —just as they demand goods and services in order to increase their utility. The supply curve for labor will shift in response to changes in the same factors that shift demand for goods and services. These include changes in preferences, changes in income, changes in population, and changes in expectations. A change in preferences that causes people to prefer more leisure, for example, will shift the supply curve to the left, creating a lower level of employment and a higher wage rate.

Labor Demand

An increase in the demand for labor will increase both the level of employment and the wage rate. We have already seen that the demand for labor is based on the marginal product of labor and the price of output. Thus, any factor that affects productivity or output prices will also shift labor demand. Some of these factors include:

- Available technology (marginal productivity of labor)
- The skills or education of the workforce (marginal productivity of labor)
- Level of physical capital (marginal productivity of labor)
- Price of physical capital (price of output)
- Price of substitute or complement goods (price of output)
- Consumer preferences (price of output)

All of the above may cause the demand for labor to shift and change the equilibrium quantity and price of labor.

Labor Union Impacts on Equilibrium

Unions are organizations of workers that seek to improve working conditions and raise the equilibrium wage rate.

A labor union is an organization of workers who have banded together to achieve common goals. The primary activity of the union is to bargain with the employer on behalf of union members and negotiate labor contracts. The most common purpose of associations or unions is maintaining or improving the conditions of employment, which may include the negotiation of wages, work rules, complaint procedures, promotions, benefits, workplace safety, and policies.

In order to achieve these goals unions engage in **collective bargaining:** the process of negotiation between a

company's management and a labor union. When collective bargaining fails, union members may go on **strike**, refusing to work until a firm addresses the workers' grievances.

Union Impacts on Equilibrium

Fundamentally, unions seek higher wages for its member workers (though, here "wages" encompasses all types of compensation, not just cash paid to the workers by the employer).

The effect of unions on the labor market equilibrium can be analyzed like any other price increase. If employers (those who demand labor) have an inelastic demand for labor, the increase in wages (the price of labor) will not translate into a drop in employment (quantity of labor supplied). If, however, their demand is elastic, employers will simply respond to union demands for higher wages by hiring fewer workers.

However, the reality of unions is more complex. As an organized body, unions are also active in the political realm. They can lobby for legislation that will affect the market not only for labor, but also for the goods they produce. For example, unions may advocate for trade restrictions to protect the markets in which they work from foreign competition. By preventing domestic firms from having to compete with unrestricted foreign firms, they can ensure that consumers do not have lower cost alternatives which would drive employers who pay a higher union wage out of business.

Figure 4.2i. Union Members Strike: One tool that unions may use to raise wages is to go on strike. Union strike rally Oxford 2006. Photo (https://en.wikipedia.org/wiki/File:UnisonStrikeRallyOxford20060328_KaihsuTai.jpg) by Kaihsu licensed under CC BY-SA 3.0.

Key Points

- Firms will hire more labor when the marginal revenue product of labor is greater than the wage rate, and stop hiring as soon as the two values are equal.
- The point at which the MRPL equals the prevailing wage rate is the labor market equilibrium.
- The marginal decision rule says that a firm will shift spending among factors of production as long as the marginal benefit of such a shift exceeds the marginal cost.
- If the marginal benefit of additional labor, MPL/PL, exceeds the marginal cost, MPK/PK, then the firm will be better off by spending more on labor and less on capital.
- According to the marginal decision rule, equilibrium in the labor market must occur where MPL/PL=MPK/PK.
- An increase in demand or a reduction in supply will raise wages; an increase in supply or a

reduction in demand will lower them.

- The demand curve depends on the marginal product of labor and the price of the good labor produces. If the demand curve shifts to the right, either because productivity or the price of output has increased, wages will be pushed up.
- In the long run the supply of labor is simply a function of the population size, but in the short run it depends on variables such as worker preferences, the skills and training a job requires, and wages available in alternative occupations.
- Although basic economic theory suggests that there ought to be one prevailing wage rate for all labor, this is not the case.
- Wage differences are called compensation differentials and can be explained by many factors, such as differences in the skills of the workers, the country or geographical area in which jobs are performed, or the characteristics of the jobs themselves.
- One common source of differences in wage rates is human capital. More skilled and educated workers tend to have higher wages because their marginal product of labor tends to be higher.
- If a certain area is a desirable place to live, the supply of labor will be higher than in other areas and wages will be lower. This is a type of geographical differential.
- Discrimination against gender or racial groups can cause compensation differentials.
- A compensating differential is the additional amount of income that a given worker must be offered in order to motivate them to accept a given undesirable job, relative to other jobs that worker could perform.
- According to economic theory, workers' wages are equal to the marginal revenue product of their labor. If one employee is very productive he or she will have a high marginal revenue product.
- In reality, wages are determined not only by one's productivity, but also by seniority, networking, ambition, and luck.
- Some of the disconnect between performance and pay can be addressed with alternate pay schemes.
- In the long run the supply of labor is a simple function of the size of the population, so in order to understand changes in wage rates we focus on the demand for labor.
- The marginal product of labor (MPL) is the increase in output that a firm experiences from adding one additional unit of labor.
- The marginal benefit to the firm of hiring an additional unit of labor is called the marginal revenue product of labor (MRPL). It is calculated by multiplying MPL by the price of the output.

- The MRPL represents the firm's demand curve for labor, which means that the firm will continue to hire more labor until the MRPL is equal to the wage rate.
- The opportunity cost of leisure is the wages lost while not working; as wages rise, the cost of leisure increases.
- The substitution effect means that when wages rise, people are likely to substitute more labor for less leisure.
- However, the income effect means that as people become wealthier, their demand for normal goods such as leisure increases.
- Typically the substitution effect dominates the supply of labor at normal wage rates, but the income effect may come to dominate at higher wage rates. This creates a backward bending labor supply curve.
- The supply curve for labor will shift in response to changes in preferences, changes in income, changes in population, and changes in expectations.
- The demand curve for labor will shift in response to changes in human capital, changes in technology, changes in the price of complements or substitutes for output, and changes in consumer preferences.
- Unions ' primary work involves negotiating wages, work rules, complaint procedures, promotions, benefits, workplace safety and policies with company management.
- If the labor market is a competitive one in which wages are determined by demand and supply, increasing the wage requires either increasing the demand for labor or reducing the supply.
- Increasing demand for labor requires increasing the marginal product of labor or raising the price of the good produced by labor.
- Unions can restrict the supply of labor in two ways: slowing the growth of the labor force and promoting policies that make it difficult for workers to enter a particular craft.

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4.3 - LABOUR-LEISURE CHOICES

Learning Objectives

- Interpret labour-leisure budget constraint graphs
- Predict consumer choices based on wages and other compensation
- Explain the backward-bending supply curve of labour

People do not obtain **utility** just from products they purchase. They also obtain utility from leisure time. Leisure time is time not spent at work. The decision-making process of a utility-maximizing household applies to what quantity of hours to work in much the same way that it applies to purchases of goods and services. Choices made along the **labour-leisure budget constraint**, as wages shift, provide the logical underpinning for the labour **supply curve**. The discussion also offers some insights about the range of possible reactions when people receive higher wages, and specifically about the claim that if people are paid higher wages, they will work a greater quantity of hours—assuming that they have a say in the matter.

According to the Bureau of Labor Statistics, U.S. workers averaged 38.6 hours per week on the job in 2014. This average includes part-time workers; for full-time workers only, the average was 42.5 hours per week. Table 6.4.1 shows that more than half of all workers are on the job 35 to 48 hours per week, but significant proportions work more or less than this amount.

Table 4.3a breaks down the average hourly compensation received by private industry workers, including wages and benefits. Wages and salaries are about three-quarters of total compensation received by workers; the rest is in the form of health insurance, vacation pay, and other benefits. The compensation workers receive differs for many reasons, including experience, education, skill, talent, membership in a laboir union, and the presence of discrimination against certain groups in the labour market.

Table 4.3a Persons at Work, by Average Hours Worked per Week in 2013 (Total number of workers: 137.7 million)(Source: U.S. Bureau of Labor Statistics, 2022a)

Hours Worked per Week	Number of Workers	Percentage of Workforce
1–14 hours	6.9 million	5.0%
15–34 hours	27.6 million	20.1%
35–40 hours	68.5 million	49.9%
41–48 hours	11.9 million	8.6%
49–59 hours	13.3 million	9.6%
60 hours and over	9.3 million	6.8%

Table 4.3b Hourly Compensation: Wages, Benefits, and Taxes in 2014 (Source: U.S. Bureau of Labor Statistics, (https://www.bls.gov/news.release/pdf/ecec.pdf) 2022b)

Compensation, Wage, Salary, and Benefits	**$30.92 per hour**
Wages and Salaries	**$20.92**
Benefits	
Vacation	$2.09
Supplemental Pay	$0.84
Insurance	$2.15
Health Benefits	$2.36
Retirement and Savings	$1.24
Defined Benefit	$0.57
Defined Contribution	$0.064
Legally Required	$2.46

The Labour-Leisure Budget Constraint

How do workers make decisions about the number of hours to work? Again, let's proceed with a concrete example. The economic logic is precisely the same as in the case of a **consumption choice budget constraint**, but the labels are different on a labour-leisure budget constraint.

Vivian has 70 hours per week that she could devote either to work or to leisure, and her wage is $10/hour. The lower budget constraint in Figure 4.3a shows Vivian's possible choices. The horizontal axis of this diagram measures both leisure and labour, by showing how Vivian's time is divided between leisure and labour. Hours of leisure are measured from left to right on the horizontal axis, while hours of labour are measured from right to left. Vivian will compare choices along this budget constraint, ranging from 70 hours of leisure and no **income** at point S to zero hours of leisure and $700 of income at point L. She will choose the point that provides her with the highest **total utility**. For this example, let's assume that Vivian's utility-maximizing choice occurs at Point O, with 30 hours of leisure, 40 hours of work, and $400 in weekly income.

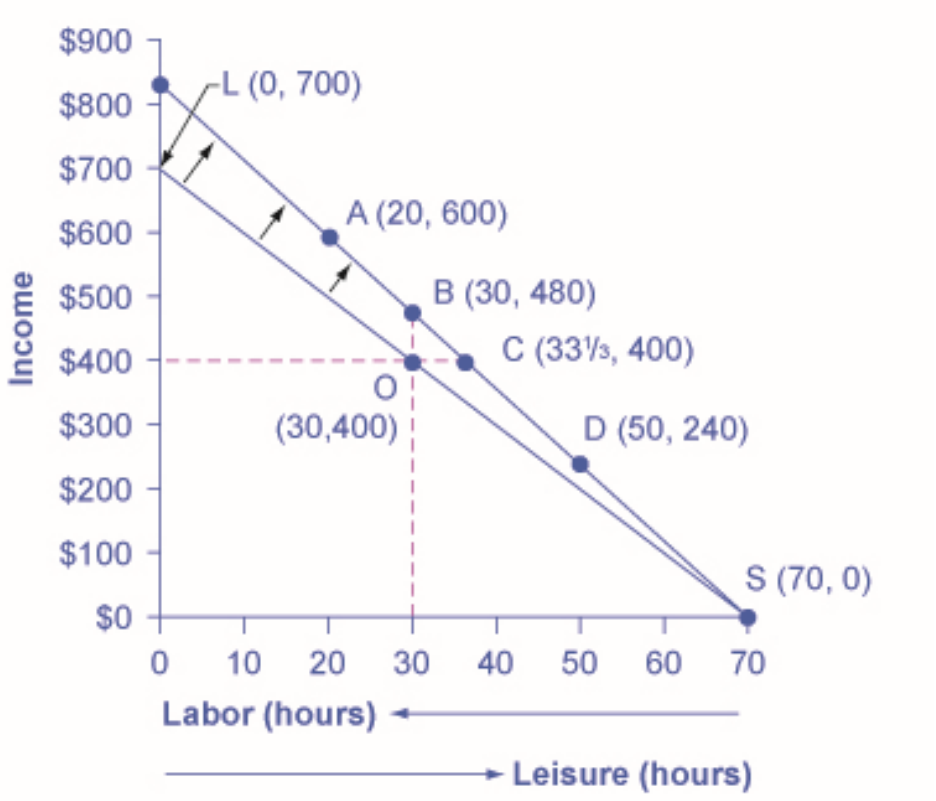

Figure 4.3a How a Rise in Wages Alters the Utility-Maximizing Choice.
How a Rise in Wages Alters the Utility-Maximizing Choice by OpenStax, licensed under CC BY 4.0.

Figure 4.3a, How a Rise in Wages Alters the Utility-Maximizing Choice, shows Vivian's original choice is Point O on the lower **opportunity set**. A rise in her wage causes her opportunity set to swing upward. In response to the increase in wages, Vivian can make a range of different choices available to her: a choice like Point D, which involves less work; and a choice like Point B, which involves the same amount of work but more income; or a choice like Point A, which involves more work and considerably more income. Vivian's personal preferences will determine which choice she makes.

For Vivian to discover the labour-leisure choice that will maximize her utility, she does not have to place numerical values on the total and marginal utility that she would receive from every level of income and leisure. All that really matters is that Vivian can compare, in her own mind, whether she would prefer more leisure or more income, given the tradeoffs she faces. If Vivian can say to herself: "*I'd really rather work a little less and have more leisure, even if it means less income,*" or "*I'd be willing to work more hours to make some extra income,*" then as she gradually moves in the direction of her preferences, she will seek out the utility-maximizing choice on her labour-leisure budget constraint.

Now imagine that Vivian's wage level increases to $12/hour. A higher wage will mean a new budget constraint that tilts up more steeply; conversely, a lower wage would have led to a new budget constraint that

was flatter. How will a change in the wage and the corresponding shift in the budget constraint affect Vivian's decisions about how many hours to work?

Vivian's choices of quantity of hours to work and income along her new budget constraint can be divided into several categories, using the dashed horizontal and vertical lines in Figure 4.3a that go through her original choice (Point O). One set of choices in the upper-left portion of the new budget constraint involves more hours of work (that is, less leisure) and more income, at a point like A with 20 hours of leisure, 50 hours of work, and $600 of income (that is, 50 hours of work multiplied by the new wage of $12 per hour). A second choice would be to work exactly the same 40 hours, and to take the benefits of the higher wage in the form of income that would now be $480, at choice Point B. A third choice would involve more leisure and the same income at point C (that is, $33 - 1/3$) hours of work multiplied by the new wage of $12per hour equals $400 of total income). A fourth choice would involve less income and much more leisure at a point like Point D, with a choice like 50 hours of leisure, 20 hours of work, and $240 in income.

In effect, Vivian can choose whether to receive the benefits of her wage increase in the form of more income, or more leisure, or some mixture of these two. With this range of possibilities, it would be unwise to assume that Vivian (or anyone else) will necessarily react to a wage increase by working substantially more hours. Maybe they will; maybe they will not.

Applications of Utility Maximizing with the Labour-Leisure Budget Constraint

The theoretical insight that higher wages will sometimes cause an increase in hours worked, sometimes cause hours worked not to change by much, and sometimes cause hours worked to decline, has led to labour supply curves that look like the one in Figure 4.3b. The bottom-left portion of the labour supply curve slopes upward, which reflects the situation of a person who reacts to a higher wage by supplying a greater quantity of labour. The middle, close-to-vertical portion of the labour supply curve reflects the situation of a person who reacts to a higher wage by supplying about the same quantity of labour. The very top portion of the labour supply curve is called a **backward-bending supply curve for labour**, which is the situation of high-wage people who can earn so much that they respond to a still-higher wage by working fewer hours. Read the following Clear It Up feature for more on the number of hours the average person works each year.

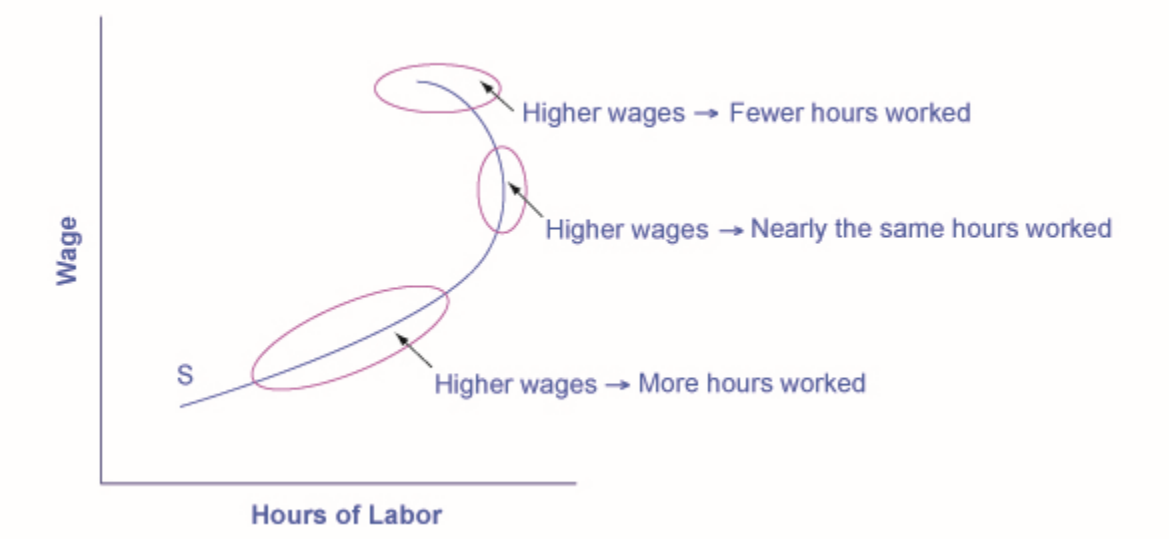

Figure 4.3b. A Backward-Bending Supply Curve of Labour. A Backward-Bending Supply Curve of Labour by OpenStax, licensed under CC BY 4.0.

Figure 4.3b. A Backward-Bending Supply Curve of Labour has the vertical axis is wage and horizontal axis is hours of labour. The bottom upward-sloping portion of the labour supply curve shows that as wages increase over this range, the quantity of hours worked also increases. The middle, nearly vertical portion of the labour supply curve shows that as wages increase over this range, the quantity of hours worked changes very little. The backward-bending portion of the labour supply curve at the top shows that as wages increase over this range, the quantity of hours worked actually decreases. All three of these possibilities can be derived from how a change in wages causes movement in the labour-leisure budget constraint, and thus different choices by individuals.

Example 6.4.1: Is America a nation of workaholics?

Americans work a lot. Table 4.3c shows average hours worked per year in the United States, Canada, Japan, and several European countries, with data from 2013. To get a perspective on these numbers, someone who works 40 hours per week for 50 weeks per year, with two weeks off, would work 2,000 hours per year. The gap in hours worked is a little astonishing; the 250 to 300 hour gap between how much Americans work and how much Germans or the French work amounts to roughly six to seven weeks less of work per year. Economists who study these international patterns debate the extent to which average Americans and Japanese have a preference for working more than, say, Germans, or whether German workers and employers face particular kinds of taxes and regulations that lead to fewer hours worked. Many countries have laws that regulate the work week and dictate holidays and the standards of "normal" vacation time vary from country to country. It is also

interesting to take the amount of time spent working in context; it is estimated that in the late nineteenth century in the United States, the average work week was over 60 hours per week—leaving little to no time for leisure.

Table 4.3c: Average Hours Worked Per Year in Select Countries(Source: Organization For Economic Co-Operation And Development [OECD], n.d.)

Country	Average Annual Hours Actually Worked per Employed Person
United States	1,824
Spain	1,799
Japan	1,759
Canada	1,751
United Kingdom	1,669
Sweden	1,585
Germany	1,443
France	1,441

The different responses to a rise in wages—more hours worked, the same hours worked, or fewer hours worked—are patterns exhibited by different groups of workers in the U.S. economy. Many full-time workers have jobs where the number of hours is held relatively fixed, partly by their own choice and partly by their employer's practices. These workers do not much change their hours worked as wages rise or fall, so their supply curve of labour is inelastic. However, part-time workers and younger workers tend to be more flexible in their hours, and more ready to increase hours worked when wages are high or cut back when wages fall.

The **backward-bending supply curve for labour**, when workers react to higher wages by working fewer hours and having more income, is not observed often in the short run. However, some well-paid professionals, like dentists or accountants, may react to higher wages by choosing to limit the number of hours, perhaps by taking especially long vacations, or taking every other Friday off. Over a long-term perspective, the backward-bending supply curve for labour is common. Over the last century, Americans have reacted to gradually rising wages by working fewer hours; for example, the length of the average work-week has fallen from about 60 hours per week in 1900 to the present average of less than 40 hours per week.

Recognizing that workers have a range of possible reactions to a change in wages casts some fresh insight on a perennial political debate: the claim that a reduction in income taxes—which would, in effect, allow people to

earn more per hour—will encourage people to work more. The leisure-income budget set points out that this connection will not hold true for all workers. Some people, especially part-timers, may react to higher wages by working more. Many will work the same number of hours. Some people, especially those whose incomes are already high, may react to the tax cut by working fewer hours. Of course, cutting taxes may be a good or a bad idea for a variety of reasons, not just because of its impact on work incentives, but the specific claim that tax cuts will lead people to work more hours is only likely to hold for specific groups of workers and will depend on how and for whom taxes are cut.

Key Concepts and Summary

When making a choice along the labour-leisure budget constraint, a household will choose the combination of labour, leisure, and income that provides the most utility. The result of a change in wage levels can be higher work hours, the same work hours, or lower work hours.

Attribution

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4.4 - LABOUR AND FINANCIAL MARKETS

Learning Objectives

- Describe how the theories of supply & demand can be applied to labor markets and financial markets
- Use the four-step process to predict how economic conditions cause a change in supply, demand, and equilibrium

The theories of supply and demand do not apply just to markets for goods. They apply to any market, even markets for labor and financial services. **Labour markets** are markets for employees or jobs. **Financial markets** are markets for saving or borrowing.

When we think about demand and supply curves in goods and services markets, it is easy to picture who the demanders and suppliers are: businesses produce the products and households buy them. Who are the demanders and suppliers in labor and financial service markets? In labor markets job seekers (individuals) are the suppliers of labor, while firms and other employers who hire labor are the demanders for labor. For example, the grocery store needs workers, or in other words, has a demand for labor. That labor is supplied by grocery workers. In financial markets, any individual or firm who saves contributes to the supply of money, and any who borrows (person, firm, or government) contributes to the demand for money.

As a college student, you most likely participate in both labor and financial markets. Employment is a fact of life for most college students: in 2011, according to the BLS, 52% of undergraduates worked part time and another 20% worked full time. Most college students are also heavily involved in financial markets, primarily as borrowers. Among full-time students, about half take out a loan to help finance their education each year, and those loans average about $6,000 per year. Many students also borrow for other expenses, like purchasing a car. We can analyze labor markets and financial markets with the same tools we use to analyze demand and supply in the goods markets. Let's take a look at a few examples.

Supply and Demand in Labor Markets

Economic events can change the equilibrium salary (or wage) and quantity of labor. Consider how the wave of new information technologies, like computer and telecommunications networks, has affected low-skill and high-skill workers in the U.S. economy. From the perspective of employers who demand labor, these new technologies are often a substitute for low-skill laborers like file clerks who used to keep file cabinets full of paper records of transactions. However, the same new technologies are a complement to high-skill workers like managers, who benefit from the technological advances by being able to monitor more information, communicate more easily, and juggle a wider array of responsibilities. So, how will the new technologies affect the wages of high-skill and low-skill workers? For this question, let's again use the four-step process of analyzing how shifts in supply or demand affect a market.

Technology and wage inequality: The four-step process

Step 1. What did the markets for low-skill labor and high-skill labor look like before the arrival of the new technologies?

In Figure 4.4a. (a) and Figure 4.4a. (b), S_0 is the original supply curve for labor and D_0 is the original demand curve for labor in each market. In each graph, the original point of equilibrium, E_0, occurs at the price W_0 and the quantity Q_0.

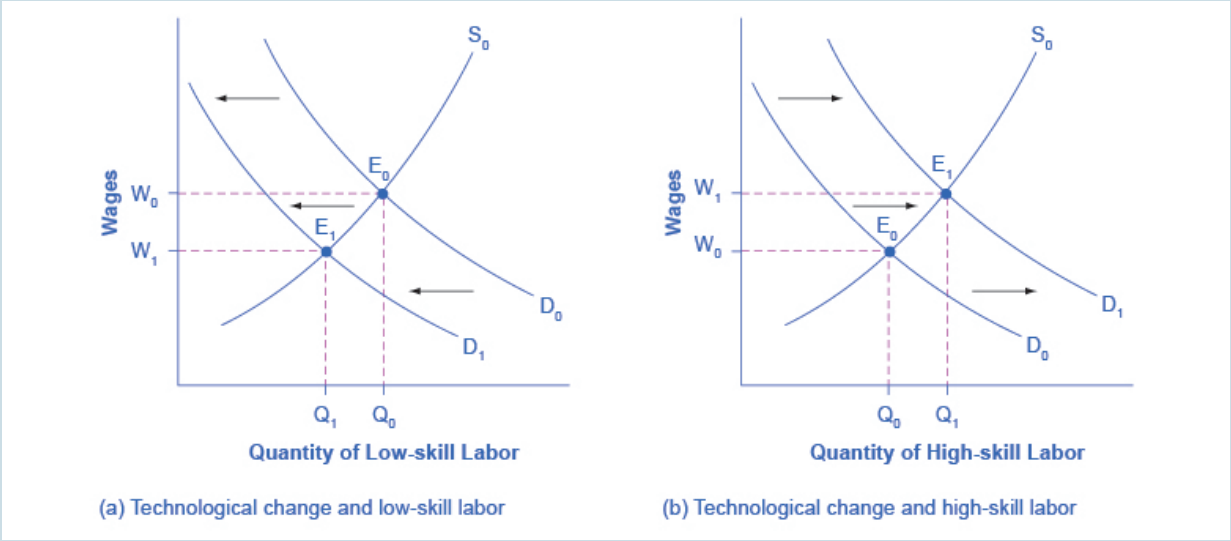

Figure 4.4a. (a) The demand for low-skill labor shifts to the left when technology can do the job previously done by these workers. (b) New technologies can also increase the demand for high-skill labor in fields such as information technology and network administration. Technology and Wages: Applying Demand and Supply by Steven A. Greenlaw & Timothy Taylor (OpenStax), licensed under CC BY.

Figure 4.4a (Text Version)

Figure 4.4a contains two graphs: Graph A – Technological change and low-skill labour, Graph B – Technological change and high-skill labour.

Graph A: The graph has the vertical axis Wages (W) and Quantity of Low-Skill Labour (Q). The original supply curve (S_0) slopes upward from left to right. The original demand Curve (D_0) slopes downward from left to right. S_0 and D_0 intersect at the original equilibrium (E_0) at price W_0 and quantity Q_0 . D_0 shifts to the left and now intersects S_0 at a new equilibrium (E_1) at price W_1 and quantity Q_1.

Graph B: The graph has the vertical axis Wages (W) and Quantity of High-Skill Labour (Q). The original supply curve (S_0) slopes upward from left to right. The original demand Curve (D_0) slopes downward from left to right. S_0 and D_0 intersect at the original equilibrium (E_0) at price W_0 and quantity Q_0 . D_1 shifts to the right and now intersects S_0 at a new equilibrium (E_1) at price W_1 and quantity Q_1.

Step 2. Does the new technology affect the supply of labor from households or the demand for labor from firms?

Step 3. Will the new technology increase or decrease demand?

Step 4. Compare the new equilibrium price and quantity to the original equilibrium price.

Check your answers[1]

So, the demand and supply model predicts that the new computer and communications technologies will raise the pay of high-skill workers but reduce the pay of low-skill workers. Indeed, from the 1970s to the mid-2000s, the wage gap widened between high-skill and low-skill labor. According to the National Center for Education Statistics, in 1980, for example, a college graduate earned about 30% more than a high school graduate with comparable job experience, but by 2012, a college graduate earned about 60% more than an otherwise comparable high school graduate. Many economists believe that the trend toward greater wage inequality across the U.S. economy was primarily caused by the new technologies.

Supply and Demand in Financial Markets

Now let's examine how the theories of supply and demand also affect financial markets. Imagine that the U.S. economy became viewed as a less desirable place for foreign investors to put their money because of fears about the growth of the U.S. public debt. Using the four-step process for analyzing how changes in supply and demand affect equilibrium outcomes, how would increased U.S. public debt affect the equilibrium price and quantity for capital in U.S. financial markets?

The effect of growing U.S. debt: The four-step process

Step 1. Draw a diagram showing demand and supply for financial capital that represents the original scenario in which foreign investors are pouring money into the U.S. economy.

1. **Step 2 Answer:** The technology change described here affects demand for labor by firms that hire workers. **Step 3 Answer:** Based on the description earlier, as the substitute for low-skill labor becomes available, demand for low-skill labor will shift to the left, from D_0 to D_1. As the technology complement for high-skill labor becomes cheaper, demand for high-skill labor will shift to the right, from D_0 to D1. **Step 4 Answer:** The new equilibrium for low-skill labor, shown as point E_1 with price W_1 and quantity Q_1, has a lower wage and quantity hired than the original equilibrium, E_0. The new equilibrium for high-skill labor, shown as point E_1 with price W_1 and quantity Q_1, has a higher wage and quantity hired than the original equilibrium (E0).

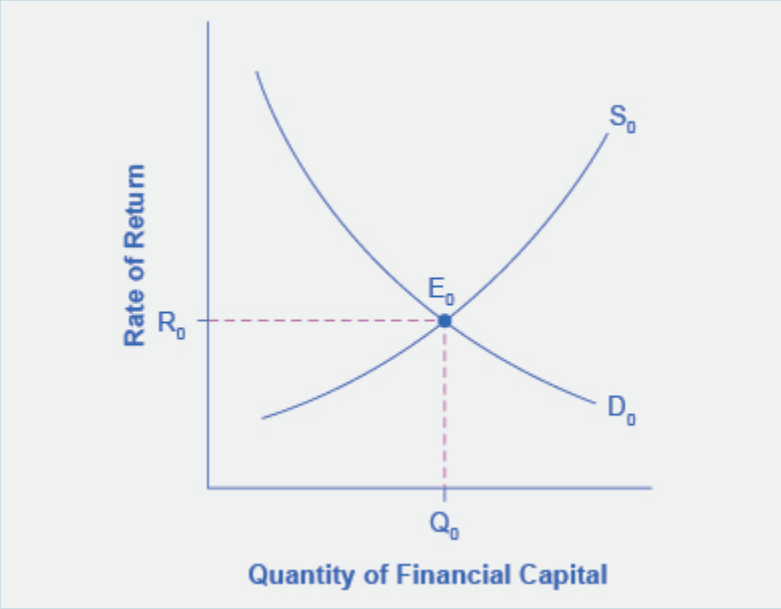

Figure 4.4b The United States as a Global Borrower Before U.S. Debt Uncertainty by Steven A. Greenlaw & Timothy Taylor (OpenStax), licensed under CC BY.

Figure 4.4b (Text Version)

The graph has a vertical axis is rate of return (R) and a horizontal axis Quantity if financial capital (Q). The demand curve (D_0) slopes downward from left to right and the supply curve (S_0) slopes upward from left to right. The original equilibrium E_0 occurs where S_0 and D_0 intersect at interest rate R_0 and quantity of financial investment Q_0.

Figure 4.4b : Figure 4.4b shows a demand curve, D_0, and a supply curve, S_0, where the supply of capital includes the funds arriving from foreign investors. The original equilibrium E_0 occurs at interest rate R_0 and quantity of financial investment Q_0.The graph shows the demand for financial capital and supply of financial capital into the U.S. financial markets by the foreign sector before the increase in uncertainty regarding U.S. public debt. The original equilibrium (E_0) occurs at an equilibrium rate of return (R_0) and the equilibrium quantity is at Q_0.

Step 2. Will the diminished confidence in the U.S. economy as a place to invest affect demand or supply of financial capital?

Step 3. Will supply increase or decrease? When the enthusiasm of foreign investors' for investing their money in the U.S. economy diminishes, the supply of financial capital shifts to the left. Figure 4.4c shows the supply curve shift from S_0 to S1.

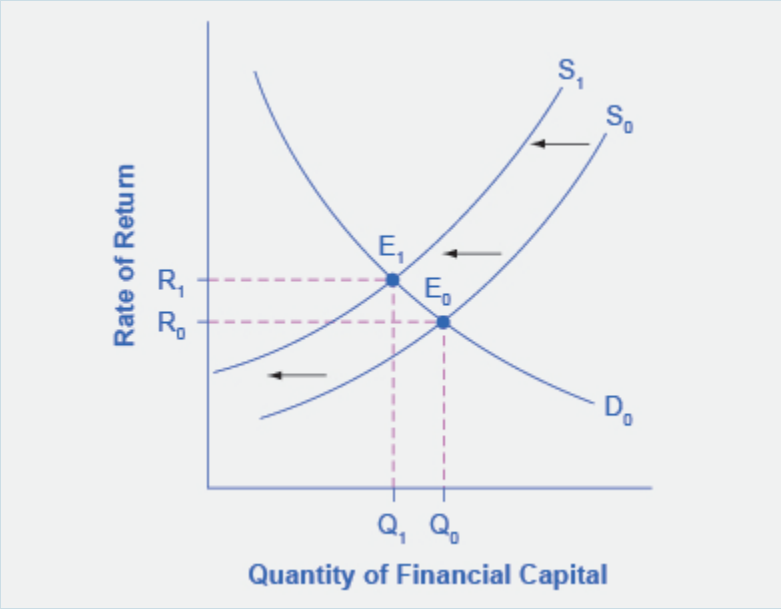

Figure 4.4c The United States as a Global Borrower Before and After U.S. Debt Uncertainty by Steven A. Greenlaw & Timothy Taylor (OpenStax), licensed under CC BY.

Figure 4.4c (Text Version)

Figure 4.4c uses Figure 2 as a base. The graph has a vertical axis is rate of return (R) and a horizontal axis Quantity if financial capital (Q). The original demand curve (D_0) slopes downward from left to right and the original supply curve (S_0) slopes upward from left to right. The original equilibrium E_0 occurs where S_0 and D_0 intersect at interest rate R_0 and quantity of financial investment Q_0. The supply curve shift from S_0 to the left to S_1. The original demand curve (D_0) now intersects with the new supply curve (S_1) at the new equilibrium E_1 interest rate R_1 and quantity of financial investment Q_1.

Figure 4.4c. The graph shows the demand for financial capital and supply of financial capital into the U.S. financial markets by the foreign sector before and after the increase in uncertainty regarding U.S. public debt. The original equilibrium (E_0) occurs at an equilibrium rate of return (R_0) and the equilibrium quantity is at Q_0.

Step 4. Compare the new equilibrium price and quantity to the original equilibrium price.

Check your answer[2]

2. **Step 2 Answer:** Yes, it will affect supply. Many foreign investors look to the U.S. financial markets to store their money in safe financial vehicles with low risk and stable returns. As the U.S. debt increases, debt servicing will increase—that is, more current income will be used to pay the

In a modern, developed economy, financial capital often moves invisibly through electronic transfers between one bank account and another. Yet these flows of funds can be analyzed with the same tools of demand and supply as markets for goods or labor.

Try It

An interactive H5P element has been excluded from this version of the text. You can view it online here: https://ecampusontario.pressbooks.pub/laboureconomics/?p=650#h5p-2

Try It – Text version

1. After hurricane Harvey hit Texas and flooded thousands of homes, there was a critical need for cleaning, repair and rebuilding. In the labor market for home repair, the demand would be represented by:
    a. construction and home repair firms, while the supply would be represented by the construction workers
    b. construction workers looking for work and the supply would be represented by the construction firms providing jobs.
    c. homeowners wanting home repair and the supply would be represented by construction and home repair firms.
2. After hurricane Harvey, you would expect the wages for home repair workers to:
    a. decrease as more workers enter the market.

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interest rate on past debt. Increasing U.S. debt also means that businesses may have to pay higher interest rates to borrow money, because business is now competing with the government for financial resources. **Step 4 Answer**: The economy has experienced an enormous inflow of foreign capital. According to the U.S. Bureau of Economic Analysis, by the third quarter of 2014, U.S. investors had accumulated $24.6 trillion of foreign assets, but foreign investors owned a total of $30.8 trillion of U.S. assets. If foreign investors were to pull their money out of the U.S. economy and invest elsewhere in the world, the result could be a significantly lower quantity of financial investment in the United States, available only at a higher interest rate. This reduced inflow of foreign financial investment could impose hardship on U.S. consumers and firms interested in borrowing.

b. increase as the supply of home repair workers decreases.
c. increase as the demand for home repair workers increases.

Check your Answers: [3]

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3. 1. (a) In labor markets, firms represent the demand for labor and the workers make up the supply for labor. 2. (c) As a large number of additional homeowners demand home repair, the demand for the service and the labor needed for home repair increases and therefore the wages of that labor also increases.

4.5 - PUTTING IT TOGETHER: APPLICATIONS OF SUPPLY AND DEMAND

This module showed that the theories of supply and demand can be applied to a variety of real world issues. Market outcomes can be evaluated based on the amount of net value created for society, which can be measured by consumer, producer and social surplus. Price ceilings and price floors result in deadweight loss–the loss of economic value caused by operating at an inefficient quantity of output.

Let's return to the example of the minimum wage. Careful analysis shows that imposition of, or increases in the minimum wage have significant distributional effects. In other words, there are winners and losers from the policy. The winners are workers who continue to have a job, but are now paid a higher salary. The losers are businesses who have to pay more for their employees. This increase in production costs will be passed on, in part to consumers who will end up paying higher prices for the businesses' products. So consumers lose also. The big losers, though, are the people who had jobs at the lower wage, but lose them when the minimum wage is increased. Which employees are most likely to lose their jobs, the most experienced and skilled, or the least experienced and skilled? Don't forget that ultimately what matters is the size of these effects. These are the technical details that policy analysts will look at before making any recommendations to decision makers.

Consider Groupon, a website which offers significant discounts on purchases at businesses people frequently use. It's not unusual to obtain 50% off the normal price. Why do customers like Groupon? Because it increases the consumer surplus they obtain on purchases.

Figure 4.5a. Image (https://www.flickr.com/photos/jeepersmedia/16163681065) by Mike Mozart, licensed under CC BY 2.0.

Why do businesses offer Groupon campaigns? Part of it is advertising, to attract customers who aren't familiar with those businesses. Some businesses offer regular Groupon deals. They must be doing this to increase their producer surplus (i.e., profit). This is likely part of a larger strategy, called *price discrimination,* which you will learn more about when you study the theory of the firm. For now, it is enough to understand that Groupon campaigns enhance producer surplus.

Since both consumer surplus and producer surplus increase, we can say that total economic (or social) surplus has increased. This is just another way of saying that transactions benefit both parties, or as economists would say, this is a more efficient outcome for society. Computing the additional consumer and producer surplus tells us by how much economic surplus has increased.

Attribution

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4.6 - LABOUR MARKETS

Learning Objectives

- Describe labour markets; explain why the value of the marginal product of labour is the demand for labour

What is the labour market?

The labour market is the term that economists use for all the different markets for labour. There is no single labour market. Rather, there is a different market for every different type of labour. Labour differs by type of work (e.g. retail sales vs. scientist), skill level (entry level or more experienced), and geographic location (the market for administrative assistants is probably more local or regional than the market for university presidents). While each labour market is different, they all tend to respond to similar disturbances in similar ways. For example, when wages go up for one type of job in an industry, they tend to go up in other types of jobs too. When economists talk about the labour market, they are describing these similarities.

The labour market, like all markets, has a demand and a supply. Why do firms demand labour? Why is an employer willing to pay you for your work? It's not because the employer likes you or is socially conscious. Rather, it's because your labour is worth something to the employer–your work brings in revenues to the

firm. How much is an employer willing to pay? That depends on the skills and experience you bring to the firm.

If a firm wants to maximize profits, it will never pay more (in terms of wages and benefits) for a worker than the value of his or her marginal productivity to the firm. We call this the **first rule of labour markets**.

Suppose a worker can produce two widgets per hour and the firm can sell each widget for $4 each. Then the worker is generating $8 per hour in revenues to the firm, and a profit-maximizing employer will pay the worker up to, but no more than, $8 per hour, because that is what the worker is worth to the firm.

Recall the definition of marginal product. Marginal product is the additional output a firm can produce by adding one more worker to the production process. Since employers often hire labour by the hour, we'll define marginal product as the additional output the firm produces by adding one more worker hour to the production process. In this module, we assume that workers are homogeneous—they have the same background, experience and skills and they put in the same amount of effort. Thus, marginal product depends on the capital and technology with which workers have to work.

A typist can type more pages per hour with an electric typewriter than a manual typewriter, and he or she can type even more pages per hour with a personal computer and word processing software. A ditch digger can dig more cubic feet of dirt in an hour with a backhoe than with at shovel.

We can define the demand for labour as the marginal product of labour times the value of that output to the firm.

Table 4.6a. Marginal Product of Labour

# Workers (L)	1	2	3	4
MP_L	4	3	2	1

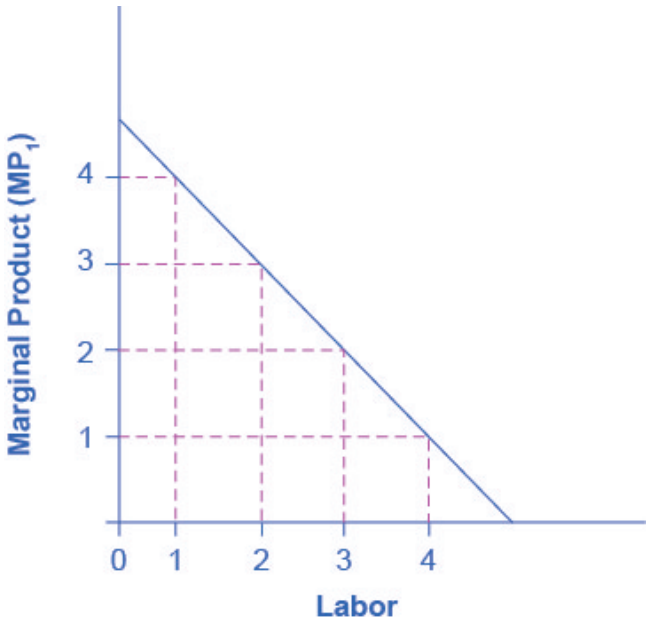

Table 4.6a. Marginal Product of Labour.
Because of fixed capital, the marginal product of labour declines as the employer hires additional workers. Marginal Product of Labor by Steven A. Greenlaw & David Shapiro (OpenStax), licensed under CC BY.

On what does the value of each worker's marginal product depend? If we assume that the employer sells its output in a perfectly competitive market, the value of each worker's output will be the market price of the product. Thus:

$$\text{Demand for Labour} = \text{MP}_L \times \text{P} = \text{Value of the Marginal Product of Labour}.$$

We show this in Table 2, which is an expanded version of Table 1.

Table 4.6b. Value of the Marginal Product of Labour

# Workers (L)	1	2	3	4
MP_L	4	3	2	1
Price of Output	$4	$4	$4	$4
VMP_L	$16	$12	$8	$4

Note that the value of each additional worker is less than the ones who came before.

Thus, the demand for labour (that is, the value of the **marginal product of labour** is downward sloping as the firm hires additional labour.

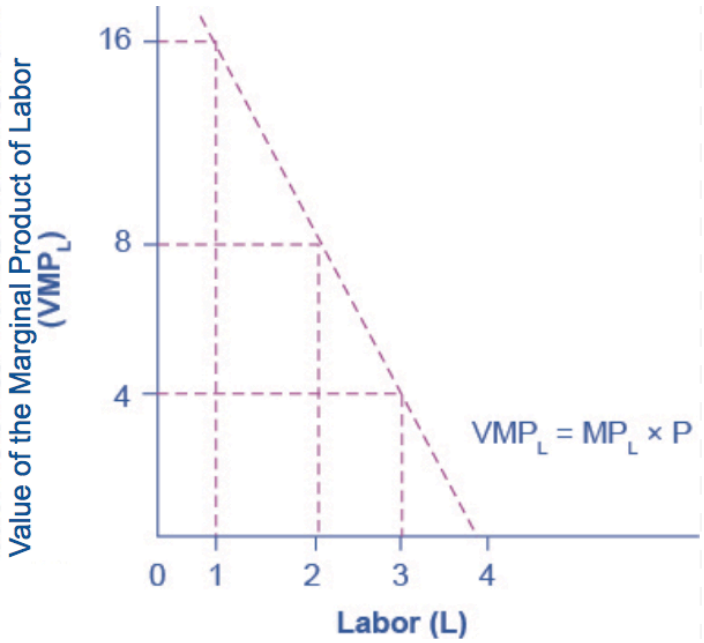

Figure 4.6b. Value of the Marginal Product of Labour. For firms operating in a competitive output market, the value of additional output sold is the price the firms receive for the output. Since MPL declines with additional labour employed, while that marginal product is worth the market price, the value of the marginal product declines as employment increases. Value of the Marginal Product of Labor by Steven A. Greenlaw & David Shapiro (OpenStax), licensed under CC BY.

Watch It

The video *The Marginal Product of Labour* takes us through the example of a restaurant interested in hiring janitors. With clean facilities, a restaurant will make more money, but they must consider the cost of a janitor versus the benefit from their labour. Watch the selected clip from this video to see how this correlates to a supply and demand graph.

Watch The Marginal Product of Labor (https://www.youtube.com/watch?v=G7ai5LAehqg) (10 mins)

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Video Source: Marginal Revolution University. (2015, April 7). *The marginal product of labor [Video]*. YouTube. https://www.youtube.com/watch?v=G7ai5LAehqg. Licensed under CC BY-ND 4.0.

Try It

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Try It – Text Version

1. Which of the following is correct concerning labour markets?
    a. Labour markets lack the supply and demand economic model.
    b. Labour differs by type of work.
    c. There is one type of labour market.
2. The demand for labour is the price of output multiplied by the marginal product of labour which is also the _____.
    a. value of the marginal product of labour
    b. minimum marginal product of labour
    c. maximum marginal product of labour

Check your Answers: [1]

1. **Question 1.** b) For example, retail sales, educators, and scientists. **Question 2.** a) The demand for labour, that is, the value of the marginal product of labour is downward sloping as the firm hires additional labour. For firms operating in a competitive output market, the value of additional output sold is the price the firms receive for the output. Since MPL declines with additional labour employed, while that marginal product is worth the market price, the value of the marginal product declines as employment increases.

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Try it 2 – Text version

1. The table below shows data for the production of Pineapples for an individual firm. Given this data, what is the marginal product of labour when quantity increases from 2 by one unit?

Workers vs Pineapple Production

Number of workers	Number of Pineapples
0	0
1	10
2	18
3	24
4	28
5	30

2. The table below shows data for the production of Bags for an individual firm. Given this data, what is marginal product of labour when quantity increases from 10 by ten units? Hint: Marginal product is the additional output of one more worker. Mathematically, Marginal product is the change in total output divided by the change in labour

Workers vs Bag production

Number of workers	Number of Bags
0	0
10	20
20	36
30	48
40	56
50	60

3. The table below shows data for the production of Jackets for an individual firm operating in a perfectly competitive market. Suppose that the price of Jackets is $3. Given this data, calculate the Marginal Product of Labour (MP_L) and the Value of the Marginal Product of Labour (VMP_L) if the quantity of output was 30 jackets.

Workers vs. Jacket production

Number of workers	Number of Jackets
0	0
10	80
20	144
30	192
40	224
50	240

Hint: Marginal product is the additional output of one more worker. Mathematically, Marginal product is the change in total output divided by the change in labour. $\mathrm{VMP}_L = \mathrm{MP}_L \times \mathrm{P}$

Check your Answers: [2]

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2. **Question 1)** 6. **Question 2)** 1.6 **Question 3)** MPL = 4.8, VMPL=14.4

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4.7 - THE DEMAND FOR LABOUR

Learning Objectives

- Explain and graph the demand for labour in perfectly competitive output markets
- Explain and graph the demand for labour in imperfectly competitive output markets
- Demonstrate how supply and demand interact to determine the market wage rate

Demand for Labour in Perfectly Competitive Output Markets

The question for any firm is how much labour to hire.

We can define a **perfectly competitive labour market** as one where firms can hire all the labour they wish at the going market wage. Think about secretaries in a large city. Employers who need secretaries can probably hire as many as they need if they pay the going wage rate.

Graphically, this means that firms face a horizontal supply curve for labour, as seen in Figure 4.7a Equilibrium Employment for Firms in a Competitive Labour Market.

Given the market wage, profit maximizing firms hire workers up to the point where: $W_{mkt} = VMP_L$

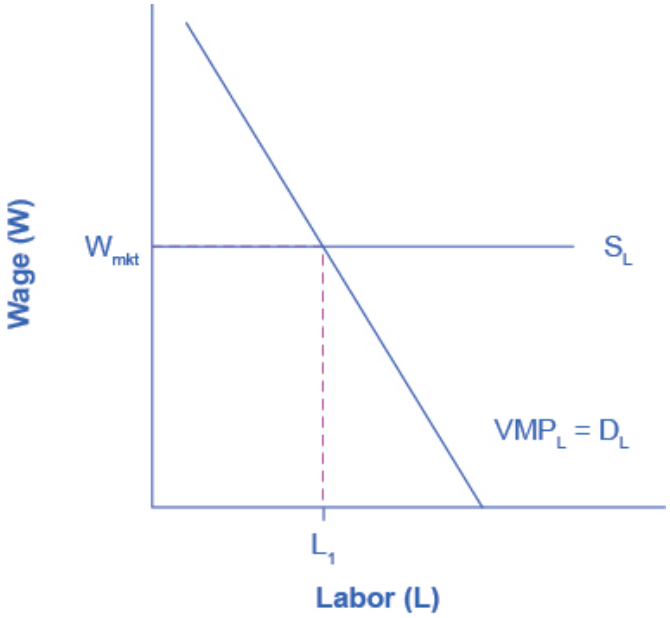

Figure 4.7a Equilibrium Employment for Firms in a Competitive Labour Market. In a perfectly competitive labour market, firms can hire all the labour they want at the going market wage. Therefore, they hire workers up to the point L_1 where the going market wage equals the value of the marginal product of labour. Figure by Steven A. Greenlaw & David Shapiro (OpenStax), licensed under CC BY 4.0.

Figure 4.7a Equilibrium Employment for Firms in a Competitive Labour Market (Text Version)

The graph shows the Marginal Product of Labour. The x-axis is Labour. The y-axis is Wage. The curve proceeds from right to left in a downward direction. A horizontal line (S_L) indicating the going market wage projects from about halfway up the y-axis at point W_{mkt}. Where the curve and the horizontal line meet, it is point L_1. $W_{mkt} = VMP_L$

Derived Demand

Economists describe the demand for inputs like labour as a derived demand. Since the demand for labour is MPL*P, it is dependent on the demand for the product the firm is producing. We show this by the P term in the demand for labour. An increase in demand for the firm's product drives up the product's price, which increases the firm's demand for labour. Thus, we derive the demand for labour from the demand for the firm's output.

Try It

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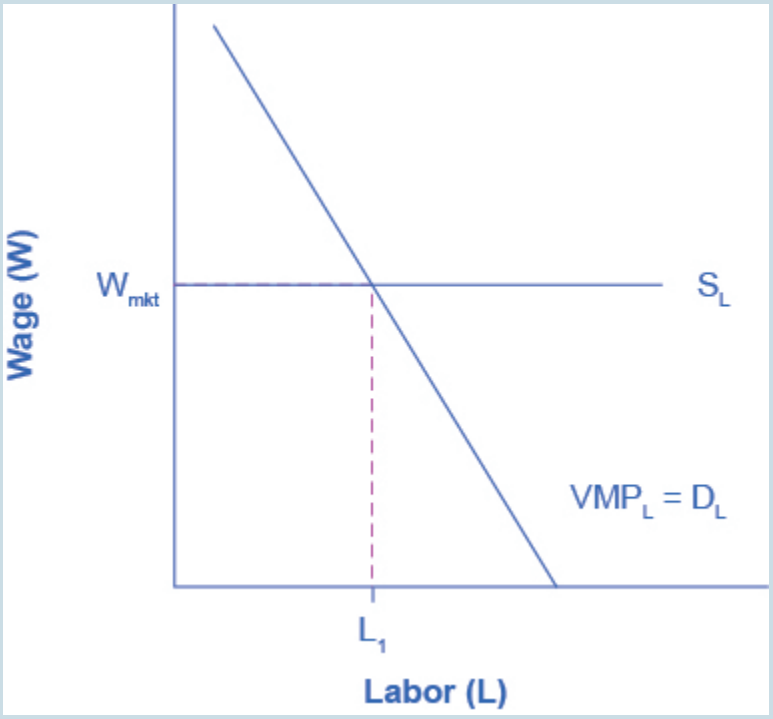

H5P Figure. Image by Steven A. Greenlaw, & David Shapiro (openstax), licensed under CC BY 4.0.

H5P Figure (Text Version)

The graph shows the Marginal Product of Labour. The x-axis is Labour. The y-axis is Wage. The curve proceeds from right to left in a downward direction. A horizontal line (S_L) indicating the going market wage projects from about halfway up the y-axis at point W_{mkt}. Where the curve and the horizontal line meet, it is point L_1. $\mathrm{VMP_L} = \mathrm{D_L}$.

1. Considering the figure above, the demand for labour is considered a(n) _____.

    a. Perfect competitive labour market
    b. Derived demand labour market
    c. Imperfectly competitive labour market

Check your Answers: [1]

Activity source: "The Demand for Labor (https://courses.lumenlearning.com/wm-microeconomics/

1. 1. a) Correct. In a perfectly competitive labour market, firm can hire all the labour they want at the going market wage. Therefore, they hire workers up to the point L1 where the going market wage equals the value of the marginal product of labour.

chapter/the-demand-for-labor/)" In by Lumen Learning, licensed under CC BY. / Converted to H5P and Text.

Demand for Labour in Imperfectly Competitive Output Markets

If an employer does not sell its output in a perfectly competitive industry, it faces a downward sloping demand curve for output. This means that in order to sell additional output the firm must lower its price. This is true if the firm is a monopoly, but it's also true if the firm is an oligopoly or monopolistically competitive. In this situation, the value of an additional unit of output sold is the marginal revenue, rather than the price. This means that a worker's marginal product is valued by the marginal revenue, not the price. Thus, the demand for labour is the marginal product times the marginal revenue, which we call the **marginal revenue product**.$\text{The Demand for Labour} = \text{MP}_\text{L} \times \text{MR} = \text{Marginal Revenue Product}$

Table 4.7a. Marginal Revenue Product of Labour

# Workers (L)	1	2	3	4
MP_L	4	3	2	1
Marginal Revenue	$4	$3	$2	$1
MRP_L	$16	$9	$4	$1

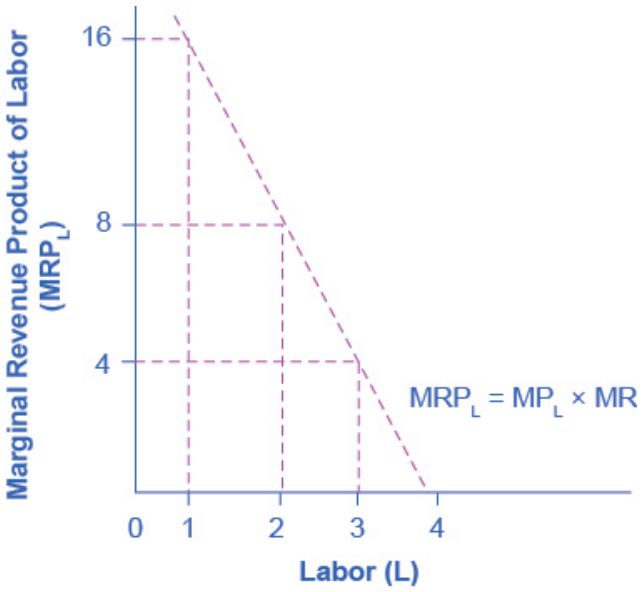

Figure 4.7b Marginal Revenue Product. For firms with some market power in their output market, the value of additional output sold is the firm's marginal revenue. Since MPL declines with additional labour employed and since MR declines with additional output sold, the firm's marginal revenue declines as employment increases. Figure by Steven A. Greenlaw & David Shapiro (OpenStax), licensed under CC BY 4.0.

Everything else remains the same as we described above in the discussion of the labour demand in perfectly competitive labour markets. Given the market wage, profit-maximizing firms will hire workers up to the point where the market wage equals the marginal revenue product, as Figure 3 shows.

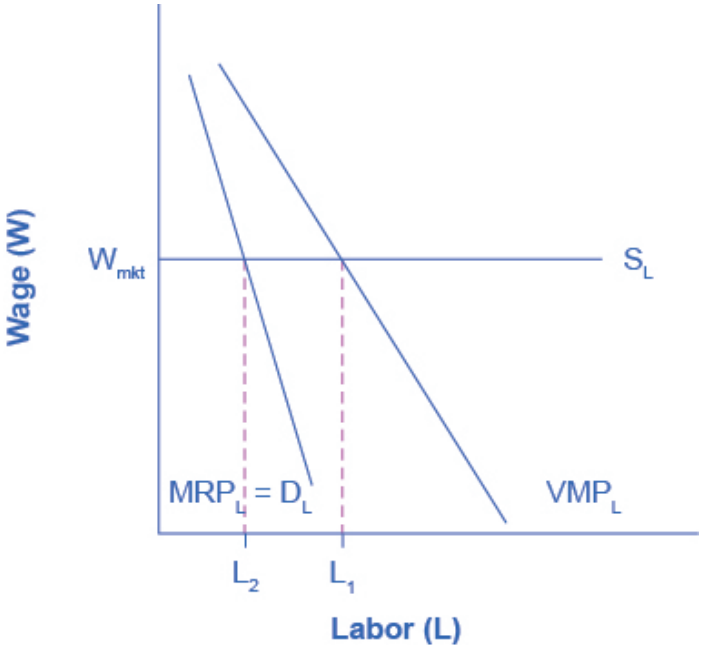

Figure 4.7c Equilibrium Level of Employment for Firms with Market Power. For firms with market power in their output market, they choose the number of workers, L_2, where the going market wage equals the firm's marginal revenue product. Note that since marginal revenue is less than price, the demand for labour for a firm which has market power in its output market is less than the demand for labour (L_1) for a perfectly competitive firm. As a result, employment will be lower in an imperfectly competitive industry than in a perfectly competitive industry. Figure by Steven A. Greenlaw & David Shapiro (OpenStax), licensed under CC BY 4.0.

Figure 4.7c Equilibrium Level of Employment for Firms with Market Power

The graph shows the Marginal Product of Labour. The x-axis is Labour. The y-axis is Wage. A horizontal line indicating the going market wage projects from about halfway up the y-axis. Two curves are included in order to demonstrate the difference for firms with market power. The first curve represents normal firms, and proceeds from right to left in a downward direction; where it intersects the Wage horizontal line, it is point L_1. The second curve, representing firms with market power, is steeper, and intersects the Wage line earlier (at a lower level of employment), at point L_2, where the going market wage equal's the firm's marginal revenue product.

Do profit maximizing employers exploit labour?

If you look back at Figure 14.6 Equilibrium Level of Employment for Firms with Market Power, you will see that the firm only pays the last worker it hires what they're worth to the firm. Every other worker brings in more revenue than the firm pays him or her. This has sometimes led to the claim that employers exploit workers because they do not pay workers what they are worth. Let's think about this claim. The first worker is worth $x to the firm, and the second worker is worth $y, but why are they worth that much? It is because of the capital and technology with which they work. The difference between workers' worth and their compensation goes to pay for the capital, and other inputs in the production process. The difference also goes to the employer's profit, without which the firm would close and workers wouldn't have a job. The firm may be earning excessive profits, but that is a different topic of discussion.

Try It

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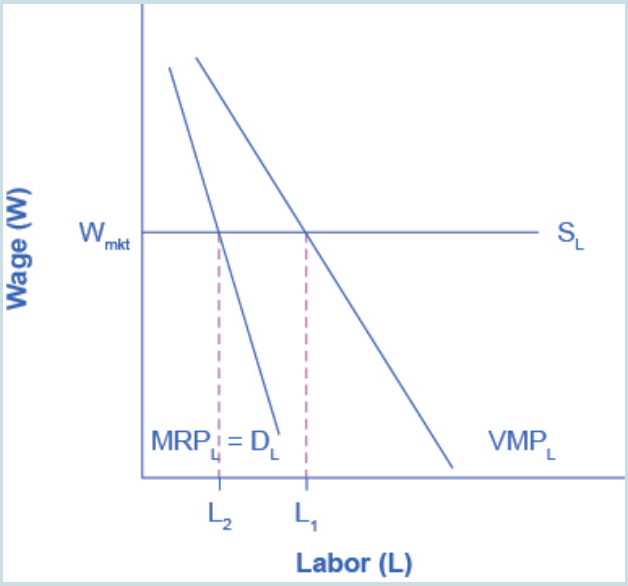

H5P Figure. Image by Steven A. Greenlaw, & David Shapiro (openstax), licensed under CC BY 4.0.

H5P Figure (Text Version)

The graph shows the Marginal Product of Labour. The x-axis is Labour. The y-axis is Wage. A horizontal line indicating the going market wage projects from about halfway up the y-axis. Two curves are included in order to demonstrate the difference for firms with market power. The first curve represents normal firms, and proceeds from right to left in a downward direction; where it intersects the Wage horizontal line, it is point L_1. The second curve, representing firms with market power, is steeper, and intersects the Wage line earlier (at a lower level of employment), at point L_2, where the going market wage equal's the firm's marginal revenue product.

1. Considering the graph above, the demand for labour is considered a(n) _____.
    a. Imperfectly competitive labour market
    b. Perfect competitive labour market
    c. Derived demand labour market

Check your Answers: [2]

2. **Question 1)** a) Correct. In a imperfectly competitive labour market, they choose the number of workers,(L2) where the going market wage equals the firm's marginal revenue product. Note that since marginal revenue is less than price, the demand for labour for a firm which has market power in its output market is less than the demand for labour(L1) for a perfectly competitive firm. As a result, employment will be lower in an imperfectly competitive industry than in a perfectly competitive industry.

Activity source: "The Demand for Labor (https://courses.lumenlearning.com/wm-microeconomics/chapter/the-demand-for-labor/)" In by Lumen Learning, licensed under CC BY. / Converted to H5P and Text.

What Determines the Going Market Wage Rate?

We learned earlier that the labour market has demand and supply curves like other markets. The demand for labour curve is a downward sloping function of the wage rate. The market demand for labour is the horizontal sum of all firms' demands for labour. The supply for labour curve is an upward sloping function of the wage rate. This is because if wages for a particular type of labour increase in a particular labour market, people with appropriate skills may change jobs, and vacancies will attract people from outside the geographic area. The market supply for labour is the horizontal summation of all individuals' supplies of labour.

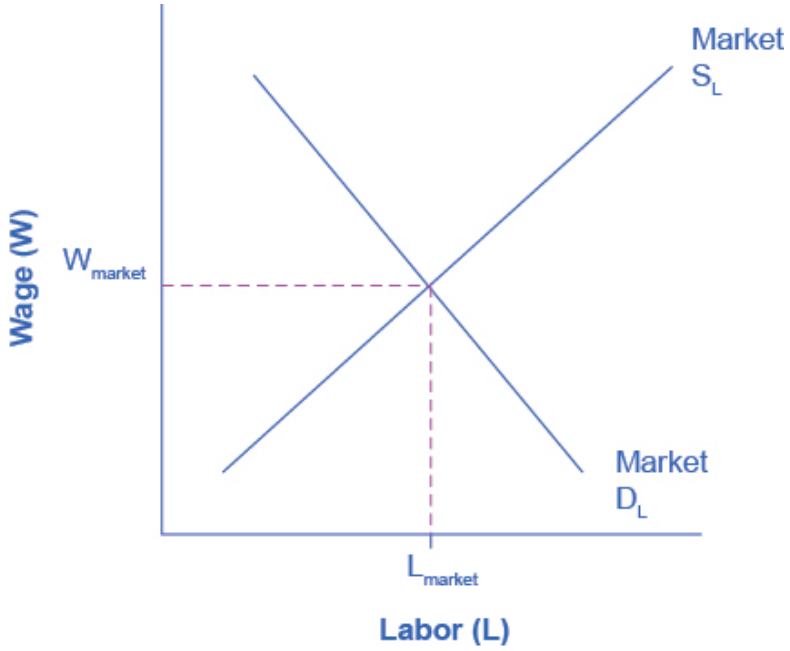

Figure 4.7d The Market Wage Rate. In a competitive labour market, the equilibrium wage and employment level are determined where the market demand for labour equals the market supply of labour. Figure by Steven A. Greenlaw & David Shapiro (OpenStax), licensed under CC BY 4.0.

Like all equilibrium prices, the market wage rate is determined through the interaction of supply and demand

in the labor market. Thus, we can see in Figure 4, the wage rate and number of workers hired in a competitive labor market.

Watch it

Watch this video for a nice overview of the labour market, and the ways that supply and demand interact to determine wages. The video will also introduce some of the key concepts we'll discuss soon, including monopsonies, unions, discrimination, and minimum wage laws.

Watch Labor Markets and Minimum Wage: Crash Course Economics #28 (https://www.youtube.com/watch?v=mWwXmH-n5Bo)(11 mins)

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Video Source: CrashCourse. (2016, March 27). *Labor markets and minimum wage: Crash course economics #28* [Video]. YouTube. https://www.youtube.com/watch?v=mWwXmH-n5Bo . Licensed under YouTube License.

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Try It – Text version

1. Supply and demand determine the labour market at equilibrium. _____ supply the labour

while _____ demand the labour. Fill in the two blanks with the appropriate terms:

a. Workers; firms
b. Firms; workers
c. Workers; consumers

Check your Answers: [3]

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Additional Key Terms

collective bargaining:
negotiations between unions and a firm or firms
labour union:
an organization of workers that negotiates with employers over wages and working conditions
perfectly competitive labour market:
a labour market where neither suppliers of labour nor demanders of labour have any market power; thus, an employer can hire all the workers they would like at the going market wage
marginal revenue product of labour:
the marginal product of an additional worker multiplied by the marginal revenue to the firm of the additional worker's output

3. 1. a) Correct. In a competitive labour market, the equilibrium wage and employment level are determined where the market demand for labour equals the market supply of labour.

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4.8 - LABOUR SUPPLY

Learning Objectives

- If we want people to work more, should we pay them more or will that cause them to work less?

A number of physicists have changed careers to become researchers in finance or financial economics. Research in finance pays substantially better than research in physics, and yet requires many of the same mathematical skills like stochastic calculus. Physicists who see their former colleagues driving Porsches and buying summerhouses are understandably annoyed that research in finance—which is intellectually no more difficult or challenging than physics—pays so much better. Indeed, some physicists are saying that other fields—such as finance, economics, and law—"shouldn't" pay more than physics.

The difference in income between physics' researchers and finance researchers is an example of a **compensating differential**. A compensating differential is income or costs that equalize different choices. There are individuals who could become either physicists or finance researchers. At equal income, too many choose physics and too few choose finance, in the sense that there is a surplus of physicists and a shortage of finance researchers. Finance salaries must exceed physics' salaries in order to induce some of the researchers who are capable of doing either one to switch to finance, which compensates those individuals for doing the less desirable task.

Jobs that are dangerous or unpleasant must pay more than jobs requiring similar skills but without the bad attributes. Thus, oil-field workers in Alaska's North Slope, well above the Arctic Circle, earn a premium over workers in similar jobs in Houston, Texas. The premium—or differential pay—must be such that the marginal worker is indifferent between the two choices: The extra pay compensates the worker for the adverse working conditions. This is why it is known in economics' jargon by the phrase of a compensating differential.

The high salaries earned by professional basketball players are not compensating differentials. These salaries are not created because of a need to induce tall people to choose basketball over alternative jobs like painting

ceilings, but instead are payments that reflect the rarity of the skills and abilities involved. Compensating differentials are determined by alternatives, not by direct scarcity. Professional basketball players are well paid for the same reason that Picasso's paintings are expensive: There aren't very many of them relative to demand.

A compensating differential is a feature of other choices as well as career choices. For example, many people would like to live in California for its weather and scenic beauty. Given the desirability of California over, for example, Lincoln, Nebraska, or Rochester, New York, there must be a compensating differential for living in Rochester; and two significant ones are air quality and housing prices. Air quality worsens as populations rise, thus tending to create a compensating differential. In addition, the increase in housing prices also tends to compensate—housing is inexpensive in Rochester, at least compared with California. There are other compensations, besides housing, for living in Rochester—cross-country skiing and proximity to mountains and lakes, for example. Generally, employment is only a temporary factor that might compensate, because employment tends to be mobile, too, and move to the location that the workers prefer, when possible. It is not possible on Alaska's North Slope.

Housing prices also compensate for location within a city. For most people, it is more convenient—both in commuting time and for services—to be located near the central business district than in the outlying suburbs. The main compensating differentials are school quality, crime rates, and housing prices. We illustrate the ideas with a simple model of a city in the next section.

Key Takeaways

- Leisure—time spent not working—is a good like other goods, and the **utility** cost of working is less leisure.
- Labour **supply** is different from other goods because the wage enters the budget constraint twice—first as the price of leisure, and second as income from working.
- If goods and leisure are substitutes, so that an increase in L decreases the **marginal** value of goods, then an increase in wages must decrease leisure, and labour supply increases in wages.
- With strong **complements** between goods and leisure, an increase in wages induces fewer hours worked.
- Complementarity between goods and leisure is reasonable because it takes time to consume

goods.

- For most developed nations, increases in wages are associated with fewer hours worked.
- A **compensating differential** is income or costs that equalize different choices.
- Jobs that are dangerous or unpleasant must pay more than jobs requiring similar skills but without the bad attributes.
- The premium—or differential pay—must be such that the marginal worker is indifferent between the two choices: The extra pay compensates the worker for the adverse working conditions.
- City choice is also subject to compensating differentials, and significant differentials include air quality, crime rates, tax rates, and housing prices.

Exercises

1. A thought question: Does a bequest motive—the desire to give money to others—change the likelihood that goods and leisure are complements?
2. Show that an increase in the wage increases the consumption of goods; that is, x increases when the wage increases.

Attribution

4.9 - THEORY OF LABOUR MARKETS

Learning Objectives

- Describe the demand for labour in perfectly competitive output markets
- Describe the demand for labour in imperfectly competitive output markets
- Identify what determines the going market rate

Clear It Up

What is the labour market?

The labour market is the term that economists use for all the different markets for labour. There is no single labour market. Rather, there is a different market for every different type of labour. Labour differs by type of work (e.g. retail sales vs. scientist), skill level (entry level or more experienced), and location (the market for administrative assistants is probably more local or regional than the market for university presidents). While each labour market is different, they all tend to operate in similar ways. For example, when wages go up in one labour market, they tend to go up in others too. When economists talk about the labour market, they are describing these similarities.

The labour market, like all markets, has a demand and a supply. Why do firms demand labour? Why is an employer willing to pay you for your labour? It's not because the employer likes you or is socially conscious. Rather, it's because your labour is worth something to the employer–your work brings in revenues to the firm. How much is an employer willing to pay? That depends on the skills and experience you bring to the firm.

If a firm wants to maximize profits, it will never pay more (in terms of wages and benefits) for a worker than the value of his or her marginal productivity to the firm. We call this the **first rule of labour markets**.

Suppose a worker can produce two widgets per hour and the firm can sell each widget for $4 each. Then the worker is generating $8 per hour in revenues to the firm, and a profit-maximizing employer will pay the worker up to, but no more than, $8 per hour, because that is what the worker is worth to the firm.

Recall the definition of marginal product. Marginal product is the additional output a firm can produce by adding one more worker to the production process. Since employers often hire labour by the hour, we'll define marginal product as the additional output the firm produces by adding one more worker hour to the production process. In this chapter, we assume that workers are homogeneous—they have the same background, experience and skills and they put in the same amount of effort. Thus, marginal product depends on the capital and technology with which workers have to work.

A typist can type more pages per hour with an electric typewriter than a manual typewriter, and he or she can type even more pages per hour with a personal computer and word processing software. A ditch digger can dig more cubic feet of dirt in an hour with a backhoe than with at shovel.

Thus, we can define the demand for labour as the marginal product of labour times the value of that output to the firm.

Table 4.9a Marginal Product of Labour

# Workers (L)	1	2	3	4
MP_L	4	3	2	1

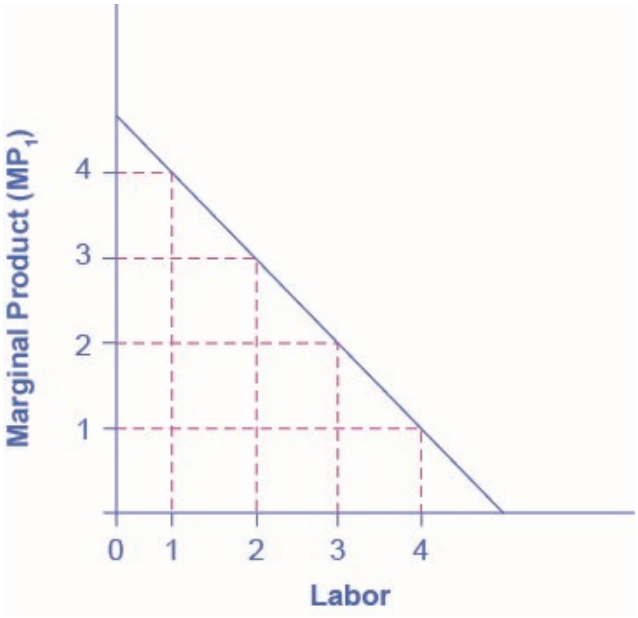

Figure 4.9a Marginal Product of Labour. Because of fixed capital, the marginal product of labour declines as the employer hires additional workers. Figure by Steven A. Greenlaw & David Shapiro (OpenStax), licensed under

On what does the value of each worker's marginal product depend? If we assume that the employer sells its output in a perfectly competitive market, the value of each worker's output will be the market price of the product. Thus,

Demand for Labour = MP_L x P = Value of the Marginal Product of Labour

The Demand for Labour = $MP_L \times P$ = Value of the Marginal Revenue Product

We show this in Table 4.9b, which is an expanded version of Table 4.9a.

Table 4.9b Marginal Revenue Product

# Workers (L)	1	2	3	4
MP_L	4	3	2	1
Price of Output	$4	$4	$4	$4
VMP_L	$16	$12	$8	$4

Note that the value of each additional worker is less than the ones who came before.

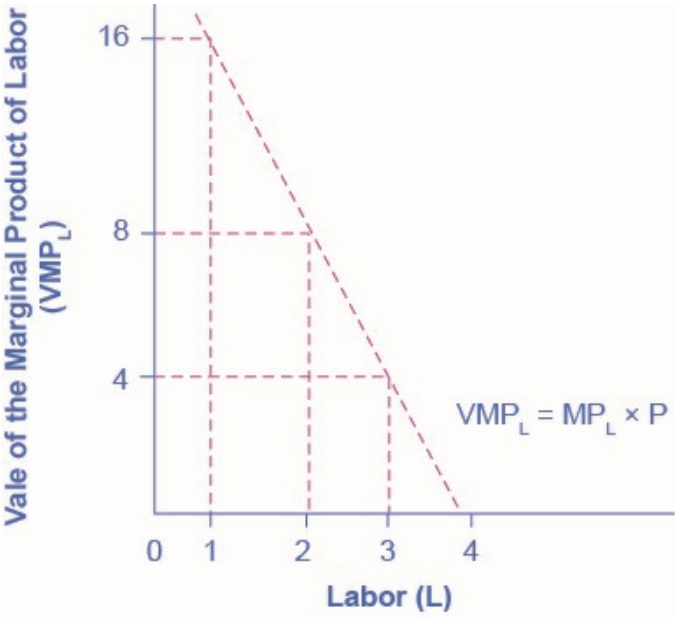

Figure 4.9b Value of the Marginal Product of Labour.For firms operating in a competitive output market, the value of additional output sold is the price the firms receive for the output. Since MPL declines with additional labour employed, while that marginal product is worth the market price, the value of the marginal product declines as employment increases. Figure by Steven A. Greenlaw & David Shapiro (OpenStax), licensed under CC BY 4.0.

Demand for Labour in Perfectly Competitive Output Markets

The question for any firm is how much labour to hire.

We can define a **Perfectly Competitive Labour Market** as one where firms can hire all the labour they wish at the going market wage. Think about secretaries in a large city. Employers who need secretaries can probably hire as many as they need if they pay the going wage rate.

Graphically, this means that firms face a horizontal supply curve for labour.

Given the market wage, profit maximizing firms hire workers up to the point where: $W_{mkt} = VMP_L$

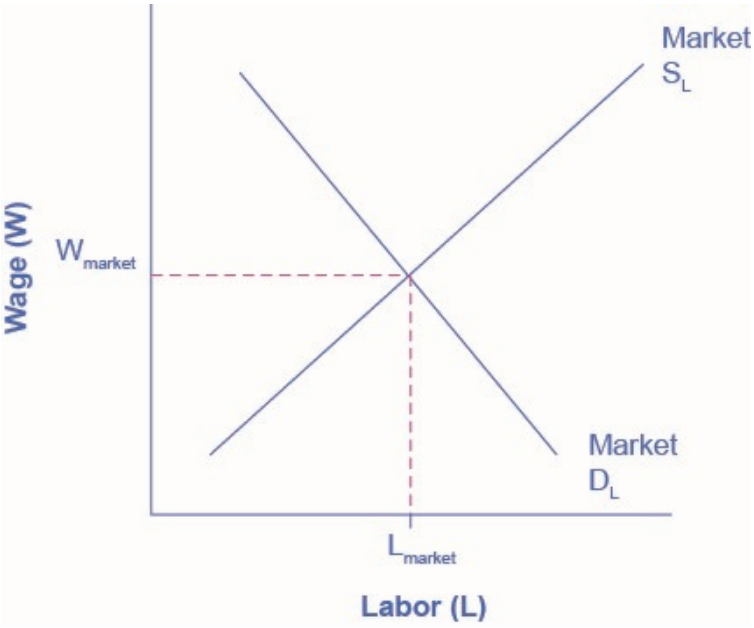

Figure 4.9c The Market Wage Rate. Figure by Steven A. Greenlaw & David Shapiro (OpenStax), licensed under CC BY 4.0.

In a perfectly competitive labour market, firms can hire all the labour they want at the going market wage. Therefore, they hire workers up to the point L_1 where the going market wage equals the value of the marginal product of labour.

Clear It Up

The probabilities assigned to events by a distribution function on a sample space are given by.

Derived Demand

Economists describe the demand for inputs like labour as a **derived demand**. Since the demand for labour is MPL*P, it is dependent on the demand for the product the firm is producing. We show this by the P term in the demand for labour. An increase in demand for the firm's product drives up the product's price, which increases the firm's demand for labour. Thus, we derive the demand for labour from the demand for the firm's output.

Demand for Labour in Imperfectly Competitive Output

Markets

If the employer does not sell its output in a perfectly competitive industry, they face a downward sloping demand curve for output, which means that in order to sell additional output the firm must lower its price. This is true if the firm is a monopoly, but it's also true if the firm is an oligopoly or monopolistically competitive. In this situation, the value of a worker's marginal product is the marginal revenue, not the price. Thus, the demand for labour is the marginal product times the marginal revenue.

$$\text{The Demand for Labour} = \text{MP}_\text{L} \times \text{MR} = \text{Marginal Revenue Product}$$

Table 4.9c Marginal Product of Labour

# Workers (L)	1	2	3	4
MP_L	4	3	2	1
Marginal Revenue	$4	$3	$2	$1
MRP_L	$16	$9	$4	$1

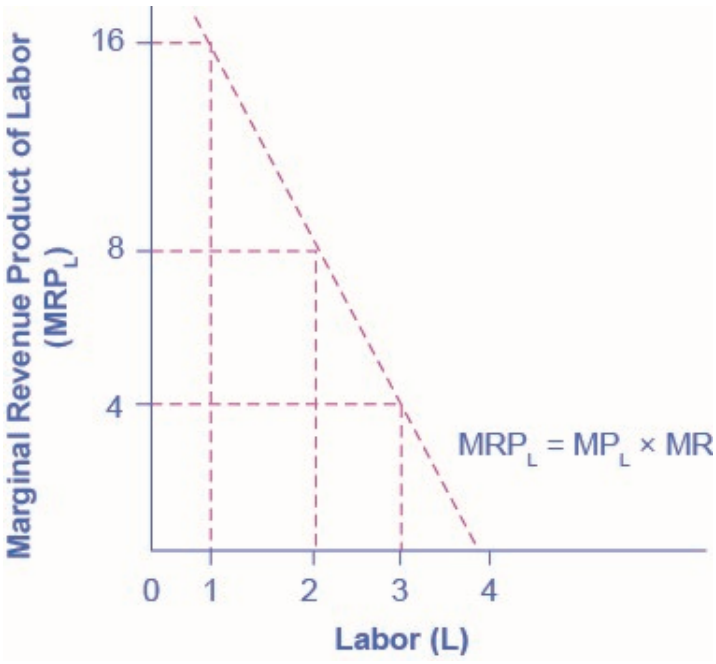

Figure 4.9d Marginal Revenue Product. For firms with some market power in their output market, the value of additional output sold is the firm's marginal revenue. Since MP_L declines with additional labour employed and since MR declines with additional output sold, the firm's marginal revenue declines as employment increases. Figure by Steven A. Greenlaw & David Shapiro (OpenStax), licensed under CC BY 4.0.

Everything else remains the same as we described above in the discussion of the labour demand in perfectly competitive labour markets. Given the market wage, profit-maximizing firms will hire workers up to the point where the market wage equals the marginal revenue product, as Figure 4.9d shows.

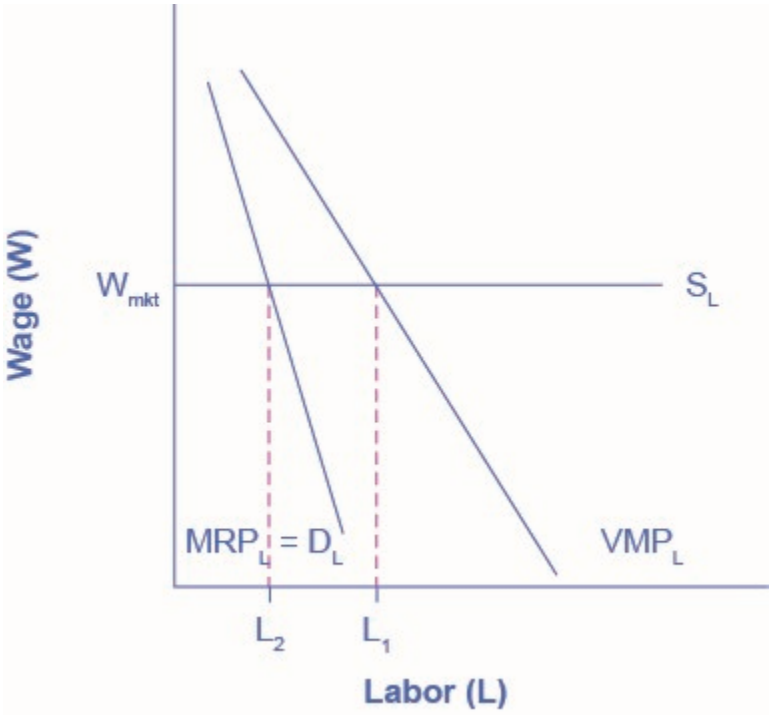

Figure 4.9e. Equilibrium Level of Employment for Firms with Market Power. For firms with market power in their output market, they choose the number of workers, L_2, where the going market wage equals the firm's marginal revenue product. Note that since marginal revenue is less than price, the demand for labour for a firm which has market power in its output market is less than the demand for labour (L_1) for a perfectly competitive firm. As a result, employment will be lower in an imperfectly competitive industry than in a perfectly competitive industry. Figure by Steven A. Greenlaw & David Shapiro (OpenStax), licensed under CC BY 4.0.

Clear It Up

The probabilities assigned to events by a distribution function on a sample space are given by.

Do Profit Maximizing Employers Exploit Labour?

Every other worker brings in more revenue than the firm pays him or her. This has sometimes led to the claim that employers exploit workers because they do not pay workers what they are worth. Let's think about this claim. The first worker is worth $x to the firm, and the second worker is worth $y, but why are they worth

that much? It is because of the capital and technology with which they work. The difference between workers' worth and their compensation goes to pay for the capital, technology, without which the workers wouldn't have a job. The difference also goes to the employer's profit, without which the firm would close and workers wouldn't have a job. The firm may be earning excessive profits, but that is a different topic of discussion.

What Determines the Going Market Wage Rate?

The labour market has demand and supply curves like other markets. The demand for labour curve is a downward sloping function of the wage rate. The market demand for labour is the horizontal sum of all firms' demands for labour. The supply for labour curve is an upward sloping function of the wage rate. This is because if wages for a particular type of labour increase in a particular labour market, people with appropriate skills may change jobs, and vacancies will attract people from outside the geographic area. The market supply for labour is the horizontal summation of all individuals' supplies of labour.

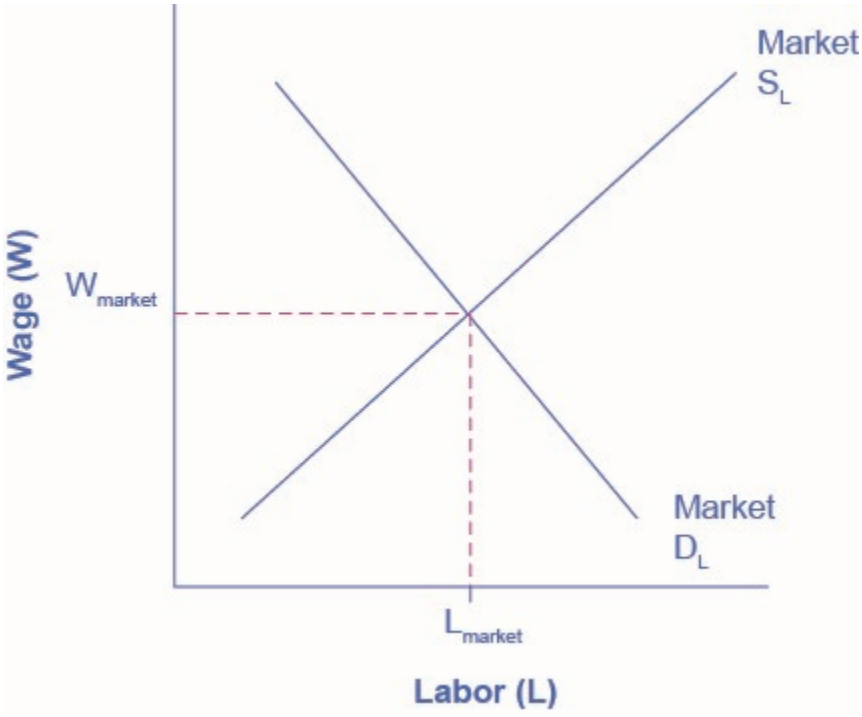

Figure 4.9f. The Market Wage Rate.In a competitive labour market, the equilibrium wage and employment level are determined where the market demand for labour equals the market supply of labour.
Like all equilibrium prices, the market wage rate is determined through the interaction of supply and demand in the labour market. Thus, we can see for competitive markets the wage rate and number of workers hired. Figure by Steven A. Greenlaw & David Shapiro (OpenStax), licensed under CC BY 4.0.

The FRED database has a great deal of data on labour markets, starting at the wage rate and number of workers hired [New Tab] (https://fred.stlouisfed.org/categories/10).

The United States Census Bureau for the Bureau of Labor Statistics publishes *The Current Population Survey*, which is a monthly survey of households (link is on that page), which provides data on labour supply, including numerous measures of the labour force size (disaggregated by age, gender and educational attainment), labour force participation rates for different demographic groups, and employment. It also includes more than 3,500 measures of earnings by different demographic groups.

The Current Employment Statistics, which is a survey of businesses, offers alternative estimates of employment across all sectors of the economy.

The link labeled "Productivity and Costs" has a wide range of data on productivity, labour costs and profits across the business sector.

Attribution

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4.10 - DEMAND AND SUPPLY AT WORK IN LABOUR MARKETS

Learning Objectives

- Predict shifts in the demand and supply curves of the labour market
- Explain the impact of new technology on the demand and supply curves of the labour market
- Explain price floors in the labour market such as minimum wage or a living wage

Markets for labour have demand and supply curves, just like markets for goods. The law of demand applies in labour markets this way: A higher salary or wage—that is, a higher price in the labour market—leads to a decrease in the quantity of labour demanded by employers, while a lower salary or wage leads to an increase in the quantity of labour demanded. The law of supply functions in labour markets, too: A higher price for labour leads to a higher quantity of labour supplied; a lower price leads to a lower quantity supplied.

Equilibrium in the Labour Market

In 2015, about 35,000 registered nurses worked in the Minneapolis-St. Paul-Bloomington, Minnesota-Wisconsin metropolitan area, according to the BLS. They worked for a variety of employers: hospitals, doctors' offices, schools, health clinics, and nursing homes.

Figure 4.10a illustrates how demand and supply determine equilibrium in this labour market. The demand and supply schedules in Table 4.10a list the quantity supplied and quantity demanded of nurses at different salaries.

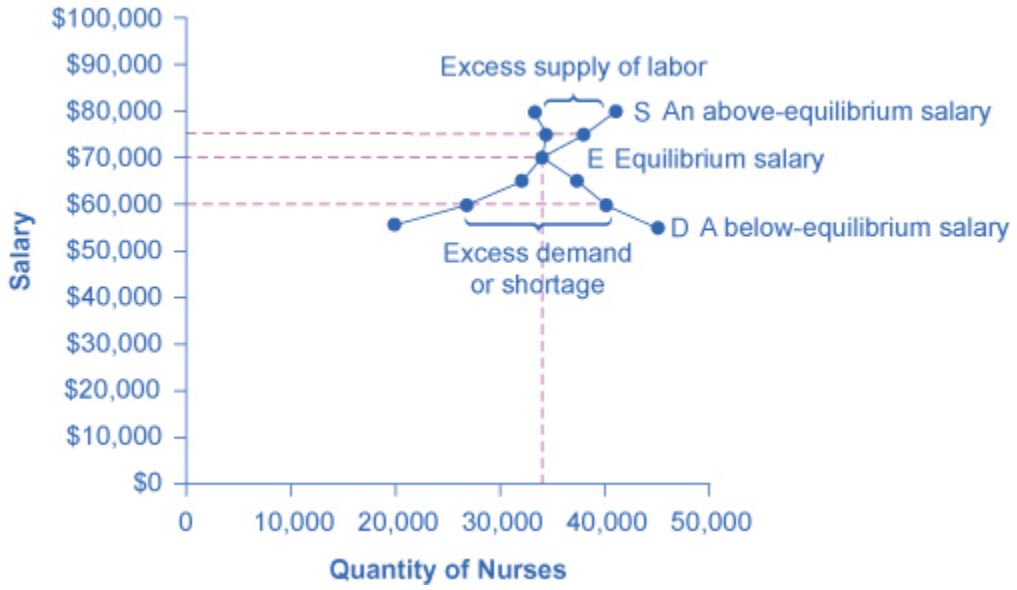

Figure 4.10a Labour Market Example: Demand and Supply for Nurses in Minneapolis-St. Paul-Bloomington. Figure by Steven A. Greenlaw & David Shapiro (OpenStax), licensed under CC BY 4.0.

Figure 4.10a (seen above) shows the demand curve (D) of those employers who want to hire nurses intersects with the supply curve (S) of those who are qualified and willing to work as nurses at the equilibrium point (E). The equilibrium salary is $70,000 and the equilibrium quantity is 34,000 nurses. At an above-equilibrium salary of $75,000, quantity supplied increases to 38,000, but the quantity of nurses demanded at the higher pay declines to 33,000. At this above-equilibrium salary, an excess supply or surplus of nurses would exist. At a below-equilibrium salary of $60,000, quantity supplied declines to 27,000, while the quantity demanded at the lower wage increases to 40,000 nurses. At this below-equilibrium salary, excess demand or a shortage exists.

Table 4.10a Demand and Supply of Nurses in Minneapolis-St. Paul-Bloomington

Annual Salary	Quantity Demanded	Quantity Supplied
$55,000	45,000	20,000
$60,000	40,000	27,000
$65,000	37,000	31,000
$70,000	34,000	34,000
$75,000	33,000	38,000
$80,000	32,000	41,000

The horizontal axis shows the quantity of nurses hired. In this example we measure labour by number of workers, but another common way to measure the quantity of labour is by the number of hours worked. The

vertical axis shows the price for nurses' labour—that is, how much they are paid. In the real world, this "price" would be total labour compensation: salary plus benefits. It is not obvious, but benefits are a significant part (as high as 30 percent) of labour compensation. In this example we measure the price of labour by salary on an annual basis, although in other cases we could measure the price of labour by monthly or weekly pay, or even the wage paid per hour. As the salary for nurses rises, the quantity demanded will fall. Some hospitals and nursing homes may reduce the number of nurses they hire, or they may lay off some of their existing nurses, rather than pay them higher salaries. Employers who face higher nurses' salaries may also try to replace some nursing functions by investing in physical equipment, like computer monitoring and diagnostic systems to monitor patients, or by using lower-paid health care aides to reduce the number of nurses they need.

As the salary for nurses rises, the quantity supplied will rise. If nurses' salaries in Minneapolis-St. Paul-Bloomington are higher than in other cities, more nurses will move to Minneapolis-St. Paul-Bloomington to find jobs, more people will be willing to train as nurses, and those currently trained as nurses will be more likely to pursue nursing as a full-time job. In other words, there will be more nurses looking for jobs in the area.

At equilibrium, the quantity supplied and the quantity demanded are equal. Thus, every employer who wants to hire a nurse at this equilibrium wage can find a willing worker, and every nurse who wants to work at this equilibrium salary can find a job. In Figure 4.10a, the supply curve (S) and demand curve (D) intersect at the equilibrium point (E). The equilibrium quantity of nurses in the Minneapolis-St. Paul-Bloomington area is 34,000, and the equilibrium salary is $70,000 per year. This example simplifies the nursing market by focusing on the "average" nurse. In reality, of course, the market for nurses actually comprises many smaller markets, like markets for nurses with varying degrees of experience and credentials. Many markets contain closely related products that differ in quality. For instance, even a simple product like gasoline comes in regular, premium, and super-premium, each with a different price. Even in such cases, discussing the average price of gasoline, like the average salary for nurses, can still be useful because it reflects what is happening in most of the submarkets.

When the price of labour is not at the equilibrium, economic incentives tend to move salaries toward the equilibrium. For example, if salaries for nurses in Minneapolis-St. Paul-Bloomington were above the equilibrium at $75,000 per year, then 38,000 people want to work as nurses, but employers want to hire only 33,000 nurses. At that above-equilibrium salary, excess supply or a surplus results. In a situation of excess supply in the labour market, with many applicants for every job opening, employers will have an incentive to offer lower wages than they otherwise would have. Nurses' salary will move down toward equilibrium.

In contrast, if the salary is below the equilibrium at, say, $60,000 per year, then a situation of excess demand or a shortage arises. In this case, employers encouraged by the relatively lower wage want to hire 40,000 nurses, but only 27,000 individuals want to work as nurses at that salary in Minneapolis-St. Paul-Bloomington. In response to the shortage, some employers will offer higher pay to attract the nurses. Other employers will have

to match the higher pay to keep their own employees. The higher salaries will encourage more nurses to train or work in Minneapolis-St. Paul-Bloomington. Again, price and quantity in the labour market will move toward equilibrium.

Shifts in Labour Demand

The demand curve for labour shows the quantity of labour employers wish to hire at any given salary or wage rate, under the *ceteris paribus* assumption. A change in the wage or salary will result in a change in the quantity demanded of labour. If the wage rate increases, employers will want to hire fewer employees. The quantity of labour demanded will decrease, and there will be a movement upward along the demand curve. If the wages and salaries decrease, employers are more likely to hire a greater number of workers. The quantity of labour demanded will increase, resulting in a downward movement along the demand curve.

Shifts in the demand curve for labour occur for many reasons. One key reason is that the demand for labour is based on the demand for the good or service that is produced. For example, the more new automobiles consumers demand, the greater the number of workers automakers will need to hire. Therefore the demand for labour is called a "derived demand." Here are some examples of derived demand for labour:

- The demand for chefs is dependent on the demand for restaurant meals.
- The demand for pharmacists is dependent on the demand for prescription drugs.
- The demand for attorneys is dependent on the demand for legal services.

As the demand for the goods and services increases, the demand for labour will increase, or shift to the right, to meet employers' production requirements. As the demand for the goods and services decreases, the demand for labour will decrease, or shift to the left. Table 4.10b shows that in addition to the derived demand for labour, demand can also increase or decrease (shift) in response to several factors.

Table 4.10b Factors That Can Shift Demand

Factors	Results
Demand for Output	When the demand for the good produced (output) increases, both the output price and profitability increase. As a result, producers demand more labour to ramp up production.
Education and Training	A well-trained and educated workforce causes an increase in the demand for that labour by employers. Increased levels of productivity within the workforce will cause the demand for labour to shift to the right. If the workforce is not well-trained or educated, employers will not hire from within that labour pool, since they will need to spend a significant amount of time and money training that workforce. Demand for such will shift to the left.
Technology	Technology changes can act as either substitutes for or complements to labour. When technology acts as a substitute, it replaces the need for the number of workers an employer needs to hire. For example, word processing decreased the number of typists needed in the workplace. This shifted the demand curve for typists left. An increase in the availability of certain technologies may increase the demand for labour. Technology that acts as a complement to labour will increase the demand for certain types of labour, resulting in a rightward shift of the demand curve. For example, the increased use of word processing and other software has increased the demand for information technology professionals who can resolve software and hardware issues related to a firm's network. More and better technology will increase demand for skilled workers who know how to use technology to enhance workplace productivity. Those workers who do not adapt to changes in technology will experience a decrease in demand.
Number of Companies	An increase in the number of companies producing a given product will increase the demand for labour resulting in a shift to the right. A decrease in the number of companies producing a given product will decrease the demand for labour resulting in a shift to the left.
Government Regulations	Complying with government regulations can increase or decrease the demand for labour at any given wage. In the healthcare industry, government rules may require that nurses be hired to carry out certain medical procedures. This will increase the demand for nurses. Less-trained healthcare workers would be prohibited from carrying out these procedures, and the demand for these workers will shift to the left.
Price and Availability of Other Inputs	Labour is not the only input into the production process. For example, a salesperson at a call center needs a telephone and a computer terminal to enter data and record sales. If prices of other inputs fall, production will become more profitable and suppliers will demand more labour to increase production. This will cause a rightward shift in the demand curve for labour. The opposite is also true. Higher prices for other inputs lower demand for labour.

Link It Up

To learn more Georgian College students can access the article Trends and Challenges for Work in the 21st Century [New Tab]. (https://georgian.primo.exlibrisgroup.com/permalink/01OCLS_GEORG/21p491/cdi_proquest_reports_218453209)

Shifts in Labour Supply

The supply of labour is upward-sloping and adheres to the law of supply: The higher the price, the greater the

quantity supplied and the lower the price, the less quantity supplied. The supply curve models the tradeoff between supplying labour into the market or using time in leisure activities at every given price level. The higher the wage, the more labour is willing to work and forego leisure activities. Table 4.10c lists some of the factors that will cause the supply to increase or decrease.

Table 4.10c Factors that Can Shift Supply

Factors	Results
Number of Workers	An increased number of workers will cause the supply curve to shift to the right. An increased number of workers can be due to several factors, such as immigration, increasing population, an aging population, and changing demographics. Policies that encourage immigration will increase the supply of labour, and vice versa. Population grows when birth rates exceed death rates. This eventually increases supply of labour when the former reach working age. An aging and therefore retiring population will decrease the supply of labour. Another example of changing demographics is more women working outside of the home, which increases the supply of labour.
Required Education	The more required education, the lower the supply. There is a lower supply of PhD mathematicians than of high school mathematics teachers; there is a lower supply of cardiologists than of primary care physicians; and there is a lower supply of physicians than of nurses.
Government Policies	Government policies can also affect the supply of labour for jobs. Alternatively, the government may support rules that set high qualifications for certain jobs: academic training, certificates or licenses, or experience. When these qualifications are made tougher, the number of qualified workers will decrease at any given wage. On the other hand, the government may also subsidize training or even reduce the required level of qualifications. For example, government might offer subsidies for nursing schools or nursing students. Such provisions would shift the supply curve of nurses to the right. In addition, government policies that change the relative desirability of working versus not working also affect the labour supply. These include unemployment benefits, maternity leave, child care benefits, and welfare policy. For example, child care benefits may increase the labour supply of working mothers. Long term unemployment benefits may discourage job searching for unemployed workers. All these policies must therefore be carefully designed to minimize any negative labour supply effects.

A change in salary will lead to a movement along labour demand or labour supply curves, but it will not shift those curves. However, other events like those we have outlined here will cause either the demand or the supply of labour to shift, and thus will move the labour market to a new equilibrium salary and quantity.

Technology and Wage Inequality: The Four-Step Process

Economic events can change the equilibrium salary (or wage) and quantity of labour. Consider how the wave of new information technologies, like computer and telecommunications networks, has affected low-skill and high-skill workers in the U.S. economy. From the perspective of employers who demand labour, these new technologies are often a substitute for low-skill labourers like file clerks who used to keep file cabinets full of paper records of transactions. However, the same new technologies are a complement to high-skill workers like managers, who benefit from the technological advances by having the ability to monitor more information, communicate more easily, and juggle a wider array of responsibilities. How will the new technologies affect the wages of high-skill and low-skill workers? For this question, the four-step process of

analyzing how shifts in supply or demand affect a market (introduced in Demand and Supply (3-introduction-to-demand-and-supply)) works in this way:

Step 1. What did the markets for low-skill labour and high-skill labour look like before the arrival of the new technologies? In Figure 4.10b (a) and Figure 4.10b (b), S_0 is the original supply curve for labour and D_0 is the original demand curve for labour in each market. In each graph, the original point of equilibrium, E_0, occurs at the price W_0 and the quantity Q_0.

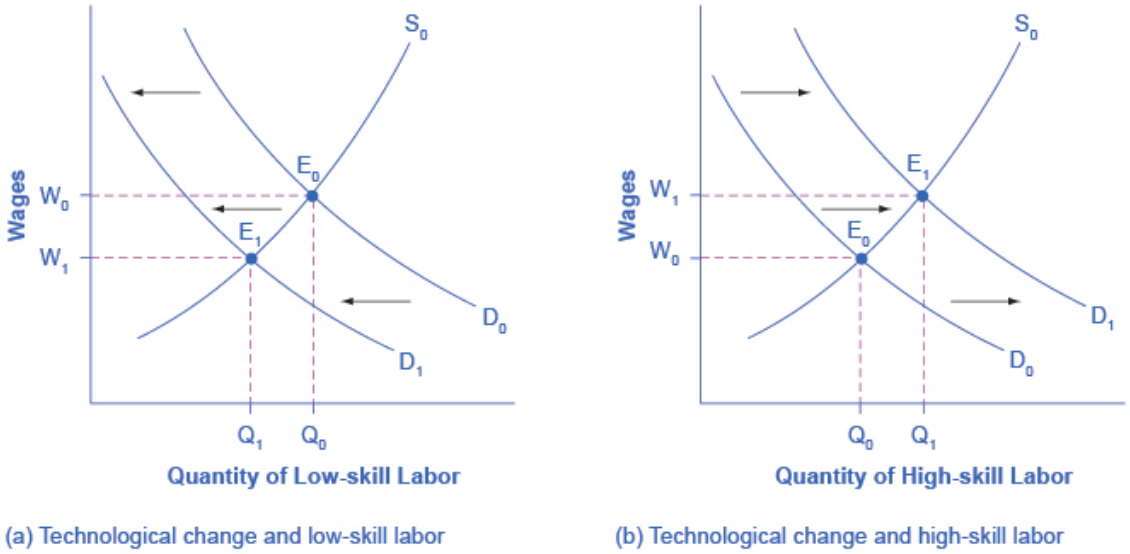

Figure 4.10b Technology and Wages: Applying Demand and Supply (a) The demand for low-skill labour shifts to the left when technology can do the job previously done by these workers. (b) New technologies can also increase the demand for high-skill labour in fields such as information technology and network administration. Figure by Steven A. Greenlaw & David Shapiro (OpenStax), licensed under CC BY 4.0.

Figure 4.10b Technology and Wages: Applying Demand and Supply (Text Version)

Contains two graphs: Graph A – Technological change and low-skill labour, Graph B – Technological change and high-skill labour.

Graph A: The graph has the vertical axis Wages (W) and Quantity of Low-Skill Labour (Q). The original supply curve (S_0) slopes upward from left to right. The original demand Curve (D_0) slopes downward from left to right. S_0 and D_0 intersect at the original equilibrium (E_0) at price W_0 and quantity Q_0 . D_0 shifts to the left and now intersects S_0 at a new equilibrium (E_1) at price W_1 and quantity Q_1.

Graph B: The graph has the vertical axis Wages (W) and Quantity of High-Skill Labour (Q). The original supply curve (S_0) slopes upward from left to right. The original demand Curve (D_0) slopes downward from

left to right. S_0 and D_0 intersect at the original equilibrium (E_0) at price W_0 and quantity Q_0 . D_1 shifts to the right and now intersects S_0 at a new equilibrium (E_1) at price W_1 and quantity Q_1.

Step 2. Does the new technology affect the supply of labour from households or the demand for labour from firms? The technology change described here affects demand for labour by firms that hire workers.

Step 3. Will the new technology increase or decrease demand? Based on the description earlier, as the substitute for low-skill labour becomes available, demand for low-skill labour will shift to the left, from D_0 to D_1. As the technology complement for high-skill labour becomes cheaper, demand for high-skill labour will shift to the right, from D_0 to D_1.

Step 4. The new equilibrium for low-skill labour, shown as point E_1 with price W_1 and quantity Q_1, has a lower wage and quantity hired than the original equilibrium, E_0. The new equilibrium for high-skill labour, shown as point E_1 with price W_1 and quantity Q_1, has a higher wage and quantity hired than the original equilibrium (E_0).

Thus, the demand and supply model predicts that the new computer and communications technologies will raise the pay of high-skill workers but reduce the pay of low-skill workers. From the 1970s to the mid-2000s, the wage gap widened between high-skill and low-skill labour. According to the National Center for Education Statistics, in 1980, for example, a college graduate earned about 30% more than a high school graduate with comparable job experience, but by 2014, a college graduate earned about 66% more than an otherwise comparable high school graduate. Many economists believe that the trend toward greater wage inequality across the U.S. economy is due to improvements in technology.

Link It Up

Learn more about the ten tech skills [New Tab] (https://readwrite.com/10-technology-skills-no-longer-in-demand/#awesm=~og2BuP53pqBEMo) that have lost relevance in today's workforce.

Price Floors in the Labour Market: Living Wages and Minimum Wages

In contrast to goods and services markets, price ceilings are rare in labour markets, because rules that prevent people from earning income are not politically popular. There is one exception: boards of trustees or stockholders, as an example, propose limits on the high incomes of top business executives.

The labour market, however, presents some prominent examples of price floors, which are an attempt to increase the wages of low-paid workers. The U.S. government sets a **minimum wage**, a price floor that makes it illegal for an employer to pay employees less than a certain hourly rate. In mid-2009, the U.S. minimum wage was raised to $7.25 per hour. Local political movements in a number of U.S. cities have pushed for a higher minimum wage, which they call a living wage. Promoters of living wage laws maintain that the minimum wage is too low to ensure a reasonable standard of living. They base this conclusion on the calculation that, if you work 40 hours a week at a minimum wage of $7.25 per hour for 50 weeks a year, your annual income is $14,500, which is less than the official U.S. government definition of what it means for a family to be in poverty. (A family with two adults earning minimum wage and two young children will find it more cost efficient for one parent to provide childcare while the other works for income. Thus the family income would be $14,500, which is significantly lower than the federal poverty line for a family of four, which was $24,250 in 2015.)

Supporters of the living wage argue that full-time workers should be assured a high enough wage so that they can afford the essentials of life: food, clothing, shelter, and healthcare. Since Baltimore passed the first living wage law in 1994, several dozen cities enacted similar laws in the late 1990s and the 2000s. The living wage ordinances do not apply to all employers, but they have specified that all employees of the city or employees of firms that the city hires be paid at least a certain wage that is usually a few dollars per hour above the U.S. minimum wage.

Figure 4.10b illustrates the situation of a city considering a living wage law. For simplicity, we assume that there is no federal minimum wage. The wage appears on the vertical axis, because the wage is the price in the labour market. Before the passage of the living wage law, the equilibrium wage is $10 per hour and the city hires 1,200 workers at this wage. However, a group of concerned citizens persuades the city council to enact a living wage law requiring employers to pay no less than $12 per hour. In response to the higher wage, 1,600 workers look for jobs with the city. At this higher wage, the city, as an employer, is willing to hire only 700 workers. At the price floor, the quantity supplied exceeds the quantity demanded, and a surplus of labour exists in this market. For workers who continue to have a job at a higher salary, life has improved. For those who were willing to work at the old wage rate but lost their jobs with the wage increase, life has not improved. Table 4.10b shows the differences in supply and demand at different wages.

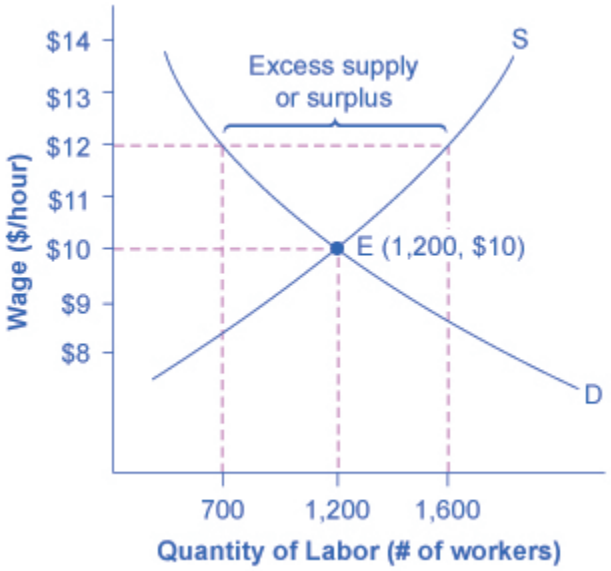

Figure 4.10b A Living Wage: Example of a Price Floor. The original equilibrium in this labour market is a wage of $10/hour and a quantity of 1,200 workers, shown at point E. Imposing a wage floor at $12/hour leads to an excess supply of labour. At that wage, the quantity of labour supplied is 1,600 and the quantity of labour demanded is only 700. Figure by Steven A. Greenlaw & David Shapiro (OpenStax), licensed under CC BY 4.0.

Figure 4.10b A Living Wage: Example of a Price Floor (Text Version)

The graph shows how a price floor results from an excess supply of labour. The vertical axis is Wage ($ per hour) and horizontal axis Quantity of Labour (number of workers). The supply curve (S) slopes upward from left to right and the demand curve (D) slopes downward left to right. S and D intersect at the equilibrium shown at Point E (1,200 workers, $10 per hour). Imposing a wage floor at $12/hour leads to an excess supply of labour. At that wage, the quantity of labour supplied is 1,600 and the quantity of labour demanded is only 700. Table 4.4 Living Wage: Example of a Price Floor details the plotted data.

Table 4.10d Living Wage: Example of a Price Floor

Wage	Quantity Labour Demanded	Quantity Labour Supplied
$8/hr	1,900	500
$9/hr	1,500	900
$10/hr	1,200	1,200
$11/hr	900	1,400
$12/hr	700	1,600
$13/hr	500	1,800
$14/hr	400	1,900

The Minimum Wage as an Example of a Price Floor

The U.S. minimum wage is a price floor that is set either very close to the equilibrium wage or even slightly below it. About 1% of American workers are actually paid the minimum wage. In other words, the vast majority of the U.S. labour force has its wages determined in the labour market, not as a result of the government price floor. However, for workers with low skills and little experience, like those without a high school diploma or teenagers, the minimum wage is quite important. In many cities, the federal minimum wage is apparently below the market price for unskilled labour, because employers offer more than the minimum wage to checkout clerks and other low-skill workers without any government prodding.

Economists have attempted to estimate how much the minimum wage reduces the quantity demanded of low-skill labour. A typical result of such studies is that a 10% increase in the minimum wage would decrease the hiring of unskilled workers by 1 to 2%, which seems a relatively small reduction. In fact, some studies have even found no effect of a higher minimum wage on employment at certain times and places—although these studies are controversial.

Let's suppose that the minimum wage lies just slightly *below* the equilibrium wage level. Wages could fluctuate according to market forces above this price floor, but they would not be allowed to move beneath the floor. In this situation, the price floor minimum wage is *nonbinding* —that is, the price floor is not determining the market outcome. Even if the minimum wage moves just a little higher, it will still have no effect on the quantity of employment in the economy, as long as it remains below the equilibrium wage. Even if the government increases minimum wage by enough so that it rises slightly above the equilibrium wage and becomes binding, there will be only a small excess supply gap between the quantity demanded and quantity supplied.

These insights help to explain why U.S. minimum wage laws have historically had only a small impact on employment. Since the minimum wage has typically been set close to the equilibrium wage for low-skill

labour and sometimes even below it, it has not had a large effect in creating an excess supply of labour. However, if the minimum wage increased dramatically—say, if it doubled to match the living wages that some U.S. cities have considered—then its impact on reducing the quantity demanded of employment would be far greater. As of 2017, many U.S. states are set to increase their minimum wage to $15 per hour. We will see what happens. The following Clear It Up feature describes in greater detail some of the arguments for and against changes to minimum wage.

Clear It Up

What's the harm in raising the minimum wage?

Because of the law of demand, a higher required wage will reduce the amount of low-skill employment either in terms of employees or in terms of work hours. Although there is controversy over the numbers, let's say for the sake of the argument that a 10% rise in the minimum wage will reduce the employment of low-skill workers by 2%. Does this outcome mean that raising the minimum wage by 10% is bad public policy? Not necessarily.

If 98% of those receiving the minimum wage have a pay increase of 10%, but 2% of those receiving the minimum wage lose their jobs, are the gains for society as a whole greater than the losses? The answer is not clear, because job losses, even for a small group, may cause more pain than modest income gains for others. For one thing, we need to consider which minimum wage workers are losing their jobs. If the 2% of minimum wage workers who lose their jobs are struggling to support families, that is one thing. If those who lose their job are high school students picking up spending money over summer vacation, that is something else.

Another complexity is that many minimum wage workers do not work full-time for an entire year. Imagine a minimum wage worker who holds different part-time jobs for a few months at a time, with bouts of unemployment in between. The worker in this situation receives the 10% raise in the minimum wage when working, but also ends up working 2% fewer hours during the year because the higher minimum wage reduces how much employers want people to work. Overall, this worker's income would rise because the 10% pay raise would more than offset the 2% fewer hours worked.

Of course, these arguments do not prove that raising the minimum wage is necessarily a good idea either. There may well be other, better public policy options for helping low-wage workers. The lesson from this maze of minimum wage arguments is that complex social problems rarely have simple answers. Even those who agree on how a proposed economic policy affects quantity demanded and quantity supplied may still disagree on whether the policy is a good idea.

Key Concepts and Summary

In the labor market, households are on the supply side of the market and firms are on the demand side. In the market for financial capital, households and firms can be on either side of the market: they are suppliers of financial capital when they save or make financial investments, and demanders of financial capital when they borrow or receive financial investments.

In the demand and supply analysis of labor markets, we can measure the price by the annual salary or hourly wage received. We can measure the quantity of labor various ways, like number of workers or the number of hours worked.

Factors that can shift the demand curve for labor include: a change in the quantity demanded of the product that the labor produces; a change in the production process that uses more or less labor; and a change in government policy that affects the quantity of labor that firms wish to hire at a given wage. Demand can also increase or decrease (shift) in response to: workers' level of education and training, technology, the number of companies, and availability and price of other inputs.

The main factors that can shift the supply curve for labor are: how desirable a job appears to workers relative to the alternatives, government policy that either restricts or encourages the quantity of workers trained for the job, the number of workers in the economy, and required education.

Attribution

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4.11 - SELF-CHECK, CRITICAL THINKING & REVIEW QUESTIONS

Self-Check Questions

1. From the data in Table 5.5 about demand for smart phones, calculate the price elasticity of demand from: point B to point C, point D to point E, and point G to point H. Classify the elasticity at each point as elastic, inelastic, or unit elastic.

Table 4.11a

Points	P	Q
A	60	3,000
B	70	2,800
C	80	2,600
D	90	2,400
E	100	2,200
F	110	2,000
G	120	1,800
H	130	1,600

2. From the data in Table 5.6 about supply of alarm clocks, calculate the price elasticity of supply from: point J to point K, point L to point M, and point N to point P. Classify the elasticity at each point as elastic, inelastic, or unit elastic.

Table 4.11b

Point	Price	Quantity Supplied
J	$8	50
K	$9	70
L	$10	80
M	$11	88
N	$12	95
P	$13	100

3. Why is the demand curve with constant unitary elasticity concave?
4. Why is the supply curve with constant unitary elasticity a straight line?
5. The federal government decides to require that automobile manufacturers install new anti-pollution equipment that costs $2,000 per car. Under what conditions can carmakers pass almost all of this cost along to car buyers? Under what conditions can carmakers pass very little of this cost along to car buyers?
6. Suppose you are in charge of sales at a pharmaceutical company, and your firm has a new drug that causes bald men to grow hair. Assume that the company wants to earn as much revenue as possible from this drug. If the elasticity of demand for your company's product at the current price is 1.4, would you advise the company to raise the price, lower the price, or to keep the price the same? What if the elasticity were 0.6? What if it were 1? Explain your answer.
7. What would the gasoline price elasticity of supply mean to UPS or FedEx?
8. The average annual income rises from $25,000 to $38,000, and the quantity of bread consumed in a year by the average person falls from 30 loaves to 22 loaves. What is the income elasticity of bread consumption? Is bread a normal or an inferior good?
9. Suppose the cross-price elasticity of apples with respect to the price of oranges is 0.4, and the price of oranges falls by 3%. What will happen to the demand for apples?

Check your answers

1. From point B to point C, price rises from $70 to $80, and Qd decreases from 2,800 to 2,600. So:

$$\begin{aligned}
\%\text{ change in quantity} &= \frac{2{,}600-2{,}800}{(2{,}600+2{,}800/2} \times 100 \\
&= \frac{200}{2{,}700} \times 100 \\
&= -7.41 \\
\%\text{ change in price} &= \frac{80-70}{(80+70)/2} \times 100 \\
&= \frac{10}{75} \times 100 \\
&= 13.33 \\
\text{Elasticity of Demand} &= \frac{-7.41\%}{13.33\%} \\
&= 0.56
\end{aligned}$$

The demand curve is inelastic in this area; that is, its elasticity value is less than one. Answer from Point D to point E:

$$\begin{aligned}
\%\text{ change in quantity} &= \frac{2{,}200-2400}{(2{,}200-2{,}400)/2} \times 100 \\
&= \frac{-200}{2{,}300} \times 100 \\
&= -8.7 \\
\%\text{ change in price} &= \frac{100-90}{(100+90)/2} \times 100 \\
&= \frac{10}{95} \times 100 \\
&= 110.53 \\
\text{Elasticity of Demand} &= \frac{-8.7\%}{10.53\%} \\
&= 0.83
\end{aligned}$$

The demand curve is inelastic in this area; that is, its elasticity value is less than one. Answer from Point G to point H:

$$\begin{aligned}\%\text{ change in quantity} &= \frac{1{,}600-1{,}800}{1{,}700}\times 100\\ &= \frac{-200}{1{,}700}\times 100\\ &= -11.76\\ \%\text{ change in price} &= \frac{130-120}{125}\times 100\\ &= \frac{10}{125}\times 100\\ &= 8.00\\ \text{Elasticity of Demand} &= \frac{-11.76\%}{8.00\%}\\ &= -1.47\end{aligned}$$

and curve is elastic in this interval.

2. From point J to point K, price rises from $8 to $9, and quantity rises from 50 to 70. So:

$$\begin{aligned}\%\text{ change in quantity} &= \frac{70-50}{(70+50)\div 2}\times 100\\ &= \frac{20}{60}\times 100\\ &= 33.33\\ \%\text{ change in price} &= \frac{\$9-\$8}{(\$9+\$8)\div 2}\times 100\\ &= \frac{1}{8.5}\times 100\\ &= 11.76\\ \text{Elasticity of Supply} &= \frac{33.33\%}{11.76\%}\\ &= 2.83\end{aligned}$$

The supply curve is elastic in this area; that is, its elasticity value is greater than one. From point L to point M, the price rises from $10 to $11, while the Qs rises from 80 to 88:

$$\begin{aligned}
\%\text{ change in quantity} &= \frac{88-80}{(88+80)\div 2} \times 100 \\
&= \frac{8}{84} \times 100 \\
&= 33.33 \\
\%\text{ change in price} &= \frac{\$11-\$10}{(\$11+\$10)\div 2} \times 100 \\
&= \frac{1}{10.5} \times 100 \\
&= 9.52 \\
\text{Elasticity of Supply} &= \frac{9.52\%}{9.52\%} \\
&= 1.0
\end{aligned}$$

The supply curve has unitary elasticity in this area. From point N to point P, the price rises from $12 to $13, and Qs rises from 95 to 100:

$$\begin{aligned}
\%\text{ change in quantity} &= \frac{100-95}{(100+95)\div 2} \times 100 \\
&= \frac{5}{97.5} \times 100 \\
&= 5.13 \\
\%\text{ change in price} &= \frac{\$13-\$12}{(\$13+\$12)\div 2} \times 100 \\
&= \frac{1}{12.5} \times 100 \\
&= 8.0 \\
\text{Elasticity of Supply} &= \frac{5.13\%}{8.0\%} \\
&= 0.64
\end{aligned}$$

The supply curve is inelastic in this region of the supply curve.

3. The demand curve with constant unitary elasticity is concave because the absolute value of declines in price are not identical. The left side of the curve starts with high prices, and then price falls by smaller amounts as it goes down toward the right side. This results in a slope of demand that is steeper on the left but flatter on the right, creating a curved, concave shape.
4. The constant unitary elasticity is a straight line because the curve slopes upward and both price and quantity are increasing proportionally.
5. Carmakers can pass this cost along to consumers if the demand for these cars is inelastic. If the demand for these cars is elastic, then the manufacturer must pay for the equipment.
6. If the elasticity is 1.4 at current prices, you would advise the company to lower its price on the product, since a decrease in price will be offset by the increase in the amount of the drug

sold. If the elasticity were 0.6, then you would advise the company to increase its price. Increases in price will offset the decrease in number of units sold, but increase your total revenue. If elasticity is 1, the total revenue is already maximized, and you would advise that the company maintain its current price level.

7. The percentage change in quantity supplied as a result of a given percentage change in the price of gasoline.
8. In this example, bread is an inferior good because its consumption falls as income rises.

$$\begin{aligned}\text{Percentage change in quantity demanded} &= \frac{(\text{change in quantity})}{(\text{original quantity})} \times 100 \\ &= \frac{22-30}{(22+30)\div 2} \times 100 \\ &= \frac{-8}{26} \times 100 \\ &= -30.77\end{aligned}$$

$$\begin{aligned}\text{Percentage change in income} &= \frac{(\text{change in income})}{(\text{original income})} \times 100 \\ &= \frac{38{,}000–25{,}000}{(38{,}000+25{,}000)\div 2} \times 100 \\ &= \frac{13}{31.5} \times 100 \\ &= 41.27\end{aligned}$$

9. The formula for cross-price elasticity is:

$$\text{Cross-price elasticity} = \quad amp; \frac{\%\text{ change in } Q_d \text{for apples}}{\%\text{ change in P of oranges}}.$$

Multiplying both sides by % change in P of oranges yields:

$$\begin{aligned}\%\text{ change in } Q_d \text{for apples} &= \text{cross-price elasticity} \times \%\text{ change in P of oranges} \\ &= 0.4 \times (-3\%) \\ &= -1.2\%\end{aligned}$$

or a 1.2 % decrease in demand for apples.

Critical Thinking Questions

1. Transatlantic air travel in business class has an estimated elasticity of demand of 0.62, while transatlantic air travel in economy class has an estimated price elasticity of 0.12. Why do you think this is the case?
2. What is the relationship between price elasticity and position on the demand curve? For example, as you move up the demand curve to higher prices and lower quantities, what happens to the measured elasticity? How would you explain that?
3. Can you think of an industry (or product) with near infinite elasticity of supply in the short term? That is, what is an industry that could increase Qs almost without limit in response to an increase in the price?
4. Would you expect supply to play a more significant role in determining the price of a basic necessity like food or a luxury like perfume? Explain. *Hint*: Think about how the price elasticity of demand will differ between necessities and luxuries.
5. A city has built a bridge over a river and it decides to charge a toll to everyone who crosses. For one year, the city charges a variety of different tolls and records information on how many drivers cross the bridge. The city thus gathers information about elasticity of demand. If the city wishes to raise as much revenue as possible from the tolls, where will the city decide to charge a toll: in the inelastic portion of the demand curve, the elastic portion of the demand curve, or the unit elastic portion? Explain.
6. In a market where the supply curve is perfectly inelastic, how does an excise tax affect the price paid by consumers and the quantity bought and sold?
7. Economists define normal goods as having a positive income elasticity. We can divide normal goods into two types: Those whose income elasticity is less than one and those whose income elasticity is greater than one. Think about products that would fall into each category. Can you come up with a name for each category?
8. Suppose you could buy shoes one at a time, rather than in pairs. What do you predict the cross-price elasticity for left shoes and right shoes would be?

Review Questions

1. What is the formula for calculating elasticity?
2. What is the price elasticity of demand? Can you explain it in your own words?
3. What is the price elasticity of supply? Can you explain it in your own words?
4. Describe the general appearance of a demand or a supply curve with zero elasticity.
5. Describe the general appearance of a demand or a supply curve with infinite elasticity.
6. If demand is elastic, will shifts in supply have a larger effect on equilibrium quantity or on price?
7. If demand is inelastic, will shifts in supply have a larger effect on equilibrium price or on quantity?
8. If supply is elastic, will shifts in demand have a larger effect on equilibrium quantity or on price?
9. If supply is inelastic, will shifts in demand have a larger effect on equilibrium price or on quantity?
10. Would you usually expect elasticity of demand or supply to be higher in the short run or in the long run? Why?
11. Under which circumstances does the tax burden fall entirely on consumers?
12. What is the formula for the income elasticity of demand?
13. What is the formula for the cross-price elasticity of demand?
14. What is the formula for the wage elasticity of labor supply?
15. What is the formula for elasticity of savings with respect to interest rates?

Problems

1. The equation for a demand curve is P = 48 – 3Q. What is the elasticity in moving from a quantity of 5 to a quantity of 6?
2. The equation for a demand curve is P = 2/Q. What is the elasticity of demand as price falls from 5 to 4? What is the elasticity of demand as the price falls from 9 to 8? Would you expect these answers to be the same?
3. The equation for a supply curve is 4P = Q. What is the elasticity of supply as price rises from 3 to 4? What is the elasticity of supply as the price rises from 7 to 8? Would you expect these answers to be the same?
4. The equation for a supply curve is P = 3Q – 8. What is the elasticity in moving from a price of 4 to a price of 7?
5. The supply of paintings by Leonardo Da Vinci, who painted the *Mona Lisa* and *The Last Supper* and died in 1519, is highly inelastic. Sketch a supply and demand diagram, paying attention to the appropriate elasticities, to illustrate that demand for these paintings will determine the price.
6. Say that a certain stadium for professional football has 70,000 seats. What is the shape of the supply curve for tickets to football games at that stadium? Explain.
7. When someone's kidneys fail, the person needs to have medical treatment with a dialysis machine (unless or until they receive a kidney transplant) or they will die. Sketch a supply and demand diagram, paying attention to the appropriate elasticities, to illustrate that the supply of such dialysis machines will primarily determine the price.
8. Assume that the supply of low-skilled workers is fairly elastic, but the employers' demand for such workers is fairly inelastic. If the policy goal is to expand employment for low-skilled workers, is it better to focus on policy tools to shift the supply of unskilled labor or on tools to shift the demand for unskilled labor? What if the policy goal is to raise wages for this group? Explain your answers with supply and demand diagrams.

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