

- Firms are sellers in product markets and buyers in factor (resource) markets.
- The demand for any resource is derived from the demand for the products that the resource can produce. Thus, resource demand depends on the price of the good or service that the resource produces and on the resource's productivity in producing the good or service.
- The demand curve for a resource in the short run is downward sloping because the marginal physical product (MPP) of additional inputs of a resource will decrease as a result of the law of diminishing marginal returns. In some textbooks, marginal physical product is called marginal product.
- The resource demand curve for a firm selling in an imperfectly competitive market will be steeper than the resource demand curve for a firm selling in a perfectly competitive market. The steeper slope results from both a decrease in the marginal physical product and a decrease in the product price required to permit the firm to sell a larger output.
- A firm will continue to hire factors of production as long as its marginal revenue product (MRP) exceeds its marginal resource cost (MRC). A firm will not hire resources once MRC exceeds MRP.
- A firm maximizes profits where a factor's marginal revenue product equals the factor's marginal resource cost. A firm maximizes profit where $MRP = MRC$.
- In a perfectly competitive labor market, a firm will hire workers until the last worker's wage (MRC) equals the marginal revenue product of that last worker hired.
- When a combination of resources is employed in producing a good or service, the profit-maximizing rule is
$$\frac{MRP_a}{MRC_a} = \frac{MRP_b}{MRC_b} = \frac{MRP_n}{MRC_n} = 1$$
- When a firm produces the profit-maximizing level of output, it must utilize a least-cost combination of resources. The rule for a least-cost combination of resources is
$$\frac{MPP_a}{MRC_a} = \frac{MPP_b}{MRC_b} = \frac{MPP_n}{MRC_n}$$
- For a firm facing a perfectly competitive resource market, resource supply is perfectly elastic and equal to marginal resource cost at a market-determined price (wage) for the resource. Under monopsony or imperfect conditions of employment, both resource supply and marginal resource cost are positively sloped curves with the marginal resource cost being a value greater than the price (wage) for all units beyond the first unit of the resource employed.
- Given a downward-sloping marginal revenue product curve and the differences existing between supply and marginal resource cost in perfect competition and monopsony, a monopsonistic employer will pay a lower price (wage) and hire fewer units of a resource than a perfect competitor.
- Economic rent is any payment to the supplier of a resource that is greater than the minimum amount required to employ the desired quantity of the resource to be supplied.
- The equilibrium real interest rate influences the level of investment and helps allocate financial and physical capital to specific firms and industries.
- Profits are the return to entrepreneurs for assuming risk and for organizing and directing economic resources.
- Profits allocate resources according to the demands of consumers.

Jimmy D. Lee, Highland Park High School, Dallas, Texas, contributed to these Key Ideas.

“As the ‘Circular Flow’ Turns”

Unit 4 turns from the study of product markets to factor markets. Instead of determining the equilibrium output prices and quantities of final goods and services, we will determine the prices and quantities of the inputs necessary for production.

The roles of households as buyers and firms as sellers are now reversed. In the factor market, households supply: They supply their labor, capital and natural resources in factor markets. Firms demand inputs in markets that can be either *perfectly competitive*, meaning their prices (wages, interest, rent) are determined by the industry and taken by the firm, or *monopsonistic*, meaning there is only one buyer of the input and this buyer seeks the most profitable price at which to buy.

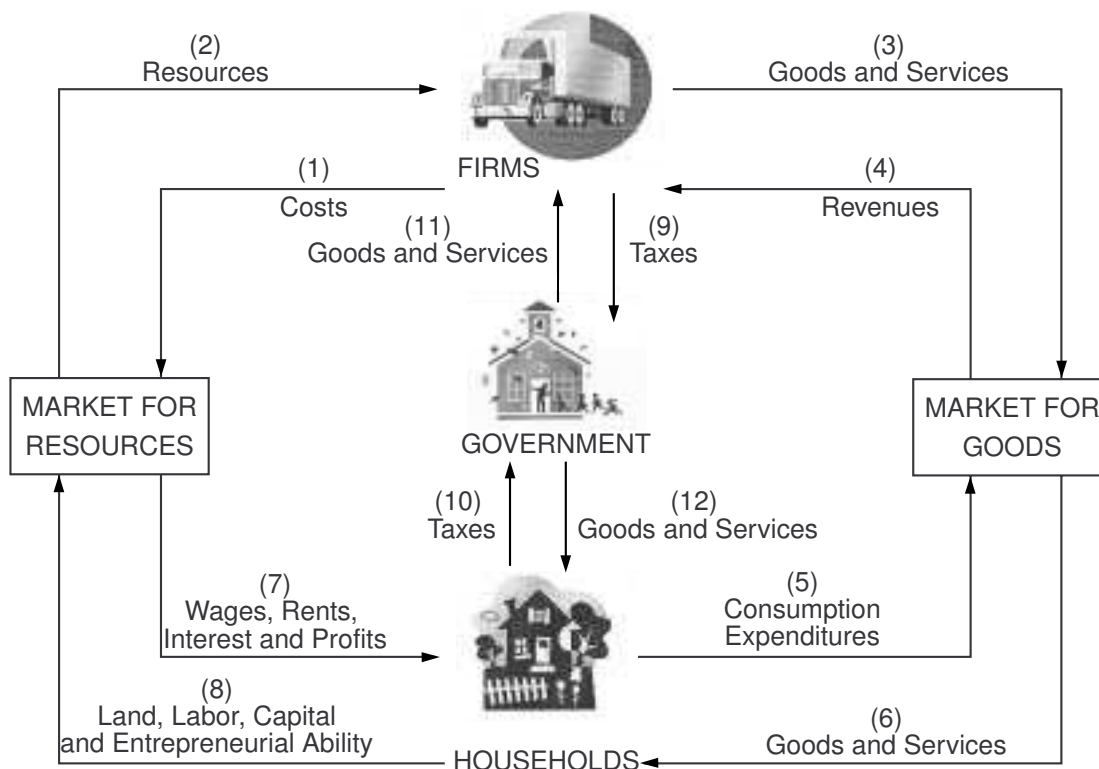
Part A

- The circular flow diagram in Figure 43.1 provides a visual representation of economic activity between product and factor markets. Study the diagram and then fill in the table on the top of the next page by determining
 - whether the activity takes place in the product or factor *market*.
 - what the *role* of the participant is in terms of supply or demand.
 - whether the *price* is a product price, a wage, interest or rent.



Figure 43.1

The Circular Flow of Resources, Households, and Government



Activity written by Mary Kohelis, Brooke High School, Wellsburg, W. Va.

Activity	Market	Role	Price
Cashier at work			
A student buying a hamburger			
A business paying rent			
A firm hiring workers			
A firm selling T-shirts			

Part B

The circular flow also demonstrates the inter-relatedness of the two markets. If input costs (for example, wages and rent) change in the factor market, then the prices of goods and services will also change. Additionally, if prices in the output market change because of changes in supply of or demand for the product, the factor market will be affected.

In the following examples, determine which market (product or factor) is affected first and then determine how the other market is affected subsequently.

2. A study announces increased cancer risk from drinking coffee.

Primary market		Other market	
Affects supply or demand		Affects supply or demand	
Influence on price (increase / decrease)		Influence on price (increase / decrease)	

3. There is an increase in the number of people looking for work.

Primary market		Other market	
Affects supply or demand		Affects supply or demand	
Influence on price (increase / decrease)		Influence on price (increase / decrease)	

4. Price in the labor market is called a _____ .

Because of the nature of the circular flow, it is important to remember that focusing on product markets without considering the impact on factor markets (and vice versa) is impossible.

How Many Workers Should Be Hired?

You are the president of Acme Yo-Yo Company, a small manufacturing firm that produces Supersonic Yo-Yos, a popular toy that makes a “supersonic” noise when used.

Acme’s yo-yos are manufactured by yo-yo makers working at two yo-yo-making machines. You have been estimating how many yo-yos your company can make using different numbers of workers, and you now have to decide just how many workers Acme will hire.

Your study of your yo-yo-making process has shown that you can produce the following number of yo-yos per day depending upon how many workers you hire.



Figure 44.1

Workers Hired and Yo-Yos Produced Per Day

Number of Workers Hired	Number of Yo-Yos Produced Each Day	Change in Number of Yo-Yos Produced
1	20	20
2	50	30
3	70	20
4	85	15
5	95	10
6	100	5

After the second worker is hired, hiring more workers still increases the number of yo-yos produced, but the extra number of yo-yos produced gets smaller and smaller as more workers are hired.

You have also learned that the market for Acme’s yo-yos is such that Acme can sell as many yo-yos as it wants every day for \$2 each and that you can hire as many qualified yo-yo makers as you need by paying each one \$30 per day.

Figure 44.2 can help you decide how many workers to hire. You can find out how many workers should be hired by comparing the *additional* revenue from hiring each worker (this is called the *marginal revenue product of labor*) with the *cost* of hiring the additional worker, which in this case is always \$30 a day. (The worker wage is called *marginal resource cost*.)

Here is how you do this: First you need to calculate the *marginal physical product* (sometimes referred to as the *marginal product*), which is the *additional* output created by one more worker. You can do this by comparing the level of output with the additional worker to the level of output with *one less* worker.

Next you need to calculate how much revenue Acme will generate when it hires workers. Then you will have to calculate how much *additional* revenue Acme earns by hiring one more worker. You can do this by comparing total revenue at one level of input with total revenue at the next-lowest level of output.

Adapted from *Student Activities to Accompany The People on Market Street Series*, Indiana Council on Economic Education, Purdue Research Foundation, 1983.



Figure 44.2

How Many Workers to Hire per Day for \$2 Yo-Yos

Number of Workers Hired (inputs)	Level of Output (number of yo-yos produced per day) (Q)	Marginal Physical Product (MPP)	Price at Which Yo-yos Can Be Sold	Total Revenue (P x Q)	Marginal Revenue Product (MPP x MR)
0	0	—	\$2.00	\$0	—
1	20	20	2.00	40 = 2 x 20	\$40
2	50		2.00		
3	70		2.00		
4	85		2.00		
5	95		2.00		
6	100		2.00		

1. Why does the number of extra yo-yos produced decrease as more workers are hired?
2. If the wage is \$30 per day, how many workers should Acme hire? Why?
3. If the demand for yo-yos increases so that Acme can sell as many yo-yos as it wants for \$3 each, what effect will this have on Acme's level of employment?
4. To make as much profit as possible, in this case a firm should hire an additional worker as long as that worker's _____ is greater than his or her _____.

The Derived Demand for a Resource

The key to understanding resource prices in factor markets is to see the relationship between demand in the factor market and demand in the product market. You should review the definitions of marginal physical product (MPP), marginal revenue (MR) and marginal revenue product (MRP).

The demand for a resource (land, labor, capital or entrepreneurship) is called *derived demand* because it is derived (comes) from the demand for the goods and services that are produced by these resources.

1. Complete Figure 45.1. The yo-yo manufacturer operates in a perfectly competitive factor market and in a perfectly competitive product market. In a perfectly competitive factor market, market supply and demand determine the price of the factors of production. In a perfectly competitive product market, supply and demand determine the price of the product.



Figure 45.1

Data for a Yo-Yo Manufacturer

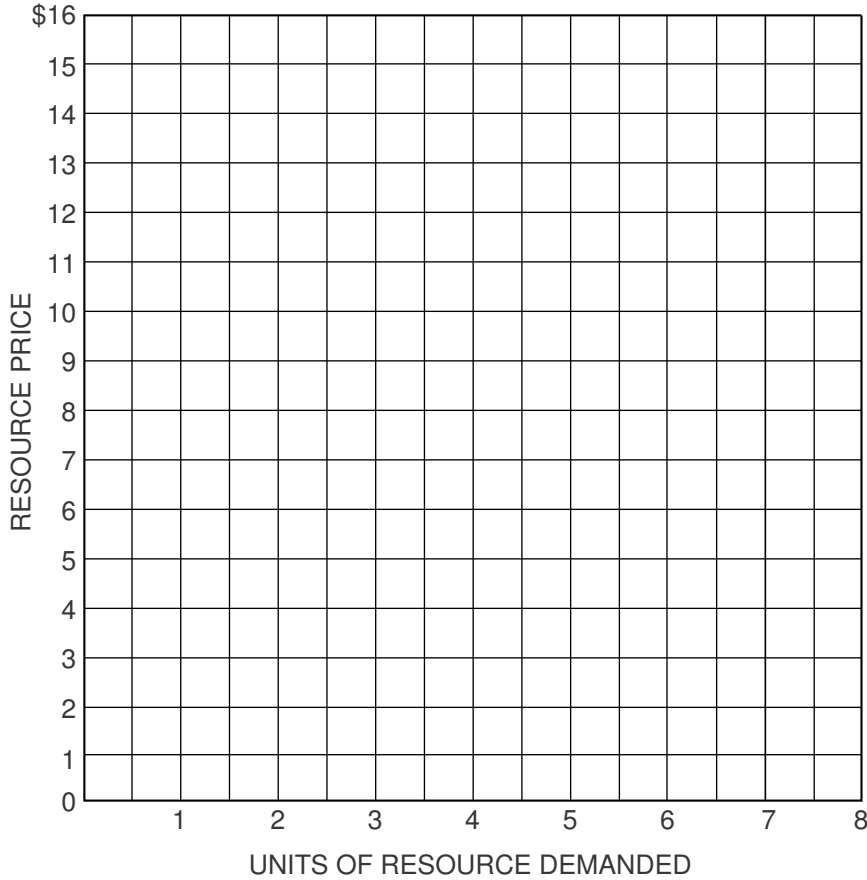
Units of Resource	Total Product	Marginal Physical Product (MPP)	Price at Which Yo-Yos Can Be Sold	Total Revenue (P x Q)	Marginal Revenue Product (MPP x MR)
0	0	—	\$2.00	\$0	—
1	8	8	2.00	16	\$16
2	14	6	2.00	28	12
3	19		2.00		
4	23		2.00		
5	26		2.00		
6	28		2.00		
7	29		2.00		

The marginal revenue product (MRP) shows the additional revenue the firm will receive from the additional output produced by adding another unit of the factor/resource. This can be calculated as $\Delta TR / \Delta \text{Resource}$ or $MPP \times P$. This is the firm's demand curve for the resource.

2. Use the answers in the last column of Figure 45.1 to graph marginal revenue product on Figure 45.2. Label the MRP curve $MRP = D$. Plot each number on the line, not at the midpoint.



Figure 45.2
Price and Quantity for a Resource

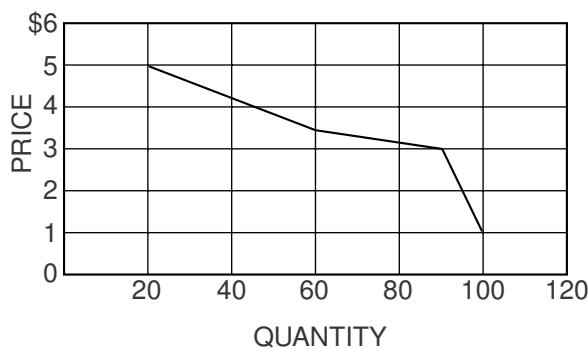


3. MRP depends on two variables. One is marginal physical product (MPP), sometimes referred to as *marginal product*. The second variable is the price of the good or service being produced. For each of the following situations, identify whether MPP of the factor or P of the product is affected and indicate whether the demand for a resource would increase or decrease.

Situation	Marginal Physical Product	Price	Demand for labor (inc. / dec.)
(A) A new yo-yo machine increases productivity of labor			
(B) The price of yo-yos increases			
(C) Better training increases the output of yo-yo labor			
(D) The demand for yo-yos increases			
(E) New technology increases the output of yo-yo labor			
(F) Consumers become sick of yo-yos			

The Only (Yo-Yo) Game in Town

*** Figure 46.1**
Daily Price and Demand for Yo-Yos



Instead of being able to sell as many yo-yos as it wants at \$2 each, suppose that Acme Yo-Yo Company is a monopolist. This means Acme has no direct competition in selling yo-yos (although Acme will face competition from other kinds of toys and games). Acme finds that as a result of its monopolistic position, it can charge a price higher than \$2 if it wants to cut back its production. Acme will, however, have to lower its price to sell additional yo-yos.

What effect will this have on Acme's demand for labor? You can figure this out by using the same procedure you followed when the price stayed constant at \$2. You will have to calculate how much additional revenue will be brought in by hiring one more worker and comparing this extra revenue with the extra cost of hiring the worker (i.e., the wage rate).

You can use the same table you used before, except that now the price changes if more yo-yos are sold.

*** Figure 46.2**
How Many Workers to Hire per Day for Varying Prices of Yo-Yos

Number of Workers Hired (inputs)	Level of Output (number of yo-yos produced per day) (Q)	Marginal Physical Product (MPP)	Price at Which Yo-yos Can Be Sold	Total Revenue (P x Q)	Marginal Revenue Product (change in TR from previous level)
0	0	—	\$0.00	\$0	—
1	20	20	5.00	\$100 = \$5 x 20	\$100
2	50		4.00		
3	70		3.50		
4	85		3.00		
5	95		2.00		
6	100		1.00		

From *Student Activities to Accompany The People on Market Street Series*, Indiana Council on Economic Education, Purdue Research Foundation, 1983

1. How is Acme's demand schedule for labor different now from when it sold all its product for \$2 each?
2. Acme's decision-making rule is the same: If an additional worker adds more to revenue than cost, this worker should be hired. If Acme can still hire workers at \$30 per day, how many workers should Acme hire? Why?
3. How does the number of workers the monopolist hires differ from the number in Activity 45?

Factor Market Pricing

Suppose that the Acme Belt Company (ABC) is a price taker in both the input and output markets—that is, it sells belts in a perfectly competitive market and purchases labor in a perfectly competitive market.

Part A

- Fill in the blank spaces in Figure 47.1. Note that marginal data are placed between levels of employment.



Figure 47.1

Labor Demand for the Perfectly Competitive Firm

Employment Number of Workers (L)	Total Output Per Day (Q)	Marginal Physical Product (MPP) ($\Delta Q / \Delta L$)	Marginal Revenue Product (MPP \times P)	
			$P_B = \$2.00$	$P_B = \$2.50$
0	0		—	—
1	10	10	\$20.00	
2	30	20	40.00	
3	70	40		100.00
4	105		70.00	
5	135	30	60.00	
6	160	25		62.50
7	180		40.00	50.00
8	195	15		
9	205	10	20.00	
10	205			0
11	195	-10		

An individual firm's factor demand curve is restricted to a range of the MRP_L curve that is downward sloping, beginning at $L = 3$ for ABC.

- If the marginal resource cost, or wage, faced by ABC is \$20 and the price of belts is \$2 per belt, then the quantity of labor demanded by ABC is _____.
- If the marginal resource cost, or wage, faced by ABC is \$20 and the price of belts is \$2.50 per belt, then the quantity of labor demanded by ABC is _____.

Activity written by Kelly A. Chaston, Davidson College, Davidson, N.C.

Part B

Now suppose that ABC is one of 1,000 identical firms that purchase labor in this perfectly competitive labor market. To get the market demand curve for labor, we need to sum over each individual firm's MRP_L curve at each given wage. Given our assumption that the firms are identical, we can simply multiply the quantity of labor demanded by a single firm by the number of firms in the market. In Figure 47.2, data are for $P = \$2.00$ and $P = \$2.50$.



Figure 47.2

The Labor Market

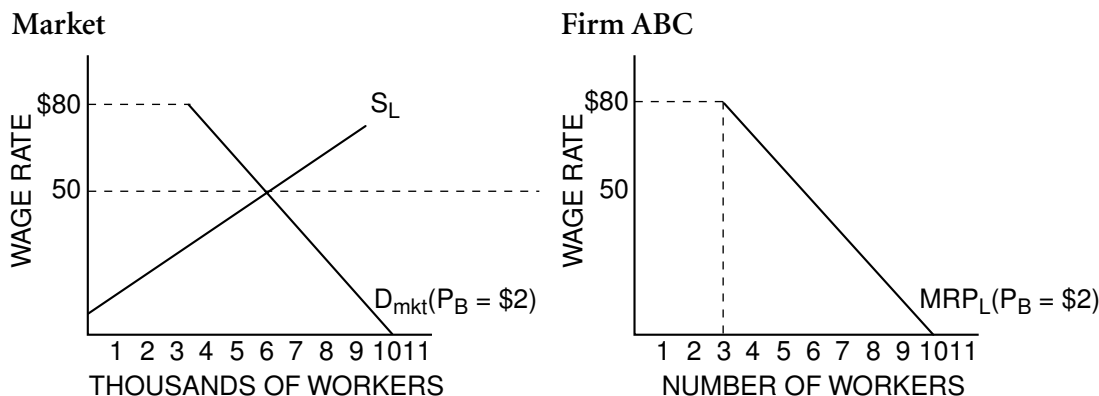
Wage	P = \$2.00			Wage	P = \$2.50		
	Number of Workers Demanded By Firm ABC ($P_b = \$2$)	Number of Workers Demanded In the Market ($P_b = \$2$)	Number of Workers Supplied		Number of Workers Demanded By Firm ABC ($P_b = \$2.50$)	Number of Workers Demanded In the Market ($P_b = \$2.50$)	Number of Workers Supplied
\$20	9	9,000	3,000	\$25.00	9	9,000	3,500
30	8	8,000	4,000	37.50	8	8,000	4,750
40	7	7,000	5,000	50.00	7	7,000	6,000
50	6	6,000	6,000	55.00	6.5	6,500	6,500
60	5	5,000	7,000	62.50	6	6,000	7,250
70	4	4,000	8,000	75.00	5	5,000	8,500
80	3	3,000	9,000	87.50	4	4,000	9,750
				100.00	3	3,000	11,000

4. If the wage is \$20 and the price of belts is \$2 per belt, then the quantity of labor demanded in the market is $1,000 \times$ _____ = _____ units of labor.

Figure 47.3 shows the market labor supply curve as well as the firm and market demand curves when $P_B = \$2$. The supply curve shows that, *ceteris paribus*, as the wage increases, more workers are willing to supply their labor to this market, and existing workers in this market are willing to supply more labor.



Figure 47.3
Market and Firm Demand for Labor



- On the graphs in Figure 47.3 and the table in Figure 47.2, the equilibrium wage in the market is _____. The equilibrium quantity of labor in this market is _____ workers.
- Given that this is a competitive labor market, ABC faces a marginal resource cost, or wage, of _____.
- Because ABC can purchase as much or as little labor as it wants without affecting the market, it is said to face a perfectly elastic labor supply curve. Draw the labor supply faced by the firm in the *Firm ABC* graph above.
- Using a different color pen or pencil, graph ABC's and the market's labor demand curves in Figure 47.3, given that the price of a belt has increased to \$2.50.
- Designate the new market equilibrium based on Figure 47.2. The equilibrium wage in the market is now _____. The equilibrium quantity of labor in this market is now _____ workers.
- What has happened to the labor supply curve faced by the firm?