Chapter 3
The Demand for Labor

Answers to Even-Numbered Review Questions

2. Assume that wages for keyboarders (data entry clerks) are lower in India than in the United States. Does this mean that keyboarding jobs in the United States will be lost to India? Explain.

Answer: Indian data entry clerks will be substituted for American ones only if the ratio of their wage to their marginal productivity is lower. Thus, it is not wage alone that affects the incentives to substitute; marginal productivity is also critical.

4. Suppose that prisons historically have required inmates to perform, without pay, various cleaning and food preparation jobs within the prison. Now suppose that prisoners are offered paid work in factory jobs within the prison walls, and that the cleaning and food preparation tasks are now performed by non-prisoners hired to do them. Would you expect to see any differences in the technologies used to perform these tasks? Explain.

Answer: When inmates were required to work without pay, their wage was essentially zero—and we would expect that prisons to have adopted labor-intensive technologies (using the argument inherent in Equation 3.8c). When wages rise, the cost of expanding output using labor becomes greater, and we expect prisons to adopt the use of more capital in the production process.
6. Suppose the government were to subsidize the wages of all women in the population by paying their employers 50 cents for every hour they worked. What would be the effect on the wage rate women received? What would be the effect on the net wage employers paid? (The net wage would be the wage women received less 50 cents.)

**Answer:** Consider a simple competitive labor market in which the demand and supply of women are both expressed in terms of the wage received by women (which, in the absence of any subsidy, is assumed to be equal to the wage paid by employers). Given the demand curve, $D_0$, and the supply curve, $S_0$, market clearing wage and employment levels will be $W_0$ and $E_0$, respectively.

Suppose the government now subsidizes employers by paying them 50 cents for every hour women work. Viewed in terms of the wage received by women, the employers’ demand curve will shift up by exactly 50 cents (reflecting the fact that this amount will be paid by the government). At the old market clearing wage received by women, $W_0$, the number of women employers want to hire, $E_2$, exceeds the number who are willing to work, $E_0$. This puts upward pressure on the wage received by women, and this wage rises until the excess demand for labor is eliminated. This equilibrium occurs at the wage rate $W_1$, and the employment level $E_1$.

It is clear from the figure that the wage received by women increases by less than 50 cents as long as the supply of labor curve is not vertical (i.e., as long as labor supply is responsive to wages). Indeed, the more responsive labor supply is to the wage rate, the less the women’s wage will rise. Since the wage paid by employers now equals the wage women receive less the 50-cent subsidy, it is also clear that the wage paid by employers declines (by 50 cents minus the increase in the wage women receive).

It is important to stress to students that one would reach identical conclusions if one analyzed the subsidy in terms of the wage employers pay. If supply and demand curves are drawn in terms of this variable, a 50-cent-an-hour subsidy for women would shift the female labor supply curve down by 50 cents. At the old wage paid by employers, the supply of female labor would now exceed the demand. Downward pressure would be placed on the wage paid by employers and it would fall by less than 50 cents (as long as labor supply was responsive to the wage). As a result, the wage received by women would rise by 50 cents less the fall in the wage paid by employers.
8. If anti-sweatshop movements are successful in raising pay and improving working conditions for apparel workers in foreign countries, how will these changes abroad affect labor market outcomes for workers in the apparel and retailing industries in the United States? Explain.

Answer: If increased labor costs abroad are not accompanied by increases in marginal productivity, then there will be incentives to substitute for these foreign workers (with capital or workers elsewhere, including the United States). However, increased costs of manufacturing university apparel also would be expected to reduce sales and the scale of output, which will put downward pressure on employment in the American apparel and retailing industries. The presence of both substitution and scale effects—working in opposite directions—implies that the ultimate effect on American workers in these industries cannot be predicted by theory alone.

Answers to Even-Numbered Problems

2. The marginal revenue product of labor in the local saw mill is \( MR_P = 20 - 0.5L \), where \( L \) = the number of workers. If the wage of saw mill workers is $10 per hour, then how many workers will the mill hire?

Answer: The mill will hire workers until \( MR_P = W \). \( 20 - 0.5L = 10 \) when \( L = 20 \) workers.

4. The output of workers at a factory depends on the number of supervisors hired (see below). The factory sells its output for $0.50 each, it hires 50 production workers at a wage of $100 per day, and needs to decide how many supervisors to hire. The daily wage of supervisors is $500 but output rises as more supervisors are hired, as shown below. How many supervisors should it hire?

<table>
<thead>
<tr>
<th>Supervisors</th>
<th>Output (units per day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>11,000</td>
</tr>
<tr>
<td>1</td>
<td>14,800</td>
</tr>
<tr>
<td>2</td>
<td>18,000</td>
</tr>
<tr>
<td>3</td>
<td>19,500</td>
</tr>
<tr>
<td>4</td>
<td>20,200</td>
</tr>
<tr>
<td>5</td>
<td>20,600</td>
</tr>
</tbody>
</table>

Answer: The firm needs to compare the marginal cost to the marginal revenue of hiring an additional supervisor. The marginal cost is always $500 for each extra supervisor. The marginal revenue is the number of additional units produced times the price of output.

<table>
<thead>
<tr>
<th>Number of Supervisors</th>
<th>MC</th>
<th>MR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$500</td>
<td>$0.50 \times 3800 = $1900</td>
</tr>
<tr>
<td>2</td>
<td>$500</td>
<td>$0.50 \times 3200 = $1600</td>
</tr>
<tr>
<td>3</td>
<td>$500</td>
<td>$0.50 \times 1500 = $750</td>
</tr>
<tr>
<td>4</td>
<td>$500</td>
<td>$0.50 \times 700  = $350</td>
</tr>
<tr>
<td>5</td>
<td>$500</td>
<td>$0.50 \times 400  = $200</td>
</tr>
</tbody>
</table>

The firm will hire three supervisors since the marginal revenue generated from hiring the third supervisor exceeds $500 but the marginal revenue generated from hiring the fourth supervisor is less than $500.
6. The table below shows the number of cakes that could be baked daily at a local bakery, depending on the number of bakers.

<table>
<thead>
<tr>
<th>Number of Bakers</th>
<th>Number of Cakes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td>4</td>
<td>27</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of Bakers</th>
<th>Number of Cakes</th>
<th>MP&lt;sub&gt;L&lt;/sub&gt;</th>
<th>MRP&lt;sub&gt;L&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>8</td>
<td>80</td>
</tr>
<tr>
<td>3</td>
<td>23</td>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>4</td>
<td>27</td>
<td>4</td>
<td>40</td>
</tr>
</tbody>
</table>

a. Calculate the marginal product of labor.
b. Do you observe the law of diminishing marginal returns? Explain.
c. Suppose each cake sells for $10. Calculate the marginal revenue product of labor.
d. Draw the marginal revenue product of labor curve, which is the demand curve for bakers.
e. If each baker is paid $80 per day, how many bakers will the bakery owner hire, given that the goal is to maximize profits? How many cakes will be baked and sold each day?

**Answer:** a.
d. The demand for labor is the MRP\(_L\) curve:

![Graph of MRP\(_L\) curve]


e. If each baker is paid $80 per day, 2 bakers would be hired and 18 cakes would be baked and sold daily.

8. The demand curve for gardeners is \(G_D = 19 - W\), where \(G\) = the number of gardeners and \(W\) = the hourly wage. The supply curve is \(G_S = 4 + 2W\).

a. Graph the demand curve and the supply curve. What is the equilibrium wage and equilibrium number of gardeners hired?

b. Suppose the town government imposes a $2 per hour tax in all gardeners. Indicate the effect of the tax on the market for gardeners. What is the effect on the equilibrium wage and the equilibrium number of gardeners hired? How much does the gardener receive? How much does the customer pay? How much does the government receive as tax revenue?

**Answer:**

![Graph of demand and supply curves with tax]

- a.
To calculate the equilibrium wage and equilibrium quantity:

\[
GD = GS \\
19 - W = 4 + 2W \\
15 = 3W \\
W = 5 \quad \text{[equilibrium wage]}
\]

Next solve for equilibrium quantity:

\[
GD = 19 - W = 19 - 5 = 14 \quad \text{[equilibrium quantity]}
\]

b. With the imposition of the tax on gardeners, the new supply is \( GS = 4 + 2(W - 2) \).

To calculate the equilibrium wage and equilibrium quantity:

\[
GD = GS \\
19 - W = 4 + 2(W - 2) \\
19 - W = 2W \\
3W = 19 \\
W = 19/3 = 6.33 \quad \text{[equilibrium wage]}
\]

Next solve for equilibrium quantity:

\[
GD = 19 - W = 19 - 6.33 = 12.67 \quad \text{[equilibrium quantity]}
\]

With the imposition of the tax, the customer pays $6.33 per hour to the gardener. The government collects the tax of $2.00 per hour, the gardener keeps $4.33 per hour, and total tax revenues are $25.34 ($2 per hour from 12.67 gardeners).

## Suggested Essay Questions

1. Retirees often have limited incomes but live in homes on which the property tax liabilities are relatively high; as a result, they often have to sell their homes and move to smaller, cheaper housing. A town in New York State recently decided to allow senior citizens the option of working for the town, at an implicit wage of $7 per hour, as a way of paying their property taxes; as a part of this program, the town pledged not to assign such seniors to jobs performed by regular employees.

Assume that the lowest wage paid to any regular employee of the town is $10, and that the town government seeks to make the most of its resources. Use economic theory to analyze the worth to the town of the tasks that will be performed by seniors. Is the loss of tax revenues likely to be offset by the labor provided?

**Answer:** The town will seek to hire workers until the marginal revenue product of labor (\( \text{MRP}_L \)) equals the wage paid. Regular employees will be hired until their \( \text{MRP}_L \) equals $10. Seniors will be hired to perform tasks that have an \( \text{MRP}_L \) of at least $7 per hour, but because they will not compete with regular workers, their \( \text{MRP}_L \) will be less than $10. The city will lose revenues of $X, which were formerly spent buying labor services that were worth at least $10 per hour, and instead will now be using that $X to purchase services worth between $7 and $10 per hour.
2. A December 2007 issue of The Economist contained the following quote in an article about Germany: “The government has just chopped the payroll tax that finances unemployment insurance, which should encourage employment.” Comment on this statement, using economic theory.

**Answer:** Cutting the payroll tax will shift the labor demand curve (when stated in terms of employee wages) to the right, but how this rightward shift affects employment depends on the shape of the labor supply curve. The steeper the supply curve, the smaller will be the employment gains and the larger will be increases in the wages paid to workers. If the supply curve is vertical, all of the shift will show up as a wage gain, and there will be no employment increases.
Chapter 6
Supply of Labor to the Economy: The Decision to Work

■ Answers to Even-Numbered Review Questions

2. Evaluate the following quote: “Higher take-home wages for any group should increase the labor force participation rate for that group.”

Answer: This quotation is correct, because for labor force participation decisions, the substitution effect dominates the income effect. The strength of the income effect is relatively weaker when the initial hours of work are smaller. When initial hours of work are zero—as is the case when a person is out of the labor force—then the income effect is zero if leisure is a normal good (increased resources cannot induce one to increase the consumption of leisure, since leisure hours are already at their maximum).

4. The way the workers’ compensation system works now, employees permanently injured on the job receive a payment of $X each year whether they work or not. Suppose the government were to implement a new program in which those who did not work at all got $0.5X but those who did work got $0.5X plus workers’ compensation of 50 cents for every hour worked (of course, this subsidy would be in addition to the wages paid by their employers). What would be the change in work incentives associated with this change in the way workers’ compensation payments are calculated?

Answer: This change in workers’ compensation has two effects. First, it reduces the subsidy for people who do not work from $X to $0.5X. This reduction in income by itself would produce an income effect that tends to induce the injured worker to work more (he or she is poorer if not working than under the previous workers’ compensation system). On the other hand, for those who work, the wage rate is increased by 50 cents an hour. (We assume here that the change in workers’ compensation payments is not so large as to influence market wages.) The increased wage by itself would tend to induce injured workers to work more because the cost of leisure has risen by 50 cents an hour; however, the eventual outcome is theoretically unclear.

The effects of these changes can be seen in the figure below.
Along segment $DE$ there is a clear-cut strengthening of work incentives. Segment $DE$ has a steeper slope than the previous budget constraint ($BQ$) and it also lies to the southwest of $BC$. Thus, along segment $DE$ there is a substitution effect inducing more work and an income effect that also induces more work. To the left of Point E, however, along segment $EF$, there are income and substitution effects that work in opposite directions. Along segment $EF$ the 50-cents-an-hour increase in the wage rate is sufficient to increase the injured worker’s income under workers’ compensation, thereby creating an income effect that reduces work incentives, other things equal. However, the substitution effect of the increased wage continues to exert an increase in work incentives, and the outcome of the two effects is not predictable in advance.

Thus, if the tangency point between the worker’s indifference curve and the full budget constraint used to be along $BC$ but to the right of Point E, the worker faces a clear-cut strengthening of work incentives under the new program. If, however, the worker’s tangency point along $BC$ was to the left of Point E, the new program would have an unpredictable effect on work incentives.

6. In 2002, a French law went into effect that cut the standard work week from 39 to 35 hours (workers got paid for 39 hours even though working 35), while at the same time prohibiting overtime hours from being worked. (Overtime in France is paid at 25% above the normal wage rate.) (a) Draw the old budget constraint, showing the overtime premium after 39 hours of work. (b) Draw the new budget constraint. (c) Analyze which workers in France are better off under the 2002 law. Are any worse off? Explain.

Answer: In the drawing below, the old (pre-2002) constraint is $ABC$, where slope of $BC$ is 25% greater (in absolute value) than the slope of $AB$. The constraint created by the new law is $ADE$, where earnings at $D$ are equal to those at $B$, and the slope of $DE$ is horizontal (workers cannot get paid for more than 35 hours of work).

Workers who used to work 39 hours per week are clearly better off under the new law. Those who worked more than 39, but whose tangency point was close to $B$, will also be better off if their original utility-maximizing indifference curve passed below Point $D$. However, for those whose original utility-maximizing indifference curves passed above Point $D$ (almost surely the case for most of those with original tangencies along $BC$), utility will fall under the new law.

8. The Tax Reform Act of 1986 was designed to reduce the marginal tax rate (the tax rate on the last dollars earned) while eliminating enough deductions and loopholes so that total revenues collected by
the government could remain constant. Analyze the work incentive effects of tax reforms that lower marginal tax rates while keeping total tax revenues constant.

**Answer:** Reducing the marginal tax rate has the effect of increasing the wage rate, because workers are allowed to keep more from any extra hours worked. Keeping tax revenues constant suggests that workers’ after-tax incomes also remain constant. Thus, the Tax Reform Act tended to increase the wage while keeping workers’ incomes constant—creating a pure substitution effect that tended to increase hours of work.

10. Assume that the current Disability Insurance (DI) benefit for those who are unable to work is $X per day, and that DI benefits go to zero if a worker accepts a job for even one hour per week. Suppose that the benefit rules are changed so those disabled workers who take jobs that pay less than $X per day receive a benefit that brings their total daily income (earnings plus the DI benefit) up to $X. As soon as their labor market earnings rise above $X per day, their disability benefits end. Draw the old and new budget constraints (label each clearly) associated with the DI program, and analyze the work incentive effects of the change in benefits.

**Answer:** The old constraint is $ABC$ in the below diagram; the new one is $BADC$.

![Diagram](image)

There is no change in the incentives to work (as long as indifference curves slope down).

### Answers to Even-Numbered Problems

2. Nina is able to select her weekly work hours. When a new bridge opens up, it cuts one hour off Nina’s commute to work. If both leisure and income are normal goods, what is the effect of the shorter commute on Nina’s work time?

**Answer:** When the new bridge opened, Nina’s budget constraint shifted to the right in a parallel fashion as the amount of available time for either work or leisure (as opposed to commuting) was increased. This shift in her constraint created an income effect (she can now work more and consume more leisure). Because both income and leisure are normal goods, both would increase. The only way income can increase in this case is for her to work more, so we must conclude that her extra hour per day from the shorter commute is divided in some way between more work and more leisure. Therefore, she works more.

4. The federal minimum wage was increased on July 24, 2007 to $5.85 from $5.15. If 16 hours per day are available for work and leisure, draw the daily budget constraint for a worker who was earning the minimum wage rate of $5.15 and the new budget constraint after the increase.

**Answer:**
6. Stella can work up to 16 hours per day at her job. Her wage rate is $8.00 per hour for the first 8 hours. If she works more than 8 hours, her employer pays “time and a half.” Draw Stella’s daily budget constraint.

Answer:

Stella’s earnings are equal to the following:

\[
[\text{Number of hours (within first 8 hours)} \times 8] + [\text{Number of hours (among next 8 hours)} \times 12].
\]

The budget constraint for the first 8 hours of work is the segment to the right of the dotted vertical line at 8 hours. The budget constraint for subsequent hours of work is the segment to the left of the dotted vertical line at 8 hours.

Suggested Essay Questions

1. Currently, the U.S. Department of Transportation has a rule that allows commercial truck drivers to drive up to 90 hours per week; after 40 hours per week, drivers’ hourly pay goes up by 50%. A proposed rule would reduce this limit to 60 hours per week. Assume truck drivers currently drive more than 60 hours per week. Ignoring the safety aspects of the proposed rule, use economic theory to analyze the likely effects of this new rule on the utility of truck drivers. Use a graph to support your analysis.
2. Suppose a country passes a law that cuts the standard work day from 8 to 7 hours. Overtime (hours worked per day beyond the “standard” workday) in this country is paid at 50% above the normal wage rate. Please answer the following questions related to the work incentives facing workers in this country:

a. Draw the old budget constraint (in leisure/income space), showing the overtime premium after 8 hours of work per day.

b. On your diagram in (a), draw in the new budget constraint.

c. Use your diagrams in (a) and (b) to analyze the change in work incentives facing workers in this country as a result of this new law.

Answer:

For those already working overtime, there will be pure income effect reducing overtime hours. For those working between 7 and 8 hours before, there will be a wage increase, producing both income and substitution effects; these effects will tend to work in opposite directions, producing an ambiguous prediction for hours of work (except for those working exactly 7 hours before; for them, the substitution effect dominates and more hours of work will be offered).

For those working a bit less than 7 hours before, some will now work overtime (more than 7 hours); others working less than 7 hours may have such steep indifference curves that their labor supply behavior will be unaffected.
Chapter 8
Compensating Wage Differentials and Labor Markets

Answers to Even-Numbered Review Questions

2. Statement 1: “Business executives are greedy profit maximizers, caring only for themselves.”
   Statement 2: “It has been established that workers doing filthy, dangerous work receive higher wages, other things equal.” Can both of these statements be generally true? Why?
   Answer: Both statements can be simultaneously true. If workers are informed about job hazards and have a choice about the jobs they take, their behavior will force even the most greedy executives to pay higher wages for filthy, dangerous work. Even the greediest profit maximizer must obtain a work force, and to do so must pay a wage that workers will accept. If workers have alternative job offers that pay the same wage but offer better working conditions, they will accept those offers and turn down work at the more dangerous or filthy workplaces. Their behavior then will force owners to either pay the compensating wage differentials or clean up the workplace.

4. A recent article stated, “Workers in low-wage jobs lack the basic security, the health benefits, and the flexibility in their work lives that most American workers take for granted.” Assuming this statement is true, do these facts contradict the theory of compensating wage differentials?
   Answer: The theory of compensating differentials predicts that, other things equal, jobs with low non-wage benefits would have to pay higher wages. This statement is implicitly comparing those in low-skilled jobs with those in high-skilled jobs, where clearly “other things” are not comparable. Thus, the facts in this statement do not contradict the theory of compensating wage differentials.
6. Suppose Congress were to mandate that all employers had to offer their employees a life insurance policy worth at least $50,000 in the event of death. Use economic theory, both positively and normatively, to analyze the effects of this mandate on employee well-being.

**Answer:** From the perspective of positive economics, mandating that employers offer at least $50,000 in life insurance will obviously have no effect on those who are already offering that much or more, but it will add to the costs of those who were previously offering less. To be competitive in the labor market, those previously offering less must have been compensating their workers in some other way (to make their jobs as attractive as those of their competitors). It is thus likely that low-insurance employers were paying higher wages than those offering more insurance. To now compete with their competitors in the product market, the affected employers must reduce their wages (to keep overall costs in the competitive range). Thus, the wages in firms previously offering less insurance will decline. Of course, if wages do not, or cannot, decline by enough to fully offset the added costs of more insurance, then employment among these employers will fall.

From the perspective of normative economics, we would like to know if this mandate improves the welfare of the workers affected. If the labor market is perfectly functioning, workers are able to obtain the combination of wages and life insurance that maximizes their utility. If the mandate forces them to take some other mix, then their utility will decline. If the market is not allowing workers to “buy” (in the form of lower wages) the life insurance they want, then mandating increased insurance could improve the welfare of affected workers (as long as the mandate does not require workers to buy more than they are willing to pay for).

8. “The concept of compensating wage premiums for dangerous work does not apply to industries like the coal industry, where the union has forced all wages and other compensation items to be the same. Because all mines must pay the same wage, compensating differentials cannot exist.” Is this statement correct? (Assume wages and other forms of pay must be equal for dangerous and non-dangerous work and consider the implications for individual labor supply behavior.)

**Answer:** This statement is not correct. To understand how the market would adjust, let us assume that we have a set of relatively safe coal mines and a set of relatively dangerous coal mines. Both sets of mines must pay the same wage rate and offer the same fringe benefits.

They both advertise for help and, assuming workers quickly find out which mines are safe and which are dangerous, the safe mines receive many more applications than the dangerous mines. The safe mines can thus be highly selective about the applicants they choose, and they will tend to hire the most dependable, hardest working, most motivated employees. The dangerous mines, with very few applicants, will have to take who they can get (those workers not chosen to work in the safe mines). Safe mines will have high quality, highly productive workers getting wage $X, while the dangerous mines will have lower quality workers obtaining the same wage. Thus, workers of unequal productivity would receive the same wage, and this is tantamount to the receipt of a compensating wage differential.

Put differently, the theory of compensating wage differentials says that people of equal skill will receive different wages when working conditions differ. But a natural corollary of this is that, when working conditions differ, people of different skills might receive the same wage. In both cases workers in less desirable circumstances receive higher wages than they would otherwise receive.
10. In 2005, a federal court authorized United Air Lines (UAL) to terminate its pension plan. The government will take over pension payments to retired UAL employees, but this action means that pension benefits will be less than promised by UAL to both its current retirees and current workers. What future labor-market effects would you expect to occur from this sudden and unexpected reduction of pension benefits?

**Answer:** If the labor market is working well, a compensating wage differential will arise to compensate for the reduced pension benefits; thus wages will tend to rise. The effects on employment levels are ambiguous. The labor demand curve (expressed in terms of wages) will tend to shift to the right as employee benefits are reduced, while the labor supply curve will shift left at each given wage rate.

### Answers to Even-Numbered Problems

2. Consider the conditions of work in perfume factories. In New York perfume factories, workers dislike the smell of perfume, while in California workers appreciate the smell of perfume, provided that the level does not climb above $S^*$. (If it rises above $S^*$, they start to dislike it.) Suppose that there is no cost for firms to reduce or eliminate the smell of perfume in perfume factories and assume that the workers have an alternative wage, $W^*$.

Draw a diagram using isocost and indifference curves that depicts the situation. (The New York and California isocost curves are the same, but their indifference curves differ.) What level of perfume smell is there in the New York factories? In the California factories? Is there a wage differential between the California and New York workers?

**Answer:** See the figure below. The California workers are paid exactly the same as the New York workers. This wage equals $W^*$. The level of smell in California is $S^*$; in New York it is 0.
4. The following two figures represent the labor market for two industries that require workers with the same skills and experience; however, Industry B is characterized by much noisier working conditions than Industry A. What is the compensating wage differential between the two industries?

![Industry A and Industry B graphs](image)

**Answer:** The equilibrium wage in Market A is $6.00. The equilibrium wage in Market B is $7.00. Market B, which is characterized by noisy working conditions, needs to offer a higher wage in order to attract workers. The compensating wage differential is $1.00 per hour.

6. The demand for labor in Occupation A is \( L_D = 20 - W \), where \( L_D \) = number of workers demanded for that occupation, in thousands. The supply of labor for Occupation A is \( L_A = -1.25 + 0.5\,W \). For Occupation B, the demand for labor is similar but the supply of labor is \( L_B = -0.5 + 0.6\,W \), which is indicative of a more pleasant work environment associated with that occupation in comparison with Occupation A. What is the compensating wage differential between the two occupations?

**Answer:** a. Occupation A:

\[
L_D = L_A \\
20 - W = -1.25 + 0.5\,W \\
21.25 = 1.5\,W \\
$14.17 = W
\]

Occupation B:

\[
L_D = L_B \\
20 - W = -0.5 + 0.6\,W \\
20.5 = 1.6\,W \\
$12.81 = W
\]

The compensating wage differential is $1.36 per hour ($14.17 – $12.81).
Suggested Essay Questions

1. Currently, the U.S. Department of Transportation has a rule that allows commercial truck drivers to drive up a limit of 90 hours per week; after 40 hours per week, drivers’ hourly pay goes up by 50%. A proposed rule would reduce this limit to 60 hours of driving per week. One supporter of the proposal said this: “Almost no drivers are choosing to work 90 hours per week; drivers will welcome the added time away from the job.” Suppose that the proposal passes, and a subsequent study shows that after the new limit took effect, the straight-time wages of truck drivers rose, other things equal. Using economic theory, comment on this finding in the context of the quotation above; explain fully.

Answer: If drivers were working 90 hours a week because they were compelled to, the new regulation would make them better off, and they should be attracted to the job at lower wages. If, however, drivers were working 90 hours a week by choice, cutting their hours to 60 would represent a reduction in their utility (they could have chosen 60 hours of work before, but chose 90 instead). The job would thus become less attractive to them, and to attract drivers, trucking firms would have to raise wages. Thus, the increase in wages would indicate that the truckers were working more than 60 hours a week by choice.

2. Courts in Japan have recently begun to make awards to the families of workers who have been judged to have been “worked to death.” That is, employers have been increasingly required by courts to make large financial payments to the heirs of workers whose hours of work have been so long that they are judged to have played a role in causing their death. How is the growth in these awards likely to affect wages in occupations or industries that require long hours of work? Why?

Answer: From the perspective of workers, the attractiveness of jobs requiring very long hours of work rises with these awards, which can be thought of as a form of life insurance. Thus, this new “benefit” provides an added inducement to enter these jobs, and the compensating wage differential needed to attract workers into these jobs should fall. On the demand side of the market, employers requiring long hours of work will want less labor at each potential wage rate, which will move the labor demand curve to the left. The rightward shift of supply and leftward shift in demand will serve to reduce wages, but its effects on employment in long-hour jobs is ambiguous.
Chapter 9
Investments in Human Capital:
Education and Training

Answers to Even-Numbered Review Questions

2. “The vigorous pursuit by a society of tax policies that tend to equalize wages across skill groups will frustrate the goal of optimum resource allocation.” Comment.

Answer: As indicated in Chapter 1 and elsewhere, the optimum allocation of resources requires that all mutually beneficial transactions be accomplished. If wages are forced toward equality by government fiat, potentially beneficial human capital transactions may be discouraged. That is, because the acquisition of training and education is costly, human capital investments will not be undertaken unless there is a future return to them. These returns normally are in the form of higher wages paid to those with the higher skill levels, and if these higher wages cannot be paid, human capital investments that might have been made will be discouraged. Thus, the pursuit of wage equalization across skill levels will discourage human capital investment and may result in too few workers entering skilled occupations.

4. When Plant X closed, Employer Y (which offers no training to its workers) hired many of X’s employees after they had completed a lengthy, full-time retraining program offered by a local agency. The city’s Equal Opportunity Commission noticed that the workers Employer Y hired from X were all young, and it launched an age-discrimination investigation. During this investigation Employer Y claimed that it hired all of the applicants from X who had successfully completed the retraining program, without regard to age. From what you know of human capital theory, does Y’s claim sound credible? Explain.

Answer: Y’s claim is consistent with human capital theory in two respects. First, its own hiring and training costs appear to be negligible (we are told that it offers no training on its own, and that its hiring standards consist of taking successful graduates of another program). Because it makes no major investments in its workers, it therefore has no reason to prefer younger workers. Second, because the retraining program to which X’s former employees had access was “lengthy,” it may well be that only the younger workers from X decided to invest in this retraining. All workers have to decide whether a human capital investment opportunity will have expected benefits (properly discounted to the present) that are at least equal to the costs, and a shorter period over which benefits are received reduces these benefits. Thus, older workers are less likely to have decided to invest in retraining—with the result that only the younger workers became qualified to apply to Employer Y.

6. A study shows that, for American high school dropouts, obtaining a General Equivalency Degree (GED) by part-time study after high school has very little payoff. It also shows, however, that for immigrants who did not complete high school in their native countries, obtaining a GED has a relatively large payoff. Can signaling theory be used to explain these results?

Answer: Graduating from high school is more or less the expectation for American students, and those who drop out may be viewed as having a low aptitude (or low tolerance) for learning, even if they later obtain a GED. Immigrants may come from countries in which high schools are either more demanding or less available, so dropping out may not send the same signal of low aptitude or tolerance. If, though a GED, these immigrants are certified as knowing the equivalent of American high school graduates, employers may prefer them to American GED recipients, other things equal.
8. Many crimes against property (burglary, for example) can be thought of as acts that have immediate gains but run the risk of long-run costs. If imprisoned, the criminal loses income from both criminal and non-criminal activities. Using the framework for occupational choice in the long run, analyze what kinds of people are most likely to engage in criminal activities. What can society do to reduce crime?

**Answer:** Committing a crime like burglary is essentially the mirror image of a human capital investment, because with an investment costs are borne in the present and the returns come later. Characteristics that tend to reduce the expected costs of committing a crime are a high discount rate (a “present orientation”) and relatively poor earnings prospects in the labor market (less to lose by being jailed).

To reduce crime, society needs to reduce the immediate benefits or increase the expected future costs of committing a crime. Reducing the benefits could be accomplished by installing protective devices that make burglaries less likely to succeed. Increasing the costs can be done by increasing the likelihood of catching thieves, increasing the length of incarceration, or raising the labor-market earnings potential of those currently with the least to lose.
10. The following statement was overheard at a party: “It is just not right that Joe, who never went to college, makes more than Ken, who has a master’s degree. People with higher degrees deserve to earn more!” Use human capital theory to comment on this quotation.

**Answer:** Earnings are influenced by many factors other than education, including experience, compensating wage differentials for job characteristics or employee benefit levels, and luck. Those who make educational investments expect a return, in terms of either money or utility, and they will not invest if the expected returns are too low. However, actual returns are subject to both demand and supply forces, which cannot be perfectly anticipated. Expectations, then, are not always realized. Thus, Ken may make less than Joe for a variety of reasons. In any event, human capital theory addresses the issue of what is required for an investment to be made, not what people “deserve” in some moral sense.

### Answers to Even-Numbered Problems

2. (Appendix) Suppose the supply curve for optometrists is given by $L_s = -6 + 0.6W$, while the demand curve is given by $L_d = 50 - W$, where $W =$ annual earnings in thousands of dollars per year and $L =$ thousands of optometrists.

   a. Find the equilibrium wage and employment levels.
   b. Now suppose that the demand for optometrists increases and the new demand curve is $L_d' = 66 - W$. Assume that this market is subject to cobwebs because it takes about 3 years to produce people who specialize in optometry. While this adjustment is taking place, the short-run supply of optometrists is fixed. Calculate the wage and employment levels in each of the first three rounds and find the new long-run equilibrium. Draw a graph to show these events.

   **Answer:**
   
   a. Initial equilibrium $W = $35, $L = 15$. (Find this by setting $L_s = -6 + 0.6W = L_d = 50 - W$ and solving for $W$.)
   
   b. First round: $L$ is still 15, so $W = $51. This is Point A in the figure below. (Find $W$ by plugging $L = 15$ into the new $L_d$ equation.)
Second round: Labor supply reacts to first round wage, $L = 24.6$, but this pushes $W$ down to $41.4$ (at Point C). Find this by plugging $W = 51$ into the $L_s$ equation to find $L = 24.6$, and then plugging $L = 24.6$ into the new $L_d$ equation.

Third round: Labor supply reacts to second round $W, L = 18.84$, but this pushes $W$ up to $47.16$ (see Point E). Find this by plugging $W = 41.4$ into the $L_s$ equation to find $L = 18.84$ and then plugging $L = 18.84$ into the new $L_d$ equation.

Long-run equilibrium, $W = 45, L = 21$. (Find this by setting $L_s = -6 + 0.6W = L_d = 66 - W$ and solving for $W$.)

4. Prepaid college tuition plans, also known as Prepaid Education Arrangements (PEAs), allow you to prepay college tuition at present-day prices. The value of the investment is guaranteed by the state to cover college tuition, regardless of its future cost. You are considering the purchase of an education certificate for $25,000, which will cover the future tuition costs of your 8-year old daughter. You expect the tuition cost of your daughter’s bachelor’s degree to be $50,000 in 10 years. What would your personal discount rate need to be in order for it to be worthwhile for you to make the investment and purchase the certificate?

Answer: For a PEA to be worthwhile, its present value to you now must be at least $25,000.

In 10 years, the PEA will be worth $50,000, and its present value to you now is $50,000/(1 + r)^{10}$, where $r$ is your personal discount rate. Thus,

$$
\frac{50,000}{(1 + r)^{10}} = 25,000,
\frac{50,000}{25,000} = (1 + r)^{10}
2 = (1 + r)^{10}
(1 + r) = (2)^{1/10}
(1 + r) = 1.0718
r = 0.0718
$$

Your personal discount rate needs to be 7.18% or less for the PEA to be worth investing in.

# Suggested Essay Questions

1. A recent report by the “Lisbon Council” concluded that eastern European (formerly Communist) countries were experiencing a significant “brain drain,” with university-educated workers migrating from the east to western European countries. The report also noted that these eastern countries were investing less in human capital than countries in the west, and it concluded that the eastern countries should substantially increase their investments in university education. Using economic theory, comment on the consistency between these two conclusions, explaining your reasoning in detail.

Answer: If workers in eastern Europe are leaving for western Europe, it is likely that the returns to educational investments captured by workers (the “private” returns) are lower in the east. As noted in Chapter 9, societies will want to invest their scarce capital resources in projects that yield the highest returns, and if educational investments are yielding relatively low returns, higher levels of investment are not indicated. Thus, unless the “private” returns to education are much less than the overall (“social”) returns, the Lisbon Council’s recommendation is not justifiable.
2. Some politicians in countries that are the recipients of large numbers of immigrants advocate adopting laws requiring immigrants to learn the local language within a specified period of time. One economist, commenting on such a proposed law, said the following: “These laws are unnecessary, as the market provides incentives to learn the local language.”

Use economic theory to describe the likely mechanism provided by the labor market to learn the local language. Analyze the characteristics of immigrants who are most likely to learn the new language.

**Answer:** Learning a new language requires an investment. Costs (of tuition, books, effort, and time) are spent in the present and the benefits are realized later. These benefits are most likely to be in the form of higher wages (as more occupations become open to the immigrant), although there are other gains from being able to communicate for social or consumption purposes. The immigrants likely to realize the largest benefits are those who want to be in jobs requiring more than just simple communication with natives.

Using human capital theory, we can theorize that immigrants more likely to invest in learning the language are those for whom the yearly benefits are larger (those living and working outside of immigrant enclaves), those who intend to remain in their new country, those who are younger, those who learn more quickly, and those who have a lower personal discount rate.