6-1. Politicians who support the green movement often argue that it is profitable for firms to pursue a strategy that is “environmentally correct” (for example, by building factories that do not pollute and are not noisy), because workers will be willing to work in environmentally correct factories at a lower wage rate. Evaluate the validity of this claim.

If it is profitable for firms to build factories that do not pollute and are not noisy, they would have been built already. After all, firms could build these profit-maximizing factories and attract persons to work at these factories at lower wages because no compensating differential would be needed. The fact that compensating differentials exist and that governments attempt to regulate the quality of the workplace implies that providing these amenities to workers is more costly than cost-saving.

6-2. Suppose wages and health insurance are the only two job characteristics workers care about. Describe the relationship between the wage level in a particular job and whether the job offers health insurance if the government does not require employers to offer health insurance to their workers. What happens to the wage structure if the government requires all firms to provide a standard package of health insurance to their workers?

When the government does not require employers to offer health insurance, workers would prefer to work in those firms that offer health insurance and would be willing to pay for the right to work in such firms (assuming that all workers prefer to have health insurance). In other words, jobs that offered health insurance would pay less than jobs that did not offer such plans. When the government mandates that all employers offer health insurance to workers, the wage in those firms that had provided either no health insurance or a “substandard” package would fall and the wage would eventually be the same in all jobs.

6-3. Workers choose to work a risky or a safe job. Suppose there are 100 workers in the economy. Worker 1’s reservation price (for accepting the risky job) is $1; worker 2’s reservation price is $2, and so on. Because of technological reasons, there are only 10 risky jobs. What is the equilibrium wage differential between safe and risky jobs? Which workers will be employed at the risky firm?

Suppose now that an advertising campaign paid for by the employers who offer risky jobs stresses the excitement associated with “the thrill of injury,” and this campaign changes the attitudes of the work force toward being employed in a risky job. Worker 1 now has a reservation price of -$10 (that is, she is willing to pay $10 for the right to work in the risky job); worker 2’s reservation price is -$9, and so on. There are still only 10 risky jobs. What is the new equilibrium wage differential?

The supply curve to the risky job is given by the fact that worker 1 has a reservation price of $1, worker 2 has a reservation price of $2, and so on. As the figure below illustrates, this supply curve (given by $S$) is upward sloping, and has a slope of 1. The demand curve ($D$) for risky jobs is perfectly inelastic at 10 jobs. Market equilibrium is attained where supply equals demand so that 10 workers are employed in risky jobs; the market compensating wage differential is $10 since this is what it takes to entice the marginal (tenth) worker to accept a job offer from a risky firm. Note that the firm employs those workers who least mind being exposed to risk.

If tastes towards risk change, the supply curve shifts down to $S'$ and the market equilibrium is attained when the compensating wage differential is -$1. This is the compensating differential required to hire the marginal worker (that is, the 10th worker). Note that this compensating differential implies that even
though most workers (from worker 12 onwards) dislike risk, the market determines that risky jobs will pay less than safe jobs.

6-4. Suppose all workers have the same preferences represented by

$$U = \sqrt{w} - 2x,$$

where $w$ is the wage and $x$ is the proportion of the firm’s air that is composed of toxic pollutants. There are only two types of jobs in the economy, a clean job ($x = 0$) and a dirty job ($x = 1$). Let $w_o$ be the wage paid by the clean job and $w_i$ be the wage paid by the polluted job. If the clean job pays $16 per hour, what is the wage in dirty jobs? What is the compensating wage differential?

If all persons have the same preferences regarding working in a job with polluted air, market equilibrium requires that the utility offered by the clean job be the same as the utility offered by the dirty job, otherwise all workers would move to the job that offers the higher utility. This implies that:

$$\sqrt{w_o} - 2(0) = \sqrt{w_i} - 2(1) \implies \sqrt{16} = \sqrt{w_i} - 2.$$

Solving for $w_i$ implies that $w_i = \$36$. The compensating wage differential, therefore, is $\$20$. 

![Diagram of compensating differential and employment](image.png)
6-5. Suppose a drop in the compensating wage differential between risky jobs and safe jobs has been observed. Two explanations have been put forward:

- Engineering advances have made it less costly to create a safe working environment.
- The phenomenal success of a new action serial “Die On The Job!” has imbued millions of viewers with a romantic perception of work-related risks.

Using supply and demand diagrams show how each of the two developments can explain the drop in the compensating wage differential. Can information on the number of workers employed in the risky occupation help determine which explanation is the right one?

The engineering advances make it cheaper for firms to offer safe jobs, and hence reduce the gain from switching from a safe environment to a risky one. This will shift the demand curve for risky jobs in and reduce the compensating wage differential (Figure 1). Note that the equilibrium number of workers in risky jobs goes down.

The glamorization of job-related risks may make people more willing to take these risks. This shifts supply to the right and reduces the compensating differential (Figure 2). Note that the equilibrium number of workers in risky jobs goes up.

Thus, information on whether employment in the risky sector increased or decreased can help discern between the two competing explanations.

Figure 1. Labor Market for Risky Jobs
6-6. Consider a competitive economy that has four different jobs that vary by their wage and risk level. The table below describes each of the four jobs.

<table>
<thead>
<tr>
<th>Job</th>
<th>Risk (r)</th>
<th>Wage (w)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1/5</td>
<td>$3</td>
</tr>
<tr>
<td>B</td>
<td>1/4</td>
<td>$12</td>
</tr>
<tr>
<td>C</td>
<td>1/3</td>
<td>$23</td>
</tr>
<tr>
<td>D</td>
<td>1/2</td>
<td>$25</td>
</tr>
</tbody>
</table>

All workers are equally productive, but workers vary in their preferences. Consider a worker who values his wage and the risk level according to the following utility function:

\[ u(w, r) = w + \frac{1}{r^2}. \]

Where does the worker choose to work? Suppose the government regulated the workplace and required all jobs to have a risk factor of 1/5 (that is, all jobs become A jobs). What wage would the worker now need to earn in the A job to be equally happy following the regulation?

Calculate the utility level for each job by using the wage and the risk level: \( U(A) = 28, U(B) = 28, U(C) = 32, \) and \( U(D) = 29. \) Therefore, the worker chooses a type C job and receives 32 units of happiness. If she is forced to work a type A job, the worker needs to receive a wage of $7 in order to maintain her 32 units of happiness as \( 7 + 25 = 32. \)
6-7. Consider Table 6-1 and compare the fatality rate of workers in the agricultural, mining, construction, and manufacturing industries?

(a) What would the distribution of wages look like across these four industries given the compensating differential they might have to pay to compensate workers for risk?

Mining would pay the highest compensating differential, followed by agriculture, then construction, and finally manufacturing.

(b) Now look at the median weekly earnings by industry as reported in Table 629 of the 2002 U.S. Statistical Abstract. Does the actual distribution of wages reinforce your answer to part (a)? If not, what else might enter the determination of median weekly earnings?

Median weekly earnings by industry are:

<table>
<thead>
<tr>
<th>Industry</th>
<th>Median Weekly Earnings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining</td>
<td>$795</td>
</tr>
<tr>
<td>Agriculture</td>
<td>$371</td>
</tr>
<tr>
<td>Construction</td>
<td>$609</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>$613</td>
</tr>
</tbody>
</table>

Thus, the distribution of wages does not perfectly reflect the compensating differential story, though mining is the best paid and the most dangerous. It is also the unhealthiest, which workers would supposedly take into account as well. Many other factors, however, probably explain the wage structure just as much if not more than compensating differentials, including preferences (family farmers), unions (manufacturing), required skills, and the length of the average work week.

6-8. The EPA wants to investigate the value workers place on being able to work in “clean” mines over “dirty” mines. The EPA conducts a study and finds the average wage in clean mines to be $42,250 and the average wage in dirty mines to be $47,250.

(a) According to the EPA, how much does the average worker value working in a clean mine?

The average value is $47,250 - $42,250 = $5,000.

(b) Suppose the EPA could mandate that all dirty mines become clean mines and that all workers who were in a dirty mine must therefore accept a $5,000 pay decrease. Are these workers helped by the intervention, hurt by the intervention, or indifferent to the intervention?

All except the marginal worker are hurt by the intervention. The workers who sort themselves into the dirty jobs are those workers that do not mind dirt, and therefore do not value working in a clean job at $5,000. (Similarly, if all of the workers in the clean jobs were forced to accept dirty jobs for $5,000 more, all of them except the marginal worker would be hurt as they all value working in a clean job at more than $5,000.)
6-9. There are two types of farming tractors on the market, the FT250 and the FT500. The only difference between the two is that the FT250 is more prone to accidents than the FT500. Over their lifetime, one in ten FT250s is expected to result in an accident, as compared to one in twenty-five FT500s. Further, one in one-thousand FT250s is expected to result in a fatal accident, as compared to only one in five-thousand FT500s. The FT250 sells for $125,000 while the FT500 sells for $137,000. At these prices, 2,000 of each model are purchased each year. What is the statistical value farmers place on avoiding a tractor accident? What is the statistical value of a life of a farmer?

The FT500 is associated with an extra cost of $12,000, but its accident rate is only 0.04 compared to the 0.10 accident rate of the FT250. Also, each farmer that buys the FT250 is willing to accept the additional risk in order to save $12,000. Thus, these workers are willing to receive $24 million ($12,000 x 2,000) in exchange for 200 – 80 = 120 accidents. Thus, the value placed on each accident is $200,000. Likewise, the 2,000 farmers who buy the FT250 are willing to receive $24 million in exchange for 2 – .4 = 1.6 fatal accidents. Thus, the value placed on each life is $15 million.

6-10. Consider the labor market for public school teachers. Teachers have preferences over their job characteristics and amenities.

(a) One would reasonably expect that high-crime school districts pay higher wages than low-crime school districts. But the data consistently reveal that high-crime school districts pay lower wages than low-crime school districts. Why?

The likely reason for this is not that teachers do not care about crime – they almost certainly do – but rather that school funding is determined in large part by local property taxes. If high crime schools are located in low income cities, there is nothing (or at least very little) the local school board can do to raise more money to pay the compensating differential.

(b) Does your discussion suggest anything about the relation between teacher salaries and school quality?

In the end, because high crime schools cannot offer the necessary compensating differential, they will not be able to attract the highest quality workers. Therefore, one would expect that the worst schools (with the worst teachers) are located in the poorest communities with the most crime. This is the typical story of proponents of replacing the property tax scheme to fund public education with a federal program.

6–11. Many employers willingly offer their employees certain benefits such as health insurance, a retirement plan, gym memberships, or even an on-site subsidized cafeteria. Why?

Offering job benefits is identical to offering a job with bad characteristics such as risk. When offering a risky job, for example, the employer must buy-off the risk from the worker. The employer chooses to do this because it is profitable, i.e., because the cost of buying-off the risk is less costly than transforming the job into a safe one. The same (but opposite) argument holds for job benefits. By offering a job with benefits, the employer can pay the worker less as the worker values the benefits. The employer will find it profitable to continue to offer benefits as long as the employer can save more in reducing the wage than it costs to provide the benefits.
One reason health insurance benefits are fairly popular is that firms can usually negotiate lower prices and better packages of care than individuals can do by themselves. Also, firms can deduct the cost of their benefits from their net revenue, whereas individuals cannot deduct the full amount of their healthcare expenses.