CHAPTER 11

11-1. Suppose there are 100 workers in an economy with two firms. All workers are worth $35 per hour to firm A but differ in their productivity at firm B. Worker 1 has a value of marginal product of $1 per hour at firm B; worker 2 has a value of marginal product of $2 per hour at firm B, and so on. Firm A pays its workers a time-rate of $35 per hour, while firm B pays its workers a piece rate. How will the workers sort themselves across firms? Suppose a decrease in demand for both firms' output reduces the value of every worker to either firm by half. How will workers now sort themselves across firms?

Workers 1 to 34 work for firm A as a time rate of $35 is more than their value to firm B, while workers 36 to 100 work for firm B. Worker 35 is indifferent. More productive workers, therefore, flock to the piece rate firm. After the price of output falls, firm A values all workers at $17.50 per hour, while worker 1's value at firm B falls to 50 cents, worker 2's value falls to $1 at firm B, etc. The question is what happens to the wage. Presumably wage also falls, to $17.50 per hour in firm A. If it falls by half, then the sorting of workers to the two firms remains unchanged.

11-2. Taxicab companies in the United States typically own a large number of cabs and licenses; taxicab drivers then pay a daily fee to the taxicab company to lease a cab for the day. In return, the drivers keep all of their fares (so that, in essence, they receive a 100 percent commission on their sales). Why do you think this type of compensation system developed in the taxicab industry?

Imagine what would happen if the cab company paid a 50 percent commission on fares. The cab drivers would have an incentive to misinform the company about the amount of fares they generated in order to pocket most of the receipts. Because cab companies find it almost impossible to monitor their workers, they have developed a compensation scheme that leaves the monitoring to the drivers. By charging drivers a rental fee and letting the drivers keep all the fares, each driver has an incentive to not shirk on the job.

11-3. A firm hires two workers to assemble bicycles. The firm values each assembly at $12. Charlie's marginal cost of allocating effort to the production process is 4N, where N is the number of bicycles assembled per hour. Donna's marginal cost is 6N.

(a) If the firm pays piece rates, what will be each worker's hourly wage?

As the firm values each assembly at $12, it will pay $12 for 1 assembly, $24 for 2 assemblies, etc. when offering piece rates. As Charlie's marginal cost of the first assembly is $4, the second is $8, the third is $12, and the fourth is $16; Charlie assembles 3 bicycles each hour and is paid an hourly wage of $36. As Donna's marginal cost of the first assembly is $6, the second is $12, and the third is $18; Donna assembles 2 bicycles each hour and is paid an hourly wage of $24.

(b) Suppose the firm pays a time rate of $15 per hour and fires any worker who does not assemble at least 1.5 bicycles per hour. How many bicycles will each worker assemble in an 8 hour day?

As working is painful to workers, each will work as hard as necessary to prevent being fired, but that is all. Thus, each worker assembles 1.5 bicycles each hour, for a total of 12 bicycles in an eight hour day.

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11-4. All workers start working for a particular firm when they are 21 years old. The value of each worker's marginal product is $18 per hour. In order to prevent shirking on the job, a delayed-compensation scheme is imposed. In particular, the wage level at every level of seniority is determined by:

$$\text{Wage} = \$10 + (.4 \times \text{Years in the firm}).$$

Suppose also that the discount rate is zero for all workers. What will be the mandatory retirement age under the compensation scheme? (Hint: Use a spreadsheet.)

To simplify the problem, suppose the workers work 1 hour per year. (The answer would be the same regardless of how many hours are worked, as long as the number of hours worked does not change over time). Some of the relevant quantities required to determine the optimal length of the contract are:

Age	Years on the Job	VMP	Accumulated VMP	Contract Wage	Accumulated Contract Wage
21	1	$18	$18	$10.00	$10.00
22	2	$18	$36	$10.40	$20.40
23	3	$18	$54	$10.80	$31.20
24	4	$18	$72	$11.20	$42.40
:	:	:	:	:	:
40	20	$18	$360	$17.60	$276.00
41	21	$18	$378	$18.00	$294.00
42	22	$18	$396	$18.40	$312.40
43	23	$18	$414	$18.80	$331.20
:	:	:	:	:	:
60	40	$18	$720	$25.60	$712.00
61	41	$18	$738	$26.00	$738.00
62	42	$18	$756	$26.40	$764.40

The VMP is constant at $18 per year. The accumulated VMP gives the total product the worker has contributed to the firm up to that point in the contract. The wage in the contract follows from the equation, and the accumulated wage is the total wage payments received by the worker up to that point. Until the 20th year in the firm, the worker receives a wage lower than her VMP; after the 21st year the worker's wage exceeds the VMP. The contract will be terminated when the total accumulated VMP equals the total accumulated wage under the delayed compensation contract, which occurs on the worker's 41st year on the job. So the optimal retirement age is age 61. Allowing the worker to retire after this age would be a bad deal for the firm as total lifetime wage payments exceed total lifetime value to the firm after 41 years of service.

11-5. Suppose a firm's technology requires it to hire 100 workers regardless of the wage level or market demand conditions. The firm, however, has found that worker productivity is greatly affected by its wage. The historical relationship between the wage level and the firm's output is given by:

Wage Rate	Units of Output
$8.00	65
$10.00	80
$11.25	90
$12.00	97
$12.50	102

What wage level should a profit-maximizing firm choose?

The data in the problem can be used to calculate the elasticity of the change in output with respect to the change in the wage. The efficiency wage is determined by the condition that this elasticity must equal 1. This elasticity is 1 when the firm raises the wage from $10 to $11.25 an hour:

$$(90\text{-}80)/80 \div (11.25\text{-}10)/10 = 1.$$

11-6. Consider three firms identical in all aspects except their monitoring efficiency, which cannot be changed. Even though the cost of monitoring is the same across the three firms, shirkers at Firm A are identified almost for certain; shirkers at Firm B have a slightly greater chance of not being found out; and shirkers at Firm C have the greatest chance of not being identified as a shirker. If all three firms pay efficiency wages to keep their workers from shirking, which firm will pay the greatest efficiency wage? Which firm will pay the smallest efficiency wage?

In this example, there is no connection between the cost of monitoring and the efficiency of monitoring, as it is assumed that monitoring efficiency cannot be changed. Moreover, the value of unemployment is the same for workers regardless of their employer. Focusing just on the probability of being caught shirking, therefore, workers in Firm A have the least incentive to shirk (as they are most likely to get caught) while workers in Firm C have the greatest incentive to shirk (as they are least likely to get caught). The idea of efficiency wages is to use wages to buy-off the incentive to shirk. Therefore, Firm A will pay the lowest efficiency wage, while Firm C will pay the greatest efficiency wage.

11-7. Consider three firms identical in all aspects (including the probability with which they discover a shirker), except that monitoring costs vary across the firms. Monitoring workers is very expensive at Firm A, less expensive at Firm B, and cheapest at Firm C. If all three firms pay efficiency wages to keep their workers from shirking, which firm will pay the greatest efficiency wage? Which firm will pay the smallest efficiency wage?

In this example, there is no connection between the cost of monitoring and the efficiency of monitoring. The efficiency wage, therefore, is determined by the incentives of the workers, not the costs of the firms. (The decision of whether to monitor workers, of course, will depend on the cost of monitoring.) Thus, all three firms will offer the same efficiency wage.

11-8. A firm can hire as much labor as it wants at $5 per hour. In return, each worker produces 10 units of output per hour. The firm can sell up to 2,500 units of output each day at $2 per unit, but it cannot sell any more than 2,500 units of output in a day. The firm has no other costs besides labor.

(a) How many hours of labor does the firm purchase and how much profit does it earn each day?

As each hour of labor costs $5 but provides 10 units of output that are sold at $2 each for an hourly revenue of $20 and an hourly profit of $15, the firm hires as many workers as necessary to sell all 2,500 units that it can sell each day. Therefore, the firm hires 250 hours of labor each day and earns profit of $2,500 \times \$2 - 250 \times \$5 = \$3,750$ of daily profit.

(b) The firm can choose to pay an efficiency wage. In particular, the firm can choose to pay $6, $7, $8, $9, or $10 per hour, and in exchange, each worker will produce 18, 23, 27, 28, or 29 units of output per hour respectively. What hourly wage should the firm offer to maximize profits?

One way to answer the problem is find the wage level at which the elasticity of output with respect to the wage equals (or is the closest) to 1. Below are the elasticities:

Wage = $6:	$(18 - 10)/10 \div (6 - 5)/5 = 4.0$
Wage = $7:	$(23 - 18)/18 \div (7 - 6)/6 = 1.67$
Wage = $8:	$(27 - 23)/23 \div (8 - 7)/7 = 1.22$
Wage = $9:	$(28 - 27)/27 \div (9 - 8)/8 = 0.30$
Wage = $10:	$(29 - 28)/28 \div (10 - 9)/9 = 0.32$

Therefore, the optimal efficiency wage is $8 per hour.

This problem can also be done with the same technique as in part (a) and simply calculate all of the profits:

Wage = $6:	$E = 2{,}500 / 18 = 139$	$\rightarrow$	$\pi = 2{,}500 \times \$2 - 139 \times \$6 \approx \$4{,}167.$
Wage = $7:	$E = 2{,}500 / 23 = 109$	$\rightarrow$	$\pi = 2{,}500 \times \$2 - 109 \times \$7 \approx \$4{,}239.$
Wage = $8:	$E = 2{,}500 / 27 = 93$	$\rightarrow$	$\pi = 2{,}500 \times \$2 - 93 \times \$8 \approx \$4{,}259.$
Wage = $9:	$E = 2{,}500 / 28 = 89$	$\rightarrow$	$\pi = 2{,}500 \times \$2 - 89 \times \$9 \approx \$4{,}196.$
Wage = $10:	$E = 2{,}500 / 29 = 86$	$\rightarrow$	$\pi = 2{,}500 \times \$2 - 86 \times \$10 \approx \$4{,}138.$

Therefore, this method also results in the optimal efficiency wage being $8 per hour.

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11-9. Consider a firm that offers the following employee benefit. When a worker turns 60 years-old she is given a one-time opportunity to quit her job, and in return the firm will pay her a bonus of 1.5 times her annual salary and pay her health insurance premiums until she is eligible for Medicare.

(a) What problem is the firm trying to solve by offering this benefit?

In general, wages (and salaries) increase with age. Thus, even when someone becomes eligible to receive "full" social security benefits and go on Medicare, several people choose to continue to work. Again, they are choosing to work when they are probably very well paid and possibly less valuable to the firm than they were in previous years. The firm, therefore, is trying to entice workers to retire and not continue to work once retirement becomes a possibility. This is a problem these days as federal law prohibits most firms from enforcing a mandatory retirement age.

(b) Why is the health insurance premium portion of the benefit important in the United States?

The health insurance premium is important in the United States, because healthcare is not provided by the government for everyone in the United States. Most people receive their healthcare through their employer. Thus, if one is not eligible to receive Medicare until he or she turns 65 years-old, for example, the cost of retiring before age 65 is larger than just the cost of foregoing earnings, it's also foregoing health care insurance premiums.

(c) For what industries might one expect such opportunities to be presented to workers?

These types of retirement incentives are most likely to arise in industries or occupations in which (1) older workers are paid a lot more than younger (new) workers and/or (2) older workers are not as productive as younger workers.

11-10.

(a) Why would a firm ever choose to offer profit-sharing to its employees in place of paying piece rates?

Piece rates can be very difficult to pay in some situations. For example, in a situation in which a group of workers is responsible for producing the good, determining who made what may be impossible. Consider Southwest Airlines, which is known to have a profit sharing program that is well-liked by its employees. To pay a flight attendant a piece rate, the airline would have to survey passengers as they depart the plane, and then, from the passengers' opinions, pay the appropriate piece rates. Clearly this is untenable. Profit sharing, on the other hand, is a convenient way to approximate the piece rate system. Since all workers are covered by profit sharing at Southwest Airlines, all workers have a continuous incentive to do their job very well. They also have the added incentive to make sure that their co-workers also do their jobs well.

(b) Describe the free riding problem in a profit-sharing compensation scheme. How might the workers of a firm "solve" the free riding problem?

When all workers are covered by a profit sharing plan, an individual worker has the incentive to shirk his responsibilities as his direct effect on profits is likely small. If all workers do this, however, the total profit created by the firm will be much smaller than it would be if workers were paid a piece rate.

One way to "solve" the free rider problem is with social pressure. If the atmosphere of the workers is that everyone works and shirkers will be punished somehow – socially, annual reviews, being fired, etc. – then the incentive to shirk is diminished. Thus, a profit-sharing scheme works best when many workers must interact with each other (such as the flight attendants, pilots, luggage movers, and ticket associates at Southwest Airlines).

11-11.

(a) How does the offering of stock options to CEOs attempt to align CEO incentives with share holder incentives?

The idea of stock options is that the CEO will get paid more (via the option to purchase shares of the firm's stock below market value) if the share price increases during his or her tenure with the firm. Thus, as share holders want the firm to maximize the share price; by offering the CEO stock options, the CEO has a greater incentive to take actions that accomplish this.

(b) Enron was a company that was ruined in part because of the stock options offered to upper management. Explain.

Although offering stock options can align CEO incentives with share holder incentives, what really happens is that the stock options provide an incentive to the CEO to maximize the short-run share price by any means possible. At Enron (and WorldCom and others), this led unethical CEOs to maximize the share price by improper accounting methods. Thus, the share price rose, but not for fundamentally strong reasons. The CEOs then cashed in their stock options before the market discovered the problem. In the long-run, share-holder value was not maximized, though CEO wealth may be.

(c) In addition to accounting reforms, how might stock options be changed to try to prevent situations like what happened at Enron from occurring in the future?

One possible solution to the problem in (b) is to issue stock options that cannot be cashed in until the CEO has been gone from the company for some time (two, five, or even ten years). Such options would supposedly cause the CEO to make the best long-run decisions for the firm.

11-12.

(a) Personal injury lawyers typically do not charge a client unless they obtain a monetary award on their client's behalf. Why?

One reason is that many litigants with worthwhile lawsuits could not afford to pay lawyer expenses if they would lose. Even though they may have a good case, they are not certain to win. And so without this type of arrangement, these litigants may not choose to go forward with the lawsuit.

Another reason is incentives. By having the lawyers receive payment only when an award is received, the incentives of the lawyer are better aligned with the objective of the litigant. In essence, this is a profit-sharing payment scheme.

(b) What would happen to the number of lawsuits if lawyers had to charge an hourly rate win or lose and could not charge a fixed percentage of the award?

By all accounts, this would greatly reduce the number of lawsuits as litigants would not go forward with frivolous lawsuits. The problem, of course, is that some potential litigants would not pursue legitimate lawsuits either, because they are risk averse and would be afraid of losing and being stuck with huge lawyer fees.

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11-13. Consider the following four tasks (all of which require significant time and/or effort): (1) Trekking through a forest carrying a trowel and 40 saplings, and every quarter of a mile kneeling to the ground, digging a hole, and planting a sapling; (2) using a pick axe to extract 100 pounds of ore from the ground; (3) a team of 200 shoveling snow from the 85,000 seats in a stadium before a January football game; and (4) advising a college senior in her senior thesis which, by protocol, requires weekly 90-minute meetings plus an additional 2 hours each week of reading and preparation. Describe in detail why an employer may or may not want to pay employees by the piece to accomplish these tasts? What are some conclusions for when paying by the piece is most useful?

The problem with paying by the piece for task (1) is monitoring. It is very costly (or impossible) to monitor people walking through the forest and planting saplings. If paid by the piece, one could imagine someone taking their 40 saplings, walking one mile out of site, throwing the samplings into a ravine, and returning 8 hours later claiming to have planted all 40.

Task (2) is very easily paid a piece rate as the worker needs to actually undertake the effort to mine 100 pounds of ore.

The problem with paying by the piece for task (3) is that the work is done by a team. In the end, the entire team has cleared all of the snow in the stadium, so maybe a team-reward or profit-sharing scheme could be employed, but it would likely be difficult to know exactly how much snow was cleared by each person.

The problem with task (4) is quality control. If the professor agrees to advise a senior thesis, the Dean of the Faculty will only know if the student received credit for the work, but that credit is assigned by the professor. Unless the Dean is willing to read all of the senior theses that received credit to evaluate their quality, the university may not be able to judge very well which professors spent 90 minutes each week with the student plus a couple more hours each week in preparation versus which professors met only once a month for 30 minutes each time.

The lesson is that piece rates are best used when work is individualized and can be easily monitored and measured with the worker having little or no control over the quality of the work.

11-14. Economists and psychologist have long wondered how worker effort relates to wages. Specifically, the question is whether worker effort responds to increased wages alone or whether effort also responds to relative wages.

(a) Design a classroom experiment that would allow you to quantify the relationship between effort, reward, and relative reward.

The reward is going to be M&Ms. At the start of the experiment, each student is secretly given an identity (maybe an ID number) and a wage. For each unit of "output" produced, student i is paid w_i M&Ms. Each student is then given a sheet of paper that shows all of the wages being paid (e.g., wages range from $w = 1$ to $w = 5$), but students don't know who is earning which wage. Alternatively, you might put students in groups of five and tell them their own wage and what the average wage is in their group of 5.

Each student is then given 200 single-digit addition problems and 1 minute to answer as many of the questions as they can. Each student, of course, must put their ID number on their answers in order to be paid later. (Note, the experimenter must be able to align wage rates with output, not only to collect data but to also pay the students after the experiment.)

(b) Explain how the data you collect can be used to identify both relationships. What do you think you would find?

Consider a class with 20 students. Divide the group into 4 groups of 5 each. In one group, the wage rates are 1, 2, 3, 4, and 5 with an average of 3. In the next group, the wage rates are 3, 4, 5, 6, and 7 with an average of 5. And so on, with averages of 7 and 9 in the last two groups respectively. Everyone is then given 200 easy math problems and 1 minute to do as many of them as they like. As the experimenter, I need to know each person's wage and each person's answers. After class, I can then score the answers, determine each students "pay," and pay them at the next class. For each student, then, I know their total output, wage, and their wage relative to their group's average. My guess is that there will be a positive relationship between wage and output, but maybe not. I don't know if relative wage will matter or not. The answer might also depend on the reward. Though it may not pass a human subjects committee, if the reward was extra credit, there might not be any wage or relative wage effect.

11-15. Some compensation schemes include a signing bonus while others include the potential to receive annual year-end bonuses.

(a) From the firm's perspective, what are the benefits of offering a signing bonus? What are the benefits of offering a year-end bonus?

Offering a signing bonus is a means by which firms compete for talent. A signing bonus may be used to signify value or to allow a potential worker to pay for transferring jobs. It is also a means by which firms might be able to keep annual salaries relatively equal while still paying the most valuable workers more.

Year-end bonuses can be rewards for merit or can be akin to offering profit sharing to workers if bonuses are tied to firm performance. Thus, in lieu of offering only a commission or only a piece-rate scheme, year-end bonuses allow the firm to dangle the idea of profit sharing, not shirking, etc. in front of its workers all year long.

(b) If a firm pays its sales staff a piece rate and a year-end bonus, why will it be the case that the rate of pay per piece is less than the market value? Why will the sales staff willingly accept such an arrangement?

Suppose each unit of output (or piece) is worth $11 to the firm. At the end of the year, the firm may have a policy that it awards 10% bonuses to people who "had a good year." In this case, the firm would pay a piece rate of $10 per piece and then top this off with a 10% (or $1 per piece) year-end bonus. Clearly the firm must pay a rate per piece throughout the year that is lower than market value in order to afford the year-end bonus. As long as the firm is known to not renege on its promise of a bonus, the workers should be fine with this. (If the firm was a frequent renege, workers would learn this and stop valuing the bonus scheme.)

(c) How does the existence of year-end bonuses support the bonding critique?

A year-end bonus is essentially a bond. The worker knows that if she performs as expected, she will receive the bonus. If she shirks on the job, however, or doesn't meet performance targets or if she leaves the firm mid-year, she will forego the bonus. That is, she foregoes the bond that she placed on the job.

To further illustrate this point, Wall Street firms are famous for offering year-end bonus packages. As a result, (1) many workers who want to change jobs simply do not in months 8 – 12 as they know they would be leaving considerable monies on the table, (2) workers who do change jobs mid-year are offered considerable signing bonuses to make up for the year-end bonus that is being foregone, and (3) most of the turnover between jobs happens in months 1 – 3, shortly after year-end bonuses have been announced.