I. Sorting & Investing in Employees

In this first section of the text, we take a very simple view of employees. It is one that is quite similar to that taken in much of biology: there is nature, and there is nurture. In our context, employees bring to the workplace certain innate abilities, such as abilities to think quickly or creatively, or the ability to work with numbers. They also develop new or more advanced skills over time, through education, experience, and on the job training.

The topics of this section are how to sort employees by their innate or accumulated skills, how to invest further in their skills, and how to manage their exit from the organization, as a function of their talents and skills. One can think of a firm's career policies as a kind of "pipeline," bringing employees in, developing and promoting them, and transitioning them out eventually. That is the sequence of this section. In later sections of the book, we broaden our perspective, to consider issues such as the work they perform, their motivation, and the firm's complex relationship to the employees.

In the process of exploring these issues, several important economic concepts are developed: asymmetric information, investment, and different methods of contracting.

Asymmetric information refers to situations where two parties to an economic transaction (in our case the firm and the employee) have different information that is relevant to the transaction. Problems of asymmetric information are ubiquitous in economies (e.g., the quality of a used car for sale; the effort that an employee expends on the job). They also tend to lead to inefficiencies, either because incorrect decisions are made, or because one party exploits its informational advantage, which causes the other party to transact less or invest less in the economic relationship.

When we consider recruiting, asymmetric information arises because the employee has more information about their suitability for a job than the firm does (the opposite case can also arise sometimes). This presents a challenge for the firm in recruiting. We will see that one way to deal with this is to use the economic principle of *signaling*, which encourages the employee to use their information in a constructive rather than strategic way. The idea of signaling has many applications in many areas of business, and we shall mention a few. This is an example of how the tools used in this book have broad application outside of employment.

The second economic tool used is the idea of optimal investment. Employees and their employers can invest in increasing their skills. In studying this issue, we will use the same ideas that play a key role in finance courses.

Finally, we will see three approaches to thinking about economic transactions or contracts. We start with the simplest – a spot market whereby the firm simply pays an employee's "market price" at each point in time. This is the standard view in introductory microeconomics classes.

But in trying to improve recruiting, we will soon see the need for more complex, multiperiod *contracts* between the firm and the employee. These contracts will also be *contingent*, in this case on employee performance. Finally, in some cases we will see that the contract between the firm and the employee involves *implicit* or informal elements, because it is not always possible to write complete formal contracts. This gives us a very useful framework for thinking about the overall employment relationship, and even issues such as corporate culture. Those ideas will be picked up again at the end of the text.

Now let us provide a small amount of structure to get started. The firm desires greater employee performance (contribution to profits), and lower labor costs. These must be traded off against each other. For the first 6 chapters of this book, employee motivation to work harder is *ignored*. Instead we will simplify the problem by assuming that the employee's performance depends on innate ability, A, and the degree of their acquired skills (which we will call human capital), H. A is fixed over time, whereas H can change. H rises if the employee learns new skills, or falls if the employee's skills depreciate or become out-of-date. If the employee's contribution to firm value is called Q, we would say that Q = Q(A, H).

In Chapters 1-2, we will be thinking about ways to sort employees on the basis of A and the current value of H. We will assume, in effect, that H is also a constant for this analysis. In Chapter 3, we then analyze how to invest in increasing human capital H. Chapter 4 then applies the tools from Chapters 1-3 to questions of employee turnover. This not only gives a useful analysis of the turnover issues, but also shows how the tools can provide insight into new questions.

Setting Hiring Standards

"When you're around someone good, your own standards are raised." (Ritchie Blackmore)

In this chapter our goal is twofold: to introduce the topic of recruitment, and also to introduce the economic approach used in the textbook. Let's ease into both by considering an example.

An Example: Hiring Risky Workers

New Hires as Options

Imagine that you are a partner in an investment bank in the City (financial district) in London, and are deciding between two candidates to fill a position as an associate (junior) investment banker. Gupta has the standard background of most of the applicants that you see, including a degree in economics, a few years of experience as a financial analyst, an MBA focus in finance, and a summer internship at an investment bank. You feel that his productivity is extremely predictable, and that he can produce £200,000 of value per year. Svensen has a very unusual background compared to other applicants. She has a very strong track record and appears quite talented, but does not have much experience related to investment banking. Hence you feel that her success is much less predictable. She may turn out to be a star, in which case she will produce £500,000 per year, but she may also turn out to be a disaster, actually losing £100,000 in value per year. Suppose that each of these outcomes for Svensen is equally likely (fifty percent odds). Then the *expected* (average) output from Svensen in any given year is exactly the same as the output from Gupta:

Expected output from Svensen = ½•500,000 – ½•100,000 = £200,000.

If the cost (wages, benefits, etc.) of both employees is the same, which is the better hire? The answer might seem counter-intuitive, but usually the firm should hire the *riskier* worker.

Suppose that both Svensen and Gupta can be expected to work at your firm for ten years. Suppose further that it takes one full year to determine whether Svensen is a star or not. The salary is £100,000 a year, and for the moment let us assume that this will be the salary for the foreseeable future.[1] In that case, your firm earns a profit of £100,000 per year from Gupta, for a total value of £1 million dollars over ten years. The top branch of Figure 1.1 shows this choice.

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[1] In this example, we ignore issues of present value, by assuming that the interest rate is zero to keep things simple. When we do this in examples in this book, it is always the case that the intuition that is developed would be identical if we used discounted present values. Similarly, all examples in this text use inflation-adjusted figures, since inflation does not affect the conclusions.

Alternatively, you can hire Svensen. With probability equal to ½, Svensen is a star, producing £500,000 per year, and your firm earns profits of £400,000 from employing her, for ten years, netting £4 million. With probability equal to ½, Svensen loses money for your firm. If this occurs, you can terminate Svensen at the end of the year, so £200,000 is the total loss, including her salary. These two outcomes are the remaining branches in Figure 1.1. Thus, the expected profit from hiring Svensen is:

Expected profit from Svensen = ½•4,000,000 – ½•200,000 = 1,900,000.

Svensen is therefore almost twice as profitable to hire as Gupta! Even though the two candidates have the same expected value, Svensen is worth much more. The firm can keep her if she turns out to be a good employee, and dismiss her if she turns out to be a bad one. The firm has the option of firing poor workers, and keeping the good ones.
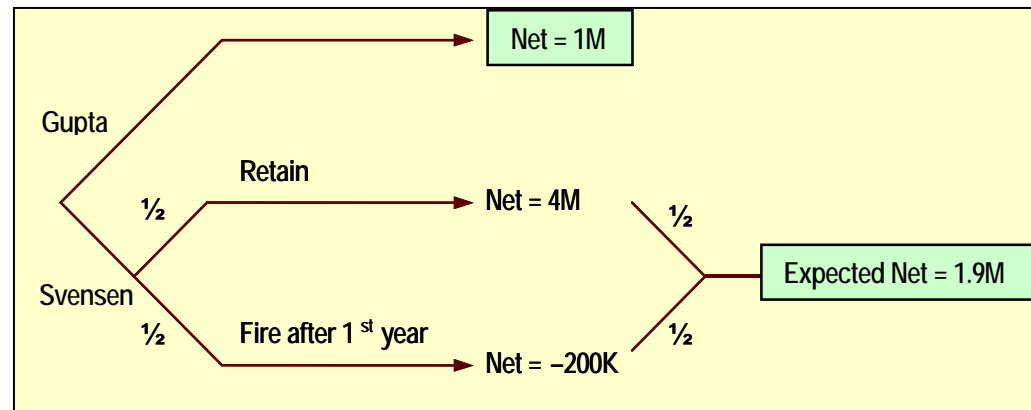
Hiring a Risky or Predictable Worker
Figure 1.1

This is the argument that is sometimes made for hiring workers with "potential" over conservative, proven ones. With the more proven worker, the firm gets a solid performer. With the risky worker, the firm may find that it made a mistake, but this can be remedied relatively quickly. It may also find that it has a diamond in the rough.

This simple example can be quite surprising to many students, since it seems to contradict the intuition that, if expected values are equal, risk is always a bad thing. However, risk is not a bad thing in the case of "real options" like hiring employees. It is a nice example because it illustrates how formal economic analysis can lead to better decisions. Our intuition tends to be the opposite of the correct answer in this case.

Analysis

The structure developed above suggests several other factors that are important in deciding whether or not to take a chance on a risky hire.

Downside Risk

The value of taking a chance on a risky candidate can be so large that it is often the better strategy, even if the safe worker has a higher expected value per year. Even if Svensen might have been a total disaster, destroying £1,000,000 of value with probability ½, it

would have paid to take a chance on her. However, the more the potential there is for an employee to destroy value, the less likely is it to be optimal to take a chance on a risky worker.

Upside Potential

Svensen was valuable because she could generate high profits if she turned out to be a star. The greater those profits, the greater the option value from a risky hire. Thus, in jobs where small increases in talent lead to large increases in value creation, hiring risky candidates will be even more valuable (as long as there is no increased downside risk as well). Think of an entrepreneur assembling a new management team. There is little to lose, but there may well be much to gain. In such a case, it will make more sense to take a chance on a risky candidate.

Termination Costs

The more costly it is to fire a worker, the more costly is a risky candidate. Nevertheless, it may still pay to hire the risky worker, and terminate in the case that the worker does not turn out to be a good fit, even if there are high termination costs. In most countries, firms are prevented from terminating workers at will. Legal or social restrictions can make the option of firing a worker after one year costly. Consider the extreme case where hiring is for life. If the firm is risk neutral (is willing to accept any risks, as long as expected values are equal), as long as Svensen's expected productivity is equal to or greater than Gupta's, it will be a profitable bet to hire Svensen. More generally, the benefits from the case where Svensen turns out to be a star are so high, that it would often be worth hiring Svensen even if firing costs were high.

Risk Aversion

If the firm is risk averse, it may still be optimal to hire Svensen. Svensen will now be costly to the firm in a different way, because she is risky. However, the differences in expected productivity are quite large, and should more than compensate for typical levels of risk aversion.

An Implementation Problem

The issue of risk aversion raises an interesting side point. When managers and recruiting specialists are taught this example, their typical response is to reject its conclusions, saying that they would be more conservative in hiring. Why is this the case? Is the theory wrong, or are the managers wrong? Quite possibly it is neither. Rather, the analysis is conducted assuming that the firm is relatively risk neutral. However, decision makers are typically risk averse, and this will affect their decisions. For example, they might expect that they will be criticized or receive a poor evaluation if they hire a bad candidate for the job. The more risk averse they are, the more they will make decisions to avoid such an outcome.

To the extent that a manager's risk aversion is different from that of the employer, this is an *incentive problem* or conflict of interest. This is a topic that we will address in Chapters 9-12. In the meantime, if those who make hiring decisions are too conservative, a possible solution to the problem would be to try to avoid punishing them when they make mistakes in hiring. Another would be to appoint less conservative managers to handle recruitment.

Length of Evaluation

The time that it takes to evaluate whether Svensen is a star or a disaster affects the value of hiring a risky candidate. If the evaluation takes ten years, there is no value to hiring Svensen, in our example. If the evaluation takes only one year, the firm can limit its cost of a disastrous hire to only one year of pay and poor productivity.

Length of Employment

The value of hiring Svensen would have been even greater if the firm could have employed Svensen for more than ten years. For example, if Svensen was 30 years old when hired, and stayed at your company (for the same salary) until retirement, the profit from hiring Svensen would be £14 million if she turned out to be a star (£400,000 per year $\times$ 35 years). This suggests that the value of a risky hire will usually be larger, the younger is the new hire, and the lower is turnover in the company (so that employees tend to stay with the firm longer).

A Counter Argument

Our conclusions are only as good as the assumptions behind them. An important element of the economic approach to personnel is careful consideration of when the assumptions do or do not apply, and of what the effect would be of changing key assumptions. In the model above, the conclusion rested primarily on one key assumption: that we can profit when we find a star employee. Let us reconsider this assumption.

If Svensen turns out to be star, is it safe to assume that we can continue to pay her £100,000? Might she try to bargain for a better salary? Might other employers try to hire her away from us? What would happen to our argument if these considerations applied?

These questions bring up a crucial consideration throughout this textbook: the firm always has to match an employee's outside market value. More precisely, the firm offers a job *package* with many characteristics, including the type of work, extent of effort required to do the work, degree of training, pay and other benefits, possibility for further advancement, and job security. The employee will consider all elements of the package in valuing the job, and compare it to alternative jobs offered by competing employers. The labor market is generally highly competitive, so that firms must constantly make sure that their jobs match those of competing employers in terms of pay and other characteristics.

For now, let us keep things simple, and focus on pay and productivity. Suppose that other employers can observe how productive Svensen is. Moreover, assume that Svensen's productivity as a star or a disaster would be the same at any other investment bank. These are reasonable starting assumptions for investment banking; the work is often quite public, and is similar at most firms.

When this is the case, if Svensen is revealed to be a star, other investment banks will be willing to pay her more than £100,000 per year. In fact, they should be willing to pay as much as £500,000 per year, since that is her productivity. Labor market competition will tend to drive competing employers toward zero profit from hiring Svensen.

If Svensen is a disaster, no investment bank should be willing to hire her. She is likely to find better employment in a different industry where her productivity is not negative.

What is the benefit to your firm of hiring Svensen in this case? There is none. In order to retain her if she is a star, you have to compete with other firms, and should end up paying about £500,000 per year. In other words, our conclusion that it would pay to hire a risky candidate rested on our ability to earn profit from Svensen if she turned out to be a star.

How can we benefit from Svensen? There are two possibilities.

Asymmetric Information

Competing firms may not figure out Svensen's productivity, at least not immediately. Even though investment banking is often quite public work, some of it is not, and the work is also generally done in teams. Outside firms may find it difficult to estimate Svensen's individual contribution because of these factors. This implies that in industries where productivity is less individualistic, and less public, hiring a risky candidate is more likely to be worthwhile. Furthermore, to the extent that your firm can delay the ability of the labor market to figure out who your stars are (of course, Svensen will try to make this information public!), it can profit from the informational advantage. Therefore, your firm may want to avoid public recognition of Svensen's contribution.

The general issue of asymmetric information is one of the key economic ideas used in this book. When one side has important information that the other does not, interesting issues arise. For example, if a firm has trouble distinguishing between the best and worst job candidates, this can lead to ineffective recruitment, and also to a different approach to recruiting (that we will discuss in Chapter 2). Incentive problems are an important example of information asymmetry; they arise when the firm cannot monitor the employee's actions perfectly.

Firm-Specific Productivity

Svensen's productivity may be higher at our firm than at other firms. To the extent that this is true, Svensen may be a star at our firm, but less so or not at all at other firms. Then they will not bid up Svensen's market value as much, and there may be profit to our firm from employing Svensen. In Chapter 3, we will discuss two important reasons why Svensen's productivity may be higher at your firm than elsewhere: firm-specific job matches or human capital. The more important is either, the more likely is it to be profitable to hire a risky candidate.

One last issue here: even if there is profit from hiring Svensen compared to what she can earn from other employers, there is still a question of how that profit is split between Svensen and the firm. That raises the question of bargaining. We will not focus on that issue in this text. However, we do discuss it briefly in Chapter 3 when we analyze how to share investments in firm-specific human capital.

> **Google's Unusual Approach to Recruiting**
>
> Google, a leading Internet search engine, competes with many high-technology companies for talent. It desires talented, creative employees that fit with its geeky and informal culture. To distinguish itself from other recruiters, Google sometimes tries unusual methods.
>
> In one case, it inserted an "aptitude" test in technology magazines. It included questions such as, "How many different ways can you color an icosahedron with one of three colors on each face?" In another case, it placed billboards that read only, "(first

The example of risky hires is a good introduction to the economic approach to studying personnel issues. We used a very simple model to analyze a complex decision. The model was useful in guiding us to important issues to consider in making this kind of hiring decision. Once the structure was set up, we were able to study the problem formally, even expressing some ideas in a few simple equations. The equations can be an effective way to rigorously express certain ideas. We will use these techniques throughout the book.

Simplification of a complex problem makes it easier to solve the problem, and get concrete answers. Of course, too much or inappropriate simplification can lead to incorrect answers, so one must be careful. But when applied intelligently, simple economic modeling can lead to powerful and practical analyses.

When we analyze organizational issues in this textbook, we will see the same set of economic ideas appearing over and over again. By the end of the book, we will have an economic "toolbox" that can be used to analyze all sorts of personnel problems. You will see examples in Chapter 4, where we use the principles discussed in the first three chapters to analyze some specific personnel policies. Economic concepts that we used in analyzing risky hires include labor market competition (for employees); prices (salary); asymmetric information; and incentives.

For those who have studied economics, this will be quite familiar territory: it is microeconomics applied to how firms are designed and their employees are contracted with. For those who have not, the approach may take some time to get used to. Over the next few chapters, you will get used to this approach, and see its value for analyzing many kinds of employment issues.

Setting Hiring Standards

Let us now step back and think about what hiring standards the firm would like to establish, before it actually begins recruiting employees.

Balancing Benefits Against Costs

Managers often say that their goal in hiring is to obtain the "best quality workers." It sounds like a good idea, but is it? The most productive workers are also likely to be the most ex-

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[2] Answers: 1. An icosahedron has twenty sides, so you can color it with three colors as many as 3 to the 20th power ways (allowing for some that use only one or two colors). That equals 3,486,784,401. 2. The first ten-digit prime number in consecutive digits of e is 7427466391. But you knew those.

pensive. Should the goal instead be to hire the "least expensive workers"? A simple analysis resolves this question.

Consider the hypothetical productivity data in Table 1.1. These data indicate that college graduates are about 28% more productive than high school graduates.

Worker ID	Monthly sales	Education
A	$100,000	HS
B	$108,333	College
C	$125,000	HS
D	$125,000	HS
E	$133,333	College
F	$141,667	HS
G	$166,667	College
H	$175,000	College
I	$175,000	College
J	$183,333	College
Average, HS grad =		$122,917
Average, college grad =		$156,944

Productivity & Education of Hypothetical Employees
Table 1.1

Now consider the data on monthly wages for high school and college graduates in Table 1.2. College graduates cost more than high school graduates.

Year	Monthly Wage		Ratio
	High School	College	
1990	$2,163	$2,850	1.32
1991	$2,140	$2,954	1.38
1992	$2,131	$3,075	1.44
1993	$2,128	$3,106	1.46
1994	$2,151	$3,116	1.45
1995	$2,088	$3,119	1.49
1996	$2,087	$2,999	1.44
1997	$2,173	$3,217	1.48
1998	$2,170	$3,373	1.55
1999	$2,208	$3,283	1.49
2000	$2,203	$3,354	1.52
2001	$2,202	$3,490	1.59
2002	$2,254	$3,593	1.59
Wages are expressed in 2005 dollars.			

Source: US Current Population Survey.

Wages for High School & College Graduates, U.S.
Table 1.2

If the firm has to pay its workers approximately the wages shown in the last row of Table 1.2, then both a high school and college graduate would be profitable to employ. (In a complete analysis we would add in any other costs of employing them, such as fringe benefits, workspace, etc. This example is simplified to focus on the general point.) Moreover, it would be more profitable to employ a single college graduate compared to a single high school graduate:

Monthly profit from hiring HS graduate = $122,917 – $2,254 = $120,663,

Monthly profit from hiring college graduate = $156,944 – 3,593 = $153,351.

However, this analysis is misleading. Suppose that your firm wants to hire enough workers to produce $1 million in monthly sales. This would require 6.4 college graduates, at a cost of $22,995, or 8.1 high school graduates, at a cost of $18,257.[3] Employing high school graduates would actually be more profitable. The reason is that high school graduates have lower cost per unit of output:

$$\frac{W_H}{Q_H} < \frac{W_C}{Q_C}.$$

In this example, high school graduates cost about $18 per $1,000 of monthly sales, while college graduates cost about $23. As long as the expression holds, it is more profitable to hire high school graduates, and vice versa. The most cost-effective employee has the lowest ratio of salary to output. The firm should choose this type, and hire enough of them to reach the desired level of output.

This illustrates two simple but important economic principles. The first is to *always think in terms of tradeoffs between costs and benefits.* In this example, the desire for high quality workers must be balanced against the desire for low cost workers. Many questions boil down to assessing the benefits of a given policy against the costs.

The second general principle is to *always compare your approach to your best alternative.* In this case, college graduates are profitable, but less so than high school students. Once we take that into account, college students are not profitable, compared to our other choice.

Worker Choice at Days Inns

Days Inns of America, a hotel franchiser, traditionally staffed its reservation center with young employees who were willing to work at the minimum wage. The staff answered phone calls from potential guests and booked reservations. However, due to a shortage of low-skilled workers, wages began to rise for this age and experience group. Days Inns decided to re-examine their targeted recruiting group for these positions.

Management realized that the sedentary nature of the job was well suited for elderly workers. In addition, senior citizens were a readily available work force that could be hired for only slightly more than young workers, when training and other costs were included.

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[3] Do not be troubled by the fact that this may require hiring a fraction of a worker. It is possible to hire a fraction of a worker – by hiring someone part time, or allocating them to other tasks part of the time. Moreover, the larger the scale of the firm, the less consequential are such issues of indivisibility.

What happened? With productivity defined as a combination of average call length and number of reservations booked, older workers talked on the phone longer but made more reservations. The higher proportion of calls that resulted in actual reservations more than offset the additional time used. Elderly workers had a lower salary to productivity ratio, making them the most cost-effective labor. The savings were even higher because the older employees had a significantly lower turnover rate.

Source: McNaught & Barth (1992)

Foreign Competition

This analysis is also useful for thinking about globalization of labor markets, and the role of foreign competition. It is often argued that countries with low labor costs drive companies in countries with high labor costs out of business. Is that accurate? Table 1.3 shows representative statistics on pay and productivity (GDP, gross domestic product) for several nations. Mexico has the lowest labor costs, while Norway has the highest. However, the real issue is not whether labor is cheaper, but whether it is more cost-effective. For example, Japan's labor costs are among the highest, but its productivity is the highest. In fact, Japan has the second lowest labor cost per dollar of productivity. A firm that had a choice between hiring Japanese or Argentinean workers would prefer the more expensive, but also more productive, Japanese workers.

	GDP per worker	Annual salary, manufacturing	Cost per $ of GDP
Mexico	$15,964	$5,743	0.360
Japan	$78,065	$33,573	0.430
New Zealand	$40,690	$18,067	0.444
Argentina	$22,399	$9,973	0.445
Norway	$85,923	$38,447	0.447
United States	$75,571	$34,682	0.459
Sweden	$55,680	$27,371	0.492
Australia	$45,357	$25,266	0.557
United Kingdom	$54,848	$36,234	0.661
South Africa	$7,880	$7,828	0.993
Averaged over 2000-2, in 2005 dollars.			

Source: United Nations

Productivity & Pay of Manufacturing Workers, Selected Countries
Table 1.3

These numbers are meant to be illustrative, rather than definitive.[4] Still, they make clear the point that cheap labor is not necessarily low-cost labor. Similarly, high-productivity labor is not necessarily the most profitable labor. You should seek low cost per unit of output, whether that arises from low wages, high productivity, or both.

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[4] The numbers may contain some aggregation error. Wages are from manufacturing, but productivity is for the economy as a whole.

The Method of Production

So far, we have proceeded as if production were independent across employees. In reality, production is interdependent across workers. We now consider three scenarios representing different approaches to production, to see what effect the method of production has on our analysis. In the first, production is independent across workers. In the second, a worker's production depends on the skills of co-workers. In the third, a worker's production depends on the capital that worker uses on the job.

1. Productivity is Independent of Co-Workers

A manager describes production in his unit as follows:

My team is a sales force. Each salesperson works independently. The organization consists of my salespeople and me. What kind of worker should I hire?

Here each worker's sales depend on his own ability and effort, irrespective of the efforts of other salespeople. This fits closely with the situation described above, so the choice between college and high school graduates is exactly the one that we have focused on so far. The simplicity of this case is best seen by comparing it to the next example.

2. Productivity Depends on Co-Workers

A second manager describes her production as follows:

This firm manufactures small appliances. We find it better to have a combination of worker types. High school graduates are cheaper and more cost-effective in the short run, but we find that we can't keep their skill levels up without some college graduates around. The high school graduates forget what they knew. The college graduates keep the high school graduates sharp. So we like to have both kinds of workers. The problem is that I'm not sure about the appropriate balance.

Here workers interact with one another. This is much more typical than the first case, since in most workplaces many jobs are interdependent with each other. College graduates affect the output of high school graduates, and vice versa. Since college graduates are not only producing appliances, but also act as part-time teachers, part of their output consists of their effect on high school graduates.

The equation shown above still holds, but output must be defined carefully. When measuring the output of college graduates, the number of high school graduates must be specified. Table 1.4 provides an example of the kind of information needed.

		Number of College Graduates Employed					
		100	110	120	130	140	150
		Output					
	100	63.1	66.8	70.4	73.9	77.2	80.5
Number of	110	64.9	68.8	72.4	76.0	79.5	82.8
High School	120	66.6	70.6	74.4	78.0	81.6	85.0
Graduates	130	68.3	72.3	76.2	79.9	83.5	87.1
Employed	140	69.8	73.9	77.9	81.7	85.4	89.0
	150	71.3	75.5	79.5	83.4	87.2	90.9

Productivity (Per Worker) of High School & College Graduates Working Together
Table 1.4

It is easy to see that output of a college graduate depends on the number of high school graduates working. For example, if 100 of each type are employed, total output is 63.1 units. If the number of college graduates is increased from 100 to 110, the gain in output is 3.7 units. However, if 150 high school graduates are employed, the gain in total output in going from 100 to 110 college graduates is 4.2. The gain from adding 10 college graduates is larger when there are more high school graduates around. Since college graduates train high school graduates, their services are more valuable when the firm has more potential "students" for them to teach. The larger the number of high school graduates in the workforce, the higher the value of adding college graduates to the workforce.

Similarly, the more valuable that high school graduates are, the more college graduates are employed. High school graduates are more valuable when the "classroom" in which they learn is less crowded. Thus the firm wants a balance of college and high school graduates. This example reveals the importance of interaction. This can be stated as follows: *when workers interact on the job, a worker's contribution to output includes the effect on co-worker output. As a result, it pays to hire better qualified workers when output is interdependent.*

3. Productivity is Independent of Co-Workers, but Depends on Capital

A third manager describes the production process as follows:

We are a large clothing company that has our men's dress shirts produced by a factory in Malaysia. Each worker uses a sewing machine, which costs us $7.50 per day to rent. We can use skilled labor, which produces an average of 4 shirts per day, or professional labor, which produces an average of 6 shirts per day. Skilled labor costs $7.50 per hour, and professional labor costs $12 per hour. The sewing machine company says that it will rent us a new machine that doubles output per worker, but the better machine costs $16.50 per day to rent. Should I rent the new machine? What kind of labor should I hire?

The analysis is easy once the relevant data are compiled, as in Table 1.5. First, consider the old machines. Without looking at the table, the manager might be tempted to not rent the new machines, since they double productivity but cost more than double compared to the old machines. But this ignores the fact that producing a shirt involves both machines and labor. Adding a new machine more than doubles the capital cost, but it does not double the total cost. There is no doubt that the firm should use the new machines.

	Output	Labor Cost	Capital Cost	Total Cost	Cost / Output
Old Machines					
Skilled	4	$60.00	$7.50	$67.50	$16.88
Professional	6	$96.00	$7.50	$103.50	$17.25
New Machines					
Skilled	8	$60.00	$16.50	$76.50	$9.56
Professional	12	$96.00	$16.50	$112.50	$9.38

Analysis of Productivity Using New or Old Machines
Table 1.5

Furthermore, given that the firm is using the new machines, it should hire professional rather than skilled workers. When old machines are used, the cost per shirt is higher with professionals than with skilled labor. But when the new machines are used, the cost per shirt is lower with professionals than with skilled labor. When expensive capital is employed, it may be cost effective to use it intensely. Professionals use the machines more efficiently, which leads us to conclude the following: *a firm should improve the quality of workers that it employs as it increases the amount or quality of its capital stock. More specifically, the optimal level of skill rises as the use of capital relative to labor increases.*

This helps explain why the president of a firm should be very highly skilled. His or her labor is combined with the entire capital stock of the firm, in a sense. It makes no sense to waste the capital by placing it under the stewardship of a low-skilled individual.

We will see later in this book that the labor market has valued highly skilled workers relatively more over time. One explanation for this is that firms have made increasing use of valuable, and very productive, capital in the form of new information technology.

How Many Workers to Hire?

The answer to this question is straightforward. The firm should continue to hire workers so long as the incremental profit from hiring an additional worker is positive.

In our example at the beginning of this section, both college and high school graduates were profitable to employ, but high school graduates were more profitable – they produced more output for the same amount of compensation. We can combine the two decision rules: hire the type of worker that provides the greatest output per dollar of pay, or least cost per unit of output. (When doing so, take into account the effects of interdependencies with co-workers or capital, of course.) Continue to do so until the point where hiring more of that type of worker is no longer profitable.

This approach implies that there is a limit to the number of workers the firm should hire, because of the principle of *diminishing marginal productivity*. As more and more workers are added to an organization, the value of an additional one falls. We see that in the call center example. Why would marginal productivity fall as you hire more workers? The main reason is that workers are combined with other resources: computers, machines, your time as their manager, etc. The more workers that you hire, holding other resources fixed, the more thinly are those resources spread across each worker. For example, if you have a small office with you, your staff, and three computers, as you hire more workers, each one gets less time on one of the computers, and less supervision by you, which tends to

reduce their productivity. This logic holds for *any* resource that is increased while keeping another resource fixed.

Consider Table 1.6. As more workers are hired for the office, the marginal productivity (extra sales) from each additional worker declines. That is a typical pattern in any business. The table also illustrates the principle that you should hire workers up to the point where they are no longer profitable; that is, when marginal productivity is less than or equal to marginal labor cost.

Number of employees	Total sales	Marginal productivity of employee	Total labor cost	Marginal cost of employee	Profit
0	$0	$0	$0	$0	$0
1	$100,000	$100,000	$14,404	$14,404	$85,596
2	$141,421	$41,421	$28,808	$14,404	$112,613
3	$173,205	$31,784	$43,212	$14,404	$129,993
4	$200,000	$26,795	$57,616	$14,404	$142,384
5	$223,607	$23,607	$72,020	$14,404	$151,587
6	$244,949	$21,342	$86,424	$14,404	$158,525
7	$264,575	$19,626	$100,828	$14,404	$163,747
8	$282,843	$18,268	$115,232	$14,404	$167,611
9	$300,000	$17,157	$129,636	$14,404	$170,364
10	$316,228	$16,228	$144,040	$14,404	$172,188
11	$331,662	$15,434	$158,444	$14,404	$173,218
12	$346,410	**$14,748**	$172,848	**$14,404**	**$173,562**
13	$360,555	**$14,145**	$187,252	**$14,404**	**$173,303**
14	$374,166	$13,611	$201,656	$14,404	$172,510
15	$387,298	$13,132	$216,060	$14,404	$171,238

Marginal Productivity & Marginal Cost of Hiring An Additional Worker
Table 1.6

The next-to-last column shows the marginal cost (compensation and other benefits) from hiring an extra worker. If this is less than the marginal productivity, profit rises from hiring more workers. If marginal productivity is below marginal cost (the lowest rows), profit would be increased by laying off some workers.

The general result is familiar to anyone who has studied economics: profit is maximized by using any resource, including employees, up to the point where the marginal benefits just equal the marginal costs.

Other Factors

Availability of Workers

In many communities, more high school graduates than college graduates are available. Does this mean that a firm should have a bias toward hiring high school graduates, as they are cheaper to hire? In most cases the answer is no. Most employers, even very large ones, employ a small part of the local labor force, so the total availability of workers is irrelevant. There are two exceptions, both of which arise when the firm employs a suffi-

ciently large part of the relevant labor market that its hiring has some effect on the market price.[5]

The first case is where a firm employs a very large fraction of the local labor force (say, a factory in rural Thailand where there are few other employers). In that case, hiring more of a certain type of worker drives up the wage. The analysis is as before, but the firm needs to take into account the rising wage in analyzing output per dollar labor cost.

The second case is more important. When the type of labor being hired is very specific, the market for it may be thin (there are few buyers for this type of worker). If so, there may be significant search costs to finding a worker with the right skills. The wage must build in these amortized search costs, since it is a cost of employing this type of worker. Once that is done, the analysis is as above.

The Firm's Financial Condition

Suppose that the firm is in financial distress. How should this affect its hiring decisions? Similarly, if the firm is having a very successful period, should this affect hiring? Once again intuition can be misleading here. None of the analysis above makes mention of the firm's financial condition. Choosing the wrong kind of labor will only make the financial condition worse.

A firm in financial distress may have trouble paying employees because of cash flow problems. However, this is a *financial* problem, not a *labor* problem. The best solution to such a problem would be to arrange financing to cover the short-term cash flow problems, so that the firm can hire workers when it is profitable to do so. In fact, creditors should encourage this, if it increases profits, since it makes it more likely that the debt will eventually be paid off.

Making Decisions With Imperfect Information

Throughout this chapter, we have conducted our analyses based on data that either exist or were assumed to exist. Unfortunately, the information required are often not immediately available or are expensive to obtain. What can a manager do in such circumstances? There are several possibilities: make a decision independent of any analysis; estimate the relevant information; conduct an experiment; or collect data from personnel records.

A decision independent of any analysis is the easiest approach. The manager makes a decision based on gut instinct, experience, or standard practice. However, it is least likely to lead to an effective decision. Even a little formal thinking is likely to lead to a better result, and if that thinking is supported by some estimation of the tradeoffs involved, the decision is even more likely to be made effectively. This book is intended to guide you to more structured, and therefore better, decisions about organizational design.

Suppose, for example, that you have tried to develop a formal analysis of an organizational design issue using the concepts in this textbook. The conclusions depend on certain pieces of information, such as the effect on productivity of high school graduates of working side-by-side with college graduates. When such information is not available, an estimate – even an informed guess – may be appropriate. The structured approach allows you to consider how robust the conclusion is, by varying the estimate up and down. In

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[5] This is the economic condition where the firm has *monopsony* power.

some cases the correct decision may be the same for a wide range of values for the estimated information. In those cases, the right answer is clear. In other cases it may be that the correct decision depends critically on the specific value of the information. In those cases, it would be worth further expenditures to get a more accurate estimate before making any decision.

An alternative is to experiment. When data on relative productivity of different types of workers is unavailable, the firm might hire some of each type (perhaps even part time, or as temps) and measure their output. Similarly, when trying to figure out the correct commission rate in a sales force incentive plan, the firm might experiment with different rates in different locations, before rolling out a plan for the entire organization.

A final alternative is to collect data in order to estimate the tradeoffs under consideration. This alternative is becoming increasingly viable with the dramatic fall in costs and rise in capabilities of computers. In the old days, firms kept personnel records on computer tapes that were difficult and slow to access. Data entry was costly and cumbersome, and data were rarely used, so firms had little incentive to maintain detailed databases. Now, firms often have detailed personnel records readily at hand, and database and other software to analyze the data easily. It is becoming more and more feasible to provide estimates – sometimes rough ones, and sometimes fairly sophisticated ones – of the impact of organizational policies on desired outcomes such as turnover or profitability.

Of these approaches, the first is almost always the least effective. If the analysis is complex, and information is incomplete or unavailable, you may be tempted to use intuition or gut instinct to make a decision. Your intuition and instincts are usually based on your experience, so they are not worthless. However, we have seen examples in this chapter where the analysis led us to some counter-intuitive conclusions. The point of the kind of formal analysis described in this book is to improve your decision making, by making it more rigorous, and clarifying the important (and unimportant) issues. Moreover, more formal thinking can help you realize the situations in which your experience guides you correctly, and incorrectly. Unfortunately, too often in this area managers rely on intuition, because the problems can be very hard to analyze formally and with structure. By the end of this book, you will have tools that will increase the effectiveness of your decisions about personnel and organizational design.

Summary

This chapter provided a simple, short introduction to the topic of hiring. We follow this up with consideration of the job offer in the next chapter. The primary purpose of this chapter was to get you started in thinking about organizational issues more formally, using economic tools. A little formal thinking can go a long way in clarifying issues, sometimes leading to surprising conclusions.

The chapter raised several issues. We started with a scenario of choosing between two job candidates, one with relatively predictable job performance and one more risky. To the extent that turnover costs can be avoided, this actually may be a good thing for an employer. This is because risky job candidates may have an option value. If she turned out to be a poor choice, the loss is limited as the firm can terminate the employee. The firm may be able to capture a substantial return if the employee turns out to be a star in some circumstances.

We then considered an employees output to wage ratio. The best worker is not the cheapest, nor the most productive, but the one with the highest ratio of productivity to cost. We should hire as long as the marginal productivity of the last worker hired is greater than or equal to the cost of the worker.

The chapter introduced some important economic ideas that you should begin to incorporate into your everyday thinking. First, never forget that you are constrained by market competition. In the case of personnel management, the job package that you offer your employees must be adequate to attract and retain the kind of employees that you want – especially if they are known to be stars. Second, always try to think in terms of tradeoffs and alternatives. When you are analyzing a decision, consider not only the benefits, but also the costs, and balance them against each other. The costs will be determined primarily by labor market pressures, which act as a constraint on optimal personnel policies. The benefits of employees depend on the production process; how they work, whom they work with; and what capital they work with. Some benefits and costs may be subtle or intangible, but they may still be important. One good example is that you should always include your best alternatives when making a decision. A choice may be profitable, but it may be less profitable than other options.

Review Questions

1. You are recruiting to fill a position in your firm. Should you try to "sell" the job to applicants by describing it in the nicest terms that you can? Should you make the job sound as desirable as possible? As a job applicant, should you try as hard as you can to convince the recruiter that you are the perfect candidate for the job? Think about these issues over the next couple of chapters. (Hint: a similar situation arises on first dates.)

2. Potential employees can be unusual in many ways. Can you think of any attributes of job applicants that would make them risky hires, but in a way that might suggest they have high option value as employees? In what ways might candidates be risky that would suggest their option value is not high?

3. Capital (including advanced information technology) can serve as a *substitute* for employees in producing a firm's output. It can also serve as a *complement*, making workers more productive at their tasks. Which effect do you think is likely to be more important in practice? Why? Which kinds of jobs are most likely to be ones in which computers or machines can *replace* workers? Which are most likely to be ones in which they cannot replace workers, but can help workers perform their jobs better?

4. Many employment issues are very complex, and involve interpersonal relationships or qualitative considerations. For this reason, they are often very difficult to quantify. If you cannot quantify some of the issues that we discuss, are the tools developed in the text irrelevant? Why or why not?

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Appendix

The formal theory behind the conclusions in the second section of this chapter is the standard economic theory of production. Assume that firm output Q is a function of high school graduate labor H, college graduate labor C, and capital K:

$Q = f(H, C; K)$.

The firm maximizes profits by deciding how much of each type of employee to hire. For a given amount of output, the firm would choose between H and C to minimize costs:

$$\min_{H,C} \ W_H \cdot H + W_C \cdot C + \lambda [Q - f(H,C;K)],$$

where W represents wage rates, and λ is a Lagrange multiplier. The first-order conditions with respect to H and C are:

$$W_H - \lambda \frac{\partial f}{\partial H} = 0,$$

$$W_C - \lambda \frac{\partial f}{\partial C} = 0.$$

The multiplier λ reflects the marginal cost of output for a given Q. Once λ has been determined, the firm sets marginal cost equal to marginal revenue to determine the amount it wants to sell, which determines the optimal output Q. We now model the three scenarios described in the chapter.

1. Productivity is Independent of Co-Workers

The independence is easily modeled by an additive production function:

$$f(Q) = [aH + bC]^z,$$

where $0 < z < 1$; $0 < a < 1$; and $0 < b < 1$. In this case,

$$\frac{\partial f}{\partial H} = az[aH + bC]^{z-1},$$

$$\frac{\partial f}{\partial C} = bz[aH + bC]^{z-1}.$$

Since from above we know that:

$$\frac{W_H}{W_C} = \frac{\partial f / \partial H}{\partial f / \partial C},$$

collecting results we have that:

$$\frac{a}{b} = \frac{W_H}{W_C}.$$

All four of these terms are exogenous parameters (unless the firm is a monopsonist, in which case the W's are endogenous). This means that the first-order conditions cannot be met except by coincidence, so that a corner solution is the optimum. Either H > 0 and C = 0, or H = 0 and C > 0. If the left-hand side of the last expression is larger than the right-hand side, high school graduates should be employed, and vice versa.

2. Productivity Depends on Co-Workers

A good way to model this case is:

$$f(Q) = zH^a C^b.$$

Analysis similar to the previous case yields the condition:

$$\frac{H}{C} = \frac{aW_C}{bW_H}.$$

Here we can have an interior solution, and the optimal amounts of H and C depend on each other.

3. Productivity is Independent of Co-Workers, but Depends on Capital

This case could be modeled similarly to case 1, but with the marginal productivities of H and C depending positively on K. In this case, a corner solution would again apply, but the optimal amounts of H and C would be positively related to the level of K. A similar approach could be applied to case 2, of course.

Recruitment

"I sent the club a wire stating, 'Please accept my resignation. I don't want to belong to any club that will accept me as a member.'" (Groucho Marx)

Introduction

In this section of the book we are interested in how firms bring employees into the organization, and the patterns of careers they have once they are there. Table 2.1 presents some data on these questions from an actual firm. The data are from confidential personnel records for all management employees in a U.S. firm, over the period 1969-1988.[1] Since the data are confidential, we will refer to the firm as "Acme Incorporated." We will present data from Acme in several chapters to help illustrate concepts.

Hierarchical Level	% of total employees	% hired at this level	Number of years in		% who stay at Acme			
			Current position	Acme	Only 1 year	Only 2 years	5-10 years	More than 10 years
1	25.4	99.0	2.3	2.4	10.7	10.4	25.5	39.8
2	26.2	31.0	2.5	4.5	15.2	10.2	19.7	38.5
3	25.4	31.0	3.0	6.0	10.7	10.1	25.5	35.6
4	20.5	27.0	4.1	7.9	15.3	7.9	24.9	30.7
5-8	2.5	19.0	4.0	9.7	7.1	14.3	42.9	28.6

Career Patterns at Acme, Incorporated
Table 2.1

Acme is in a service industry. Its management ranks have 8 hierarchical levels, from entry (Level 1) to CEO (Level 8). Most management employees are in the first four levels. Level 1 is what is often called a *port of entry*; virtually all who work in jobs at this level were hired into Acme at this level. Since it is the bottom of the management job ladder, this should not be surprising, as demotions are very rare in most companies. Nevertheless there is a stark contrast between Level 1 and higher levels. At Levels 2-8, most employees were not hired from the outside, but instead were promoted from within.

Because of promotion from within, managers in upper levels have substantial experience at Acme on average. For example, Level 4 managers have almost eight years of experi-

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[1] The Acme tables are based on Baker, Gibbs & Holmstrom (1994a,b). The Acme data are from a single firm, but the patterns that we illustrate with the Acme data in this book appear to be fairly representative of the policies in many firms, in different countries. See the papers cited in Gibbs & Hendricks (2004).

ence in the company. It also appears that movement between levels (that is, promotions) is more rapid at lower levels, since the average number of years in the current job is longer in upper levels.

The last four columns give some sense of turnover and career length for Acme's managers. There are two patterns. First, many leave Acme very quickly after being hired. For example, about 11% of those who are hired at Level 1 leave within the first year, while another 10% leave the next year. Conversely, if a manager stays at Acme beyond the first year or so, he or she has a good chance of staying for many years. For example, about a quarter will stay for between five and ten years, while about a third will stay for more than ten years.

Thus, there seems to be evidence of *sorting* in the first few years on the job. Almost a quarter of new hires will leave within two years, either because Acme decided it did not want to keep them, or because new employees decided they did not want to stay. Second, if employees survive the sort, they often enjoy *careers* at the company that last for many years. This suggests there is some value to having employees remain with the firm. These are issues we explore in this and the next three chapters.

With this introduction, let us now return to the issues we raised in Chapter 1. Once your firm has decided which types of workers it would like to hire, it must recruit for those types. There are two general issues. First, how can it weed out undesirable applicants? In some jobs, hiring the wrong type of employees can cause major problems, disrupting output and costing the firm not only wages but lost profits. Second, how can the firm attract the right types of applicants? Attracting the right type will reduce workforce problems, as well as recruitment and turnover costs. Put another way, your firm must sort new hires, just as Acme apparently does. How can you think about sorting for the most effective workforce?

Screening Job Applicants

One strategy for attracting good quality job applicants is to offer a high level of pay or benefits. This will generate a large pool of applicants, and higher quality applicants will be more likely to apply for the job than if pay was lower. Unfortunately, so will low quality applicants. The personnel office will be flooded with resumes, and only a small portion may be qualified. An even worse consequence is that some undesirable workers will slip through the hiring process and become employees, while some desirable workers will get lost in the shuffle and never hired. So, in general this is not a very useful approach just by itself.

The problem of the wrong type of applicant applying to the firm is called *adverse selection*.[2] This is a general problem in economics, not just in employment. The problem arises because of asymmetric information. One party knows what "type" they are (in this case, a high or low quality job candidate), and the other does not. The one that knows uses this information strategically to personal advantage. A classic example involves used car sales. Owners know the quality of their used car. Those with good quality used cars are more likely to keep them, while those with low quality used cars are more likely to sell them. This implies that the quality of used cars is lower than it would otherwise be. It also implies that

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[2] In 2001, George Akerlof was awarded the Nobel Prize in Economics for analyzing the problem of adverse selection. He shared it with Michael Spence, who was awarded the prize for analyzing the problem of signaling that we discuss later in this chapter. Joseph Stiglitz also shared the prize that year, for analyzing problems of asymmetric information.

owners of high quality used cars may find it difficult to get a good price for their car, since buyers worry that it is a low quality car.

Adverse selection arises in our case when the wrong kinds of workers are attracted to the firm. A number of approaches can be used to mitigate the problem of adverse selection in recruiting. Let us begin with a simple case first, the use of credentials.

Credentials

An obvious approach to weeding through resumes of job applicants is to look for credentials that distinguish some applicants from others. The most important ones are generally the type of experience (job and promotion history) the applicant has, the type of training (e.g., college major or MBA), and the quality of school the applicant attended. Indeed, these are almost always the most important lines on anyone's resume. What makes a credential useful for hiring? Here are some considerations:

Informativeness of the Credential

Ability to perform well on the job must be positively correlated with ability to obtain the credential. For example, a university degree is a useful credential only if university graduates tend to be more productive at the job in question.

Cost of Obtaining the Credential

A valuable property of the credential is that it is relatively easy for well-qualified workers to obtain, compared to poorly qualified workers. When this is true, the credential is very likely to signal differences in ability. For example, it is not very difficult for a qualified accountant to pass the CPA (Certified Public Accountant) exam, but it is virtually impossible for someone with no training in accounting to pass. Thus, using the CPA as a screen effectively sorts between qualified and unqualified accountants.

On the other hand, a credential that is extremely expensive for all workers to obtain will not do well in sorting them. If a credential is very difficult to obtain, few applicants will have it. For a credential to be effective, it must be that most qualified applicants possess the credential while most unqualified ones do not. If a very small subset of qualified applicants has the credential, or a large subset of unqualified ones does, the credential is not helpful.

Return on investment in the credential. If the difference in wages between those who have credentials and those who do not is not very great, small differences in credentials will signal large differences in ability. For example, if the credential is education, and the increase in earnings from obtaining a college degree is small, only the most talented will get the degree. This is because they are the ones for which obtaining the degree is cheapest. When the rewards to obtaining a degree are large, even not-so-able people can be induced to get the degree.

We will see these ideas again below when we discuss *signaling*. Signaling is one way of resolving adverse selection problems. In many cases, a high quality type can incur some costs to *signal* to others that they are high quality. If low quality types do not also invest in the signal, then it can serve to distinguish the high quality types from the low quality types. For example, an owner of a high quality used car can offer a warranty. It may also be possible for a high quality job applicant to signal this to potential employers. Before we discuss this idea, it is useful to consider simpler sorting issues first.

Learning a Worker's Productivity

Suppose that you advertised an investment banker job as in Chapter 1. In response you received a set of resumes from job applicants. You looked through them, and selected a subset with appropriate credentials. In a job like investment banking, small differences in ability, personality, or other employee characteristics may lead to large differences in effectiveness on the job. Unfortunately, the self-selection of applicants to the job, and further winnowing by sifting through their resumes, makes the pool of remaining applicants look more and more alike. In general, the more that a set of applicants has already been sorted, the lower will be the variance between the remaining candidates. What should you do next?

You could hire one at random, and take a chance. However, given the stakes it is likely to make sense to expend some resources to screen them further.

There are a variety of methods that firms use to screen applicants. Some give job applicants tests, to see how they perform on specific tasks. This approach is more likely to work well for jobs with fixed, measurable tasks. It is not likely to work well for an investment banker. Many firms use psychological profiling. Unfortunately, this technique does not tend to work well in practice. One reason is that psychology is a highly inexact science. Another is that job applicants have an incentive to "game" the test, trying to sound like better employees than they are in reality. For example, one study found that 90% of job applicants who took one popular psychological test were able to inflate their "conscientious" score.[3] Finally, virtually all firms conduct personal interviews of job applicants. Such interviews can vary from simple to elaborate. In the case of investment banking, applicants may be put through several rounds of interviews, eventually being flown to the company's headquarters to meet with high-level partners over several days. Such a process can be extremely expensive.

All of these examples involve some degree of costs (except when the firm hires applicants without any screening whatsoever). Consider the following example, and think about the extent to which your firm should invest resources in screening applicants carefully.

Screening Bankers

Table 2.2 shows productivity levels for five hypothetical types of job applicants (A through E) in two different firms, an investment bank and a commercial bank. Assume that the remaining applicants (after earlier rounds of weeding out) are paid about £100,000, so each bank expects to pay about the same salary to anyone it hires.

		Type				
		A	B	C	D	E
% of Job Applicants		10%	20%	40%	20%	10%
Productivity (£	Investment Bank	−£250	0	125	200	450
thousands)	Commercial Bank	£95	100	110	120	125

Screening Investment Banking Job Applicants
Table 2.2

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[3] See Paul (2004).

Finding out what type a job applicant is has obvious value to each firm. The investment bank would want to avoid A and B types, while the commercial bank would want to avoid A types because productivity would be lower than pay.[4] Suppose that applicants can be put through a series of tests that cost £2,000 per person, and give definitive information on which type the applicant is. How valuable is such information? In other words, how much would each be willing to pay to screen workers before hiring? Table 2.3 provides figures to help us answer this (all numbers are rounded to the nearest £1,000).

	Screen?	Productivity	Salary	Screening Cost	Profit
Investment	No	£110	£100	£0.0	£10.0
Bank	Yes	193	100	2.9	90.1
Commercial	No	110	100	0.0	10.0
Bank	Yes	112	100	2.2	9.8

Profitability of Screening at an Investment Bank & a Commercial Bank
Table 2.3

With no screening, both banks would have £110,000 average productivity from each new hire, or average profit of £10,000.

With screening, the investment bank would reject types A and B, and accept only 70% of all applicants. The average productivity of the C, D and E types hired would be about £193,000, substantially higher than without screening. The screening cost per worker actually hired would be £2,000•10/7 (since the bank would hire an average of 7 out of every 10 applicants), or £2,857 per hire. Average profit from each new hire would rise with screening to about £90,100. The investment bank would profit greatly from screening applicants.

If the commercial bank screened applicants, it would reject those of type A, hiring 90% of all applicants. Average productivity would rise only slightly to about £112,000, but at a screening cost of £2,000•10/9, approximately £2,222, per new hire. Profit per new hire, net of screening costs, would fall to about £9,800. The commercial bank would not benefit from screening.

Why the difference? There are two reasons. First, the investment bank wanted to screen out three times as many workers as the commercial bank. The point of screening is to avoid hiring the applicants who would not be profitable. Second, the downside from hiring poor candidates was worse at the investment bank; some applicants would have produced nothing, and others would have destroyed value. The investment bank was more at risk from hiring the wrong type of worker.

This example motivates issues to consider when screening (see the Appendix for a formal treatment):

Screening is more profitable when the test is more effective: A test can be more effective in several ways. First, it can be cheaper to administer. Second, it can be more accurate. That is, it can correctly distinguish between desirable and undesirable job applicants a

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[4] Actually, you should remember from Chapter 1 that each bank would want to hire those with the highest productivity per £ of compensation cost. We are simplifying here by asking how each firm can improve profits by avoiding applicants who would imply financial losses if hired.

higher percentage of the time. No test is 100% accurate. Moreover, as noted earlier, job applicants often try to game such tests so as to appear to be a better candidate than they really are. Finally, an effective test is more discriminating. That is, it weeds out a higher fraction of candidates, recommending a smaller fraction for hiring. In the example above, the commercial bank's screen was not very valuable because only 10% of candidates were rejected.

Screening is more profitable when the stakes are higher: The purpose of screening is to avoid the unprofitable candidates. Therefore, the greater the downside risk from hiring the wrong person, the more value there is to screening. Similarly, the longer that a new candidate can be expected to stay with the employer, the more valuable will be the screen. Firms that intend to hire employees for the long term thus tend to invest more in careful screening before committing to a new hire.

Is Screening Profitable? For Whom?

If the investment bank screens workers, productivity is much higher for its employees than for random job applicants. Now the same issue arises that we faced with our risky hire in the previous chapter, Svenson, when she turned out to be a star. The labor market will value our screened employees more highly, simply because we decided to hire them (they passed our screen). Therefore, it is not realistic to assume that we can continue to pay £100,000 at the investment bank, if productivity is almost double that. Other investment banks would bid away our workers, once they realized that we screen our employees carefully.

What will we end up having to pay our employees? It is hard to tell without additional information. It is even conceivable that we would have to pay as much as their productivity, £193,000, if the labor market is very competitive. Screening may not always be profitable to the employer; indeed some firms screen extensively, while others hardly screen at all.

What about job applicants? Why would they apply to a firm if they knew they would be screened? It must be that the potential higher pay, if they pass the screen, compensates for the trouble and risk involved in the screening. If the application process is not too difficult, then the extra compensation need not be too high to make it worthwhile for applicants to try. If the screen is extensive, such as probation (described below), however, job applicants may have to be compensated significantly in order to be willing to undergo the screening process.

When the firm cannot benefit much from the screen because labor markets are competitive, job applicants will have to pay for much or all of the screening. Of course, this happens already in the case of pre-job market screening such as education or professional certification. But it may also happen with on-the-job screening. Workers can pay for the screening implicitly, by their willingness to accept lower pay during the screening period then they would otherwise earn.

In any case, it is likely that both the employer and its employees will share the benefits (and costs) of screening. Firms that screen more extensively will tend to be higher paying firms, both because their employees are more productive, and because applicants will require some compensation for the costs and risks of trying to successfully earn long-term employment at the firm.

A further consideration arises when employees have some idea about whether they are high or low ability. Those who are high ability have a better chance of passing the screen,

so they have more to gain from the screening. Thus, they should be more willing to undergo and pay for the screening. We discuss this below under the topic of signaling.

Probation

The screening methods described above may be useful, but are imperfect. An important concern is that they are only proxies for what the firm really cares about – how the person actually performs the job. In many cases, the only way to truly tell if a job applicant is a good fit for the job is to have them *perform* the job itself. Thus, a final approach to screening is to have the job applicant do the job for some period, either very briefly during interviews, or more extensively during some testing period. The most elaborate form of this is to hire a worker for a probationary period, and only hire them long-term if their performance during probation is adequate.

Of course, a problem with probation is that costs of terminating employees can be substantial. In Italy, if the firm is found to have fired an employee who has worked for the firm long enough without legal cause, the firm must rehire the worker, pay lost wages and social insurance contributions, and pay a penalty to the government. In Indonesia, firms must pay workers severance of more than one month of salary for each year that the employee worked for the firm, up to 9 months of severance, plus 15% of salary as "worker's rights replacement money." By contrast, turnover costs are usually very small in Denmark. The general trend has been toward increased turnover costs, due to greater employment regulation and litigation over wrongful termination.

Where firing costs are high, employers can often still use probation, under a different form. For example, employees might be hired on a temporary basis through a temporary employment agency. Those who perform well could then be offered regular employment. Those who do not perform well do not need to be fired; they are just not hired from the temporary agency. Indeed, some temp agencies have an explicit strategy of serving as a screening agency of this kind for employers.

A similar approach that firms can sometimes use is to hire applicants on temporary (fixed term) contracts. When the contract term is over, the firm can elect to hire the worker more permanently, offer a new fixed term contract, or not rehire the worker at all. Such contracts are not just used for low skilled jobs; many firms hire high-level consultants in a similar fashion.

Evidence suggests that increasing regulation of employment is one factor behind the recent growth in temp agencies worldwide. For example, in the United States some employment regulations vary from state-to-state. Those states that regulate termination more strongly tend to be the ones where firms are more likely to use temporary workers. In Europe, the employment relationship is more highly regulated than in most other parts of the world, and hiring of temps is quite common. According to one study in 2003, 13 percent of all wage earners in the European Union were employed on temporary contracts. In Spain, the corresponding figure was 31%, and roughly half of workers under the age of 30 were employed on temporary contracts.

Implications of Probationary Screening

If the firm uses probation to screen workers, and retains those who are good performers, there are several interesting implications. First, the firm is likely to promote those who survive the screening. They have been revealed to be more productive than average job applicants. Once this is evident, the firm is likely to give them greater responsibility.

Second, the system will generally be up-or-out, since those not promoted will typically not be rehired. This is much like the lower levels of promotion ladders that are seen in most professional service firms.

Third, a large raise in compensation will usually accompany the promotion. The firm promotes those it finds most productive, so a promotion implies that you are more talented than the average new hire, which raises your market value. For this reason, firms typically have to offer raises on promotion, or risk losing those promoted. Moreover, since promotion is based on performance, and performance depends in part on an employee's effort on the job, the promotion will become a form of incentive pay. We return to these issues in Chapter 11.

Signaling

The ideas of screening and probation can be extended easily to another important case. Screening is sometimes unrealistic, because it assumes that workers do not know much about their own talents. In reality, most people have a good idea about their skills, work ethic, and ambition – the things that make them a good employee. Let us now assume that workers know what type of employee they will be.

If workers know what type they are, and share this information honestly with employers, a firm could recruit employees of a certain type by simply putting up a notice that it is looking for workers of that type. Unfortunately, this is not likely to be an effective approach. Recall our discussion earlier in this chapter about offering high wages to high skilled workers. A firm that tried this would find itself facing adverse selection, since job applicants who were

not highly skilled would be tempted to apply anyway. This is why we decided that some kind of screening would be necessary.

When workers know more about their employability than employers do, screening can be used to solve this adverse selection problem. After all, screening works by sorting workers, and keeping those who fit well and are most productive with the firm. It then pays higher wages to those who are screened out. Shouldn't this attract those who are good candidates to apply in the first place, and deter those who are not good candidates? Let us consider an example to see how this might work.

Consider a simplified example of recruiting for an investment bank. Suppose that simple interviewing allows the bank to weed out Types A through C easily, but that it is much harder to distinguish between Types D and E without further screening. The bank would like to hire E types because they are the most profitable. Instead of screening, can it construct a job offer involving probation, up-or-out promotion, and a raise on promotion that is attractive to the E types, but not to the D types?

To model this situation, we need a little more information. First, let us assume that the bank can figure out what type an employee is after observing them on the job for one year. However, the accuracy of this judgment is not perfect: 10% of the time, the wrong decision is made. Thus, 10% of D types are promoted when they should not be (does this remind you of your boss?), and 10% of E types are not.

We also need to know what each type could earn elsewhere, since we have to offer a more desirable package to E types, but a less desirable package to D types. Assume that D types can earn £175,000 in other jobs, while E types can earn £200,000 in other jobs. Thus, their alternatives working elsewhere for two periods are twice these salaries, £350,000 for D types, and £400,000 for E types.

Finally, we need to know how long those promoted will work for us. To keep things simple, assume that they will work for one year after promotion. Table 2.4 provides these figures (rounded to the nearest £1000), and calculates the expected value of the job offer to each type, for different salaries in the two years W_1 and W_2.

W_1	W_2	Type					
		D			E		
		Expected pay		Apply?	Expected pay		Apply?
		Alternative	Apply		Alternative	Apply	
£200	£200	£350	£378	yes	£400	£400	no
180	225	350	360	yes	400	403	yes
160	250	350	343	no	400	405	yes
140	275	350	325	no	400	408	yes
120	300	350	308	no	400	410	yes
100	325	350	290	no	400	413	yes

Motivating Self Selection of Job Applicants
Table 2.4

The first offer considered equals what E type applicants could earn elsewhere, £200,000 per year. This obviously attracts D types, but is no lure to E types. The second offer lowers pay during the probation period (W_1), and raises pay after promotion (W_2). Each row below further lowers W_1 and increases W_2. Because the promotion is not guaranteed, the firm

must offer more than £400,000 in total pay $W_1 + W_2$ in order to attract E type applicants. For this reason, and reflecting the risk involved in accepting lower initial pay compared to what E types could earn elsewhere, each subsequent row involves higher total pay for those who win promotion.

To calculate the actual values to D and E if they apply, note that each earns W_1 in period 1. In period 2, D types earn W_2 with 10% odds, and their alternative wage with 90% odds. Similarly, in period 2, E types earn W_2 with 90% odds, and their alternative wage with 10% odds:
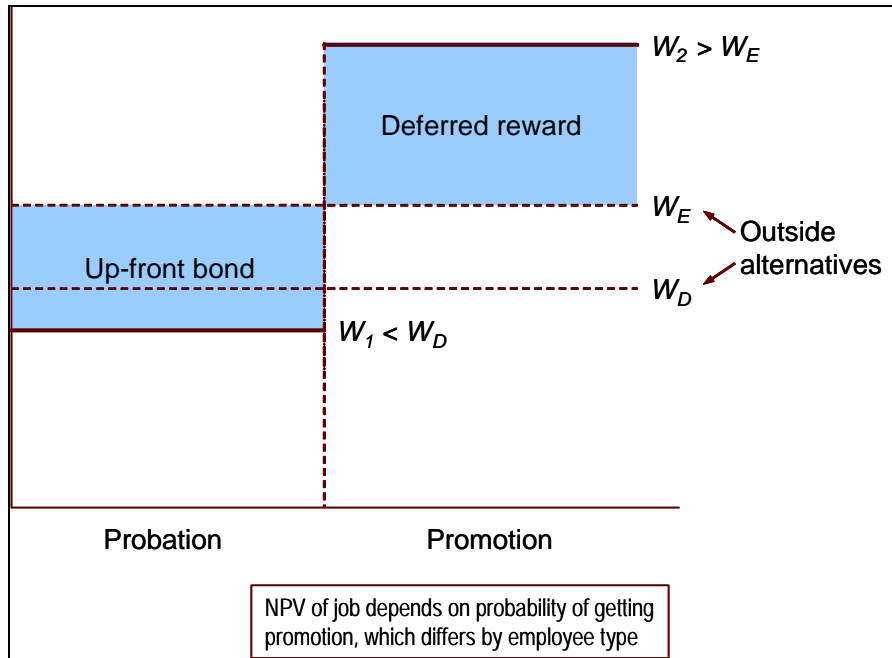
Value of applying for D = W_1 + 0.9•£175,000 + 0.1•W_2;

Value of applying for E = W_2 + 0.1•£200,000 + 0.9•W_2.

The first two offers are attractive to D types. This is because pay is higher at the investment bank than they could get elsewhere, even during probation. Our first lesson is that in order to deter some applicants from applying, we must pay less than those applicants can get elsewhere before probation.

Similarly, the last few offers are attractive to E types, because the high pay after promotion is enough to compensate for the low initial pay, given the high probability that E types will be promoted. Our second lesson is that in order to attract some applicants, we must offer more than they could earn elsewhere after probation.

Thus, probation can generate good self selection of job applicants, thereby solving the adverse selection problem, if we pay a sufficiently low amount during probation, and a sufficiently high amount after probation. One way to understand this is to note that in effect the firm is demanding that each applicant *post a bond* – by accepting less than they could earn elsewhere – during probation. In return, if they perform well and are promoted, the firm will *give them a reward* – by paying them more than they could earn elsewhere. Figure 2.1 shows the type of contract that we are considering.

$W_2 > W_E$

Deferred reward

W_E

Outside alternatives

Up-front bond

W_D

$W_1 < W_D$

Probation

Promotion

NPV of job depends on probability of getting promotion, which differs by employee type

Deferred Pay as a Screening Mechanism
Figure 2.1

This illustrates the general economic idea of *signaling*. Signaling is a method that can sometimes be used to solve adverse selection problems. In signaling, the "high quality" type *signals* his or her type to the market by *incurring a cost*. If "low quality" types are not willing to incur this same cost, then the signaling is effective: the fact that someone incurs the cost proves that they are the high quality type.

Who Pays, and Who Benefits?

As with our discussions of risky hires and screening, the question of who pays and who benefits (the employer or employee) arises. Signaling only works if the incentives of job applicants are addressed: Type D's must be deterred, but Type E's must be motivated to apply. Thus, it is the employee who will pay for most or all of the cost of signaling, and en- joy most or all of the benefit of the signal. In Figure 2.1, we see that employees pay for the signal by accepting wages below what they could get elsewhere initially. They also pay in the sense that they incur some risk that they will not pass the screen and get promoted, even if they are high ability (if the screening is imperfect). They are rewarded later by earn- ing more than they could earn elsewhere after promotion.

The employer may also pay for part of the screen, and get some of the benefits. Whether this happens depends on what average wages end up being compared to productivity. The firm benefits during the screening period from pay that is below productivity, but incurs costs when it pays more than productivity to those that are promoted.

Examples

An example of signaling is the seller of a used car who offers a warranty. The warranty is costly to the seller, and is the signal. The fact that the seller is willing to offer the warranty, while some other sellers are not, may signal that the car is of higher than average quality.

In our employment example, Type E's can signal their type (and confidence in their ability to perform well and earn promotion) by their willingness to accept low pay in the first period. This only works if the D types are not also willing to accept the same contract.

There are many applications of signaling in the business world. For example, venture capitalists typically demand that entrepreneurs invest all of their family's personal funds in a new business venture. They may even demand that the entrepreneur mortgage his or her home, and invest the proceeds in the startup. At first glance this may seem odd – isn't the venture capitalist supposed to provide the funds? Demanding that the entrepreneur put some "skin in the game" is important, however, as it helps the venture capitalist separate out the most confident and serious candidates from the least.

Another example involves joint ventures between two firms. In such cases, it is common for both firms to invest some funds. One reason for this may be so that each firm can signal to the other the seriousness of their intentions to make the joint venture profitable.

Does Education *Educate?*

Education is another possible example of signaling. Assume for the sake of argument that students learn *nothing* useful in school.[5] However, suppose that more talented students find it easier to learn the material quickly. If so, then they might be able to signal their talents to the labor market by investing in more education than less talented students. In this view of education, instructors require students to pass through increasingly difficult screens. At each stage, some find the cost of passing the next screen to be too high, so they do not get that level of education. Those who find the screen relatively cheap do enroll for that level of schooling. The labor market recognizes this, paying more to those who have obtained more schooling.

Indeed, as Table 1.3 in the last chapter showed, those with more schooling do earn more. Is this due to signaling? It is possible, but it seems extremely implausible that this is the only explanation. If the only purpose of education is to screen, we could probably find more efficient ways to do so than to have students go to college for four years, for example: we could give them a large test at the end of high school. In Chapter 3, we consider investments in new skills. Education clearly plays an important role in doing this.

That said, there is evidence that education does have some role in screening workers. For example, those who almost complete four years of college earn noticeably less than those who go a little bit further and complete their degree – there is a discrete jump in earnings associated with earning the formal credential. This is hard to explain by training alone.

A final and important example is a generalization of our probation idea. As discussed above, probation is a form of pay for performance. It can serve as a signal if high ability job applicants are willing to accept a job offer with a risky but potentially lucrative promotion ladder. The same idea applies to any form of pay for performance. If a new hire is willing to accept more risky pay for performance, this may signal that they are higher ability, and believe themselves to be a good fit for the job. The opposite is true if they try to renegotiate to reduce the pay for performance. Thus, pay for performance helps sort employees in addition to motivating them.

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[5] We sincerely hope that both this book and your professor convince you otherwise!

Signaling More Formally: Separating and Pooling Equilibria

Let us consider a formal example of signaling so that we can see how it works. Suppose that junior accountants can invest in some education or on-the-job training. If they complete the training, they become Certified Public Accountants (CPAs). Assume that there are only two types of accountants, "quicks" and "slows," depending on their ability as accountants: quicks are more productive, and also find it easier to obtain the training necessary to pass the CPA exam.

To formalize these ideas, denote the present value of the employee's productivity as Q, and the cost of obtaining the CPA credential as C. Subscripts refer to the two different types of accountants.

Assume that the labor market pays accountants a salary that exactly equals their expected productivity. The fraction of accountants who are quicks is α, so the fraction who are slows is $1-\alpha$. Thus, if the labor market cannot tell the two types of accountants apart (if there is no signaling), pay equals:

Average productivity = $\overline{Q}$ *=* $\alpha \bullet Q_q + (1-\alpha) \bullet Q_s$.

On the other hand, if the quicks *do* succeed in distinguishing themselves, they will be paid their productivity Q_q. Who do not signal will then be assumed to be slows, so anyone who does not signal is paid Q_s.

The quicks would like to distinguish themselves from the slows, so that they can be paid more. At the same time, the slows would like to be confused with the quicks, so that they can avoid being paid less. This is a general property of adverse selection models: the "lower quality" types generally attempt to associate themselves with the "higher quality" types, who conversely attempt to set themselves apart from the lower quality types. Will the quicks be able to signal their ability by obtaining a CPA?

In order for signaling to work, three conditions are necessary. First, if all other quicks are signaling, and slows are not, an individual quick must be better off with signaling too. This requires that pay net of the quick's cost of the CPA is higher than the pay if she decided to join the slows by not getting a CPA:

$Q_q - C_q > Q_s$.

Second, if all other slows skip the CPA and quicks invest in the CPA, an individual slow must be better off not getting the CPA as well. If a slow decided to "infiltrate" the quicks, he would be paid Q_q, but it would cost C_s. If he did not, he would earn Q_s. Thus, for slows to skip the credential, it must be true that:

$Q_q - C_s < Q_s$.

These two together imply that:

$C_q < Q_q - Q_s < C_s$.

Intuitively, the gain from signaling must be higher than the cost for high ability types, but not so high that low ability types are also motivated to signal.

Third, for *all* of the quicks to be willing to signal, their profit from doing so must be higher than what they would get if none of them signaled at all. If none signal, everyone is paid average productivity, so this requires that:

$$Q_q - C_q > \overline{Q} \;.$$

This condition is even stronger than the other condition for quicks described above, since $\overline{Q} > Q_s$. Very large α implies that $\overline{Q}$ is very close to Q_q, making it more likely that this last condition cannot be met.

Intuitively, signaling to distinguish themselves from the crowd is more likely to be profitable for quicks the rarer that they are. If there are many high quality types, it is relatively easy for low quality types to "hide" themselves among the high quality group.

If these conditions are *not* met, neither has an incentive to obtain the credential, and quicks do not distinguish themselves from slows. In this case there is no signaling. Such a case is called a *pooling equilibrium*. This illustrates that signaling is not always possible.

If the conditions are met, quicks signal and slows do not. This is called a *separating equilibrium*, since quicks are able to separate themselves out from slows by investing in the credential.

These points provide a formal illustration of arguments we provided about screening earlier. Signaling involves screening, but adds an important new ingredient: workers know their type, and firms try to structure job offers so that those who are a better match for their firm reveal this by their willingness to accept the offer, while those who are a poor fit reveal this by refusing to accept the offer.

Which Type of Firm is More Likely to use Signaling?

Signaling is helpful when employers do not have enough information about job applicants to assess their potential accurately enough. It is useful when differences in talent among potential employees matter a lot to productivity. When differences in talent do not make much difference to productivity, signaling will not be very useful. These ideas suggest when we should expect to see employment practices consistent with signaling.

First, signaling should be more important in jobs where skills are most important. Such jobs tend to be those that are at high levels of the hierarchy, in research and development, and in knowledge work. They also correspond well to professional service firms, such as consulting, accounting, law firms, and investment banks. In such professions, even small differences in talent can lead to large differences in effectiveness on the job, so sorting for talent is very important. For this reason, such firms tend to screen very carefully at recruiting, and usually have promotion systems that correspond well to our probation story above, at least in the first few years on the job.

Signaling is also more likely to be used where there is not much information already available about job applicants. Workers who are new to the labor market (say, having just graduated from college or an MBA program) are more likely to see such policies. New hires with many years of experience, and an extensive resume of past accomplishments, should expect to see less use of signaling policies in the job offers that they receive. Nevertheless, firms can use these techniques even for hiring experienced talent at very high levels, when appropriate. For example, a new CEO is often hired for a fixed period contract, with extensive pay for performance. To the extent that the CEO's ability to implement

the strategy is hard to determine, and the CEO knows more about this than the board's hiring committee, such practices can improve CEO recruiting.

Summary

An important objective of personnel policies is to sort talent into appropriate employers and positions in order to increase organizational effectiveness. Since there is asymmetric information during recruiting, firms must screen job applicants. When a high salary is offered, unqualified workers may apply for the job if there is a significant chance that they can survive. This is the economic problem of adverse selection.

There are a number of ways that a firm can cut down the number of undesirable applicants. One way is to look for credentials that are good predictors of on-the-job performance. This works well when the credential is easy to obtain for qualified people but difficult to obtain for unqualified ones.

Beyond credentials, firms can invest in more or less extensive screening when hiring. This can include formal testing, psychological profiling, lengthy and multi-round interviews, and trying workers out on the job briefly. All of these can be helpful, though it is likely that they will be far from perfect predictors of job performance.

The most accurate screen is to employ workers for some probationary period on the job. Of course, it may also be the most expensive. The worker must be paid during this period, and costs can be especially severe in jobs where there is a large downside risk in the worker's job (ability to destroy value). Many firms use some form of probation, either formally or informally, in their hiring practices.

Workers can be induced to join the firm when they are given a contingent contract. In the case of probation, workers receive sufficiently low pay during probation so that only those who believe that they will be successful are willing to apply for the job. A well-crafted probation and post-probation salary schedule can keep undesirable applicants from applying while attracting desirable ones. This is easier to achieve when it is difficult for unqualified workers to sneak past the probationary period and when qualified and unqualified workers have similar outside opportunities.

Screening and probation are important applications of the economic idea of signaling. Signaling is a method that sometimes can solve adverse selection problems. If workers know their ability, qualified workers would try to make this known to employers by signaling, and unqualified workers would try to hide the fact that they are unqualified. Therefore, firms should design recruiting policies to encourage qualified workers to apply, while making it difficult for unqualified workers to get through probation.

Another possible way to induce good self-selection among job applicants is to use strong pay for performance. In fact, probation does this, since the post-probation promotion and raise in pay is contingent on good performance. More generally, incentive pay of any kind tends to improve recruiting, since better fitting employees are more likely to accept strong incentive pay.

Firms can use contingent rewards after probation to attract higher-quality workers. However, this is not free; it comes at the cost of higher wages. These policies are most likely to be useful in companies where small differences in talent can lead to large differences in productivity of employees. This is most likely at high levels of the organization, and in firms

where intellectual work is emphasized. Professional service firms, especially leaders in their respective industries, often employ policies of this type. These include careful recruiting, extensive performance evaluation during the first few years of employment, and up-or-out promotion systems with large rewards to those who are retained. They may also include strong individual pay for performance.

In the classic view of economics, goods are bought and sold on spot markets, with the terms of the transaction consisting of quantity, quality, and price. Our analysis in this chapter has opened up a different view: when firms use probation or contingent pay to screen workers, they offer a *multiperiod* contract. This contract is *contingent* on the employee's performance: how they are treated depends on how they perform. Finally, it also involves a *promise* by the firm – to reward those who perform well with higher pay later. These complications arise because the quality of the good – ability of the worker – is not readily available information. Thus, the economic relationship between the employer and the employee becomes complex. This idea is developed further in the next chapter, and even further still in Chapter 15 at the end of the text.

Review Questions

1. If workers might also be screened by universities, can a firm earn profit from screening them? Under what circumstances is screening more likely to take place on the job rather than before workers enter the labor market?

2. What kinds of firms are most likely to aggressively sort through workers and use up-or-out career systems? Why?

3. How might a *firm* signal to potential employees about important characteristics of the job it is offering? Can you give any examples?

4. Can you give any examples of signaling in other business contexts? How about that you have seen in your own life? In each case, what is the cost of the signal? In what way do those who signal differ from those who do not? Does the signal meet our criteria for a separating equilibrium?

5. Think about the French law allowing small firms to lay off workers at lower costs in the first two years on the job. Who would benefit from passing such a law? Would any workers (or potential workers) benefit? Were the students protesting at the Sorbonne in Paris (one of the most prestigious universities in France) likely to be affected by the law? How? What about unions?

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Appendix

Screening

Here we provide a formal example of the principles of screening discussed in the chapter. Assume that there are two types of job applicants, E and D. Productivity is Q; E types are more productive than D types, so that $Q_E > Q_D$ The probability that a random job applicant is type E equals p; the probability the applicant is type D equals 1–p. The firm pays wage W to those it hires; $Q_E > W > Q_D$. Thus, the firm makes profit from E types, but a loss from D types.

Expected profit from random new hire = $p(Q_E – W) + (1–p)(Q_D – W)$.

The firm has a screen available that costs s, with accuracy q. That is, q equals the probability that the correct decision is made, while 1–q equals the probability of a mistake.

Expected profit with screening = $p•q(Q_E – W) + (1–p)(1–q)(Q_D – W) – s$,

since a fraction (1–q) of E types are mistakenly rejected, and the same fraction of D types are mistakenly hired.

The change in profits from screening compared to not screening equals:

Δ profit = $–p(1–q)(Q_E – W) –(1–p)q(Q_D – W) – s$.

The first term is negative. It is the loss from mistakenly rejecting candidates of type E. The second term is positive, since $Q_D < W$. It is the gain from appropriately rejecting D types. Of course, the third term is also negative.

That the test is more effective when it is more accurate, cheaper, or more discriminating follows immediately:

$$\frac{\partial \Delta profit}{\partial q} > 0; \qquad \frac{\partial \Delta profit}{\partial s} < 0; \qquad \frac{\partial \Delta profit}{\partial p} < 0.$$

The more negative is the loss $Q_D - W$ from hiring the wrong type, the greater is the gain from screening. Therefore, the test is more effective when the stakes are higher. The longer that the wrong type will remain employed at the firm, the larger will this expression be.

Signaling

We now incorporate signaling into the probation model described above. We show how the wage must be structured each period to ensure signaling. There are types E and D, as defined before. The firm offers W_1 and W_2 in two periods. In period one, workers are observed on the job. Those deemed to be good fits are promoted and paid W_2, while the rest are fired and earn their outside pay. The promotion decision is made with accuracy q as above.

The outside alternatives for each type are $W_E > W_D$. In assuming that there are different outside alternatives, we are taking a different tack than in the formal treatment of signaling in the chapter above. In effect, we are assuming that while this firm may be able to induce self selection of E types, we are begging the question about whether or not E types signal in other firms as well. This may not be the case. However, it seems reasonable to assume that E types can expect to have higher average earnings over their career than D types through some means or another, since they have higher ability.

In order to deter D types, but attract E types, we must meet both of these conditions:

$W_1 + (1–q)W_2 + q \bullet W_D < 2 \bullet W_D$.

$W_1 + q \bullet W_2 + (1–q)W_E > 2 \bullet W_E$,

The first expression says that E types expect to do better at this firm. The second says that D types expect to do worse. A little algebra shows that this scheme can induce self-selection if:

$W_1 < W_D + (1 – q)(W_D – W_2) < W_D$,

$W_2 > W_E + (W_E – W_1)/q > W_E$.

In fact, the optimal wages (that minimize compensation cost) are:[6]

$$W_1 = W_D - \left(\frac{1 - q^2}{2q - 1} \right)(W_E - W_D),$$

$$W_2 = W_E + \left(\frac{2 - q}{2q - 1} \right)(W_E - W_D).$$

These imply that $W_1 < W_D < W_E < W_2$, of course, so the scheme involves deferred pay. By inspection of either of the last two sets of expressions, it is easy to see that:

- The more accurate the test (larger q), the smaller is W_1, and thus the larger is the bond posted by E types. Similarly, W_2, and thus the reward on promotion, is larger

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[6] We thank Professor Erik de Regt, Maastricht University, for deriving these.

the more accurate is the test. Intuitively, a more accurate test makes E's more willing to accept high-stakes signaling, since there is less chance of a mistake.

- The smaller is W_D, the smaller is W_1. The larger is W_E, the larger is W_2. Thus, the larger the differences in productivity between the two (reflected in their outside market values), the larger will be the reward on promotion.

These can be seen more formally in the last set of equations above, since those imply:

$$\frac{\partial W_2}{\partial q} < 0 < \frac{\partial W_1}{\partial q}.$$

Investment in Skills

"An investment in knowledge pays the best interest." (Benjamin Franklin)

Introduction

This chapter is about what you are doing *right now*: investing in skills and knowledge. Is Ben Franklin correct that this is a good investment for you? How can you tell? Should your employer pay for your education? Offer on-the-job training?

When asked about turnover, most firms express concern that they will lose their investments in employee skills. This suggests that they do offer some training, and would like to avoid turnover when they make such investments.

The data in Table 2.1 showed that turnover is high among Acme's new hires, but that many others stay for a relatively long time. One interpretation is that Acme sorts new hires through probation. Those who do not fit leave quickly, and those who do fit stay for a long time. But could long careers for some employees be a result of on-the-job training as well?

Another interesting finding was that Acme tends to promote from within. This too might be explained by sorting: upper level positions are filled with current employees who have already passed the screen. In other words, new hires are more uncertain than internal candidates. Once again, though, could on-the-job training have anything to do with promotion from within?

Table 3.1 tests the idea that promotion from within is solely due to sorting. It compares the future performance of new hires and internal candidates that Acme uses to fill positions in Level 2. If internal candidates have already been sorted, we would expect less variation in their career performance after entering Level 2, compared to outside hires.

The data are consistent with our hypothesis (patterns are also similar in higher levels of Acme's hierarchy). For example, outside hires leave Acme with higher probability than do internal candidates. This is strong evidence that new hires still need to be sorted. Of those who stay, new hires are more likely to be demoted, and less likely to be promoted. However, when they are promoted, they advance further on average than do internal candidates who are promoted. In other words, new hires are more likely to have extreme outcomes: demotion, exit, or rapid promotion. They are more variable in their value to Acme compared to those Acme hired at Level 1 and promoted to Level 2.

			# of years after entering Level 2				
			2	3	4	5	10
New hire into Level 2		% who left Acme	15.4	25.6	33.5	42.0	61.7
	Of those remaining at Acme …	% demoted	1.4	1.6	1.8	2.1	1.0
		% still at Level 2	79.4	51.5	39.7	33.3	22.0
		% promoted	19.2	46.9	58.5	64.6	77.0
		Average # of levels promoted	1.0	1.0	1.7	1.4	1.8
Promoted to Level 2		% who left Acme	11.3	21.1	28.4	33.6	59.1
	Of those remaining at Acme …	% demoted	0.0	0.0	0.0	0.1	0.0
		% still at Level 2	84.2	49.7	32.1	23.7	8.6
		% promoted	15.8	50.3	67.9	76.2	91.4
		Average # of levels promoted	1.0	1.0	1.1	1.3	1.6

Performance of New Hires & Promoted Employees at Acme
Table 3.1

New hires may be valuable to Acme because they are risky and have an option value, as described in Chapter 1. But do they differ from Acme's internal candidates in other ways as well? Table 3.2 provides some evidence on this question, for outside and internal candidates in Levels 2-4. Acme's new hires tend to have about a half to one more year of education, and several more years of work experience, than those who are promoted to similar jobs from within Acme. In other words, their average education and experience is higher.

Average years of …		Level		
		2	3	4
New hire into level	Schooling	16.4	16.5	17.0
Promoted to level		15.7	16.1	16.5
New hire into level	Work experience	12.9	15.8	20.5
Promoted to level		12.3	14.0	16.2

Human Capital of New Hires & Promoted Employees at Acme
Table 3.2

What can explain this observation? One possibility is that Acme is risk averse. In order to be willing to hire a risky candidate from the outside, Acme might require that their credentials be superior to internal candidates. However, even risk averse employers might well be willing to hire risky candidates because of their option value.

An alternative explanation is that employees who have been at Acme for a few years have a different advantage: they have been trained by Acme in ways that increase their productivity. If the training is specialized to Acme's business, outside hires would not have this knowledge. This would give internal candidates an advantage in filling job slots. If so, new hires would have to be better along other dimensions, like general work experience, in order to be considered for the job. Thus, some of the patterns that we are seeing may well be due to training.

Until this point we have assumed that workers have fixed talents, in order to analyze implications of sorting your workforce. We now add a new and important consideration: workers learn over time, both through formal education and on the job. Moreover, the Acme data suggest that such training might improve a worker's productivity at their current em-

ployer more than at other firms, at least in some cases. Here we develop a framework for thinking about training overall, and how training might have different effects on productivity in one firm compared with others.

Matching

Before we consider investments in skills, there is another explanation for the career patterns we have seen that only involves sorting: *matching*. Suppose that, because every firm is different in its business, organization, and corporate culture, employees with similar abilities will not fit equally well at the same employer. If so, employees and firms need to seek out good "fits" or "matches" with each other. Two employees of similar ability may be more productive in two different firms. Perhaps one firm has an aggressive culture that expects employees to work long hours and on weekends, and one worker is well suited to that environment while the other is not.

If such matching is important, workers must be sorted, just as when they differ in ability. However, the sorting would be on whether or not a worker's attributes other than skills match well with a firm's (or job's, within a firm) attributes.[1] This would include factors such as the worker's portfolio of different skills, personality (and how it fits the company or work-group's culture), or locational preference. These factors are much of what is meant when people talk about their "fit" with an organization.

Matching would imply high turnover early in the career, as workers and firms test the relationship to see if there is a good fit, and low turnover later. It might also imply that workers experience increases in pay once they are found to be a good fit, if pay rises after probation.

Furthermore, this is just another form of sorting, so outside hires would have greater variance in employment outcomes than internal candidates. Finally, internally promoted candidates would, on average, have a better match with the firm than would outside hires, since internal candidates have already survived screening. This would put them at an advantage, which external candidates could only overcome if they had stronger credentials along other dimensions, such as more work experience or education.

The sorting story and its more subtle counterpart, matching, are based on the assumption that the employee's productivity does not change on the job. Nevertheless, people do acquire new skills through education and on the job training, so trying to explain career patterns without such considerations is unrealistic.

Investments in Education

Economics, and increasingly the business world, view education and training as investments which can be modeled just like any other kind of investment. The analysis of investments of this kind is called *Human Capital* theory. It is such an important part of mod-

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[1] Given this description, it should not be surprising that the metaphor of dating and marriage is often used by economists when analyzing the topics that we discuss in this chapter. In fact, similar principles have been employed by economists to study marriage and related topics.

ern economics that two Nobel Prizes in economics were awarded, at least in part, in recognition of this theory.[2]

One argument stated earlier is that education does not provide any actual learning, but only signals about student's abilities. That view is far-fetched. The human capital analysis of education provides a much more realistic way to think about education.

Human capital can be acquired in many ways. Examples include investments in exercise and health care. The two most important for our purposes are education or other pre-labor market training, and on-the-job training. Here we analyze education; in the next section we analyze on-the-job training.

In capital theory, investments are made if the *present value* of the cash flow or other benefits generated by the investment exceeds the present value of the costs of the investment.[3] Let us formalize our thinking. Suppose that an individual is choosing whether to drop out or finish college this year, which we will call period 0. Future years will be denoted years 1 … T, where T is the last year of her career.

If the student drops out now, her earnings in future years will be H_t, where the subscript t refers to future periods. If she continues on in school, earnings in future years will be K_t. Given this, the increased earnings from finishing school are $K_t - H_t$ each year.

Education provides many benefits beyond increased earnings. One is the pure joy of learning (don't you feel that now?). It may also make you more effective at home activities, or increase your enjoyment of travel or literature. We focus on earnings because it is the most important benefit in the labor market. However, the arguments easily incorporate any non-pecuniary benefits from learning. If there are non-pecuniary benefits, their value should be included in K_t. They would simply increase the return on the investment, and should be included in any investment decision.

Suppose that the interest rate is r per year. This means that an investment of $1 made today would be worth $(1+r)$ next year, $(1+r)^2$ after two years, and so on. Similarly, $1 received next year is worth $1/(1+r)$ this year.

With these assumptions, the present value of the return on the education investment (again, focusing only on financial gains from education) is:

$$\textit{Return on Education (present value)} = \sum_{t=1}^{T} \frac{K_t - H_t}{(1+r)^t}.$$

There are two costs of investments in education. The first is the direct cost of tuition, this textbook, supplies, etc. Denote this by C_0. The zero subscript calls attention to the fact that direct costs for training investments are generally borne up front and do not need to be discounted.

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[2] Theodore Schultz (1979) and Gary Becker (1992).

[3] For those who are not familiar with the term, present value refers to the value, from today's point of view, of costs or revenues that accrue later. Income earned next year is worth less now, because you are not able to use the funds for a full year. Interest rates are the way that economies price cash flows in future periods. For example, if you invest $100 dollars today in a CD (certificate of deposit) earning 5% interest, it is equivalent to $105 next year. Put another way, the present value of $105 next year is $100.

The second cost is the opportunity cost of the time spent on education. For example, typical (full time) MBA students quit relatively high-paying jobs to go back to school for eighteen months. When they do, they give up salaries that in many cases are greater than the direct cost of tuition. Even part-time students can incur important opportunity costs: they give up evenings and weekends to study and attend classes, and have less leisure and vacation time than they would otherwise. If the student could work at home, on the farm, or in the family business, there would still be opportunity cost even if there is no salary. This is because the work has value to the family, and the family may need to pay to get someone else to do the work. Any proper analysis of an investment, including in training, should include opportunity costs in addition to direct costs.

Therefore we need to include the (additional) earnings that a student would receive if she were to drop out before completing college. If she stays in college, she will not receive those earnings. Let us call that F_0. The total cost of the remaining investment in college equals $C_0 + F_0$.

The decision rule for any investment is that it should be made as long as the present value of the return on the investment exceeds the present value of the cost of the investment. This *net present value* equals:

$$\textit{Net Present Value of Investment in Education} = \sum_{t=1}^{T} \frac{K_t - H_t}{(1+r)^t} - (C_0 + F_0). \qquad (3.1)$$

When 3.1 is positive, finishing college is a good investment. When 3.1 is negative, college is not a good investment. Put another way, if the costs are larger than the increased income, she would be better off by dropping out of school, going to work, and investing the tuition cost C_0 and extra earnings F_0. The interest earned would exceed the increase in earnings by finishing school, in present value.

For early years of schooling, the returns to schooling exceed the costs. There are two reasons. First, there is much to be learned when an individual knows very little. A little bit of school can affect productivity dramatically, but gradually diminishing returns usually set in.

Second, the costs of going to school are very low during the early years of schooling. With public subsidies to education, direct costs C_0 are virtually zero up through high school or college in most societies. Furthermore, foregone earnings during the early years of schooling F_0 are very low (though they are not zero, because even children could work in a family business or in household production).

Eventually, however, the reverse must be true. Costs of schooling could exceed the (financial) returns. Consider an actual former Executive MBA student of one of the authors. He had a college degree. He was both a doctor and a lawyer, each of which requires its own advanced degree. After earning his MBA, he decided to enroll in a PhD program! The extra degree was highly unlikely to improve his earnings, and would never allow him to recoup the direct and opportunity costs of the PhD. At that point, the educational benefits were purely consumption. In his case, the non-pecuniary benefits of education were very high. (That is probably true for you, too, though perhaps not quite so high.)

This logic implies that it pays for almost everyone to invest in some formal education, but that there is also an optimal stopping point for each individual. The stopping point is the year when the net present value of investment in education calculated in equation 3.1 switches from positive to negative.

Effects of Costs and Benefits

Expression 3.1 has several other implications that are borne out in practice.

Costs

Increases in tuition or other costs reduce enrollment. The reason is that any students who were close to the margin (net present value of education close to zero) will now find that the costs exceed the benefits.

A related point is that those who already have high-paying jobs will be reluctant to go back to school, all else equal. For this reason, universities and MBA programs generally have rising application rates when an economy is in recession, and falling application rates when the economy is doing well. Education is a better investment when your labor market opportunities are weaker, and vice versa, because this is the opportunity cost of schooling.

Interest Rates

Increases in interest rates mean lower optimal levels of schooling, just as with any investment in which the returns are realized in the future. The higher the interest rate, the more that future earnings are discounted from today's point of view.

That said, interest rates do not have dramatic effects on schooling decisions, for two reasons. One is that schooling is an investment with a long payout period, so long-term interest rates are more relevant than short-term rates, and they are generally less volatile. Moreover, the rate that is often important for schooling decisions is the implicit borrowing rate that parents charge their children to finance schooling. What parents extract in-kind or through direct transfer from their children later (if anything) may not be closely tied to the interest rates that were in effect when the child was in school.

Career Length

An additional set of implications of 3.1 involves the term T. The longer the work life, the larger is the optimal investment in schooling. Thus, people are more likely to invest in schooling when they are young, because they expect to be able to enjoy the return on their investment for longer.

The same logic predicts that women will tend to invest less in schooling than men, even though women tend to have longer life expectancies than men. The reason is that the average woman spends less time in the labor market than the average man, which reduces the return on investment in education.[4] This point can be extended. The primary reason that women tend to spend less of their career in the labor market is fertility. This often leads to careers that are interrupted for a few years, and then continued. Thus, women have some incentive to focus their education relatively more on occupations in which their skills depreciate less quickly over time.

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[4] Women reading this book are not likely to be very different from the men reading it, in terms of labor force behavior. Women who specialize in advanced fields have already made clear by their investment behavior that they plan to participate actively in the labor market. Furthermore, their high wages will help fuse them even more to the labor market.

Specialization of Human Capital

Most students eventually specialize their education, for example by focusing on a major area of study in college. Further education beyond college is usually even more specialized, with almost all classes focused on one field. Why is that the case? Education, like most investments, tends to have diminishing returns. That is, one more year of study in a particular field tends to have less impact on mastery of the field than did the previous year. This would seem to indicate that people should invest in a portfolio of skills rather than focus, to avoid the problem of diminishing returns. Indeed, we do, at lower levels of education. Almost all education systems require every student to develop a general education with a little knowledge of many different subjects. It is only at relatively advanced stages of knowledge, in education and on-the-job training, that specialization becomes important.

People generally specialize advanced education because of one of the most important factors in an economy: *comparative advantage* and *gains from trade*. We already mentioned this idea in Chapter 1. If individuals focus on one area and become relatively expert, they can trade their output with those who specialize in other areas of expertise. We all benefit from the fact that advanced chemists develop new products and pharmaceuticals. They benefit from the fact that we specialize in other areas of work. Neither group has to learn about all topics.

In other words, it is usually true that the effective learning in one field gradually falls as more time is devoted to studying that field. However, the economy tends to reward relatively highly incremental advanced knowledge in many fields. Thus, it usually pays to specialize one's advanced education.

Specialization is an important issue inside firms, with implications for both organizational structure and job design. We will return to this topic in Chapters 6-7.

Effectiveness of Learning

The final set of implications revolves around differences in K. K – H is the difference in earnings due to education. It depends on how much is learned, and how much those extra skills are valued by the labor market. When K – H increases, the net present value of education rises and schooling should rise.

Empirically, those with more innate ability tend to learn more efficiently in school, leading to higher K. This means that the benefits of schooling are often higher for those who are already highly talented. In other words, smarter students optimally invest in more schooling.[5] Of course, this increases inequality in skills, and earnings, in the economy.

Improvements in school quality should have a positive effect on K, and vice versa. Technological innovation in education can be expected to increase investments in education by citizens. Similarly, changes in the effectiveness of teaching methods or quality of teachers (which could be positive or negative) change the returns to education investments.

An important factor is the level of technology associated with the average job. Although college education may be valuable to farmers, it is not likely to have as much value to a farmer as to an accountant. Education is complementary with a technologically advanced society. Being uneducated, unable to read, or unable to do simple mathematics is more of a hindrance in a society that has a majority of white-collar jobs than in a society of farmers.

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[5] Note that this is the key reason why education is a good credential.

Thus, K and overall levels of education are higher in advanced societies than they were in 1900. This logic can also help explain current patterns of education across different societies, and trends in returns to education over the last several decades, which we describe now.

Was Benjamin Franklin Correct?

The quote at the beginning of this chapter suggests that education is a good investment. The good news for you is that it is, on average. Economists have estimated the *internal rate of return* (implied interest rate on the investment) from education in a variety of countries, and it is generally quite high. For example, most students reading this textbook are investing in college or an advanced degree. In the U.S., Asia, or Europe, the rate of return on higher education is usually estimated to be about 11% per year or more. This tends to be better than the stock market, once we adjust for relative risk.

Not only is education a good investment, but it has become an even better one in recent decades. The labor market has valued skills more and more in recent years. Figure 3.1 illustrates this for the U.S. labor market. The series marked with circles (which uses the scale on the right) plots the ratio of average hourly wages for workers with a college degree, divided by average hourly wages for those with a high-school education, over time. It shows a strong trend over the last three decades toward relatively higher earnings for those with a college degree. In 1970, college graduates earned about 50% more than high school graduates. By 2003, they earned roughly twice as much. Similar patterns exist for more advanced degrees, such as an MBA or MD.
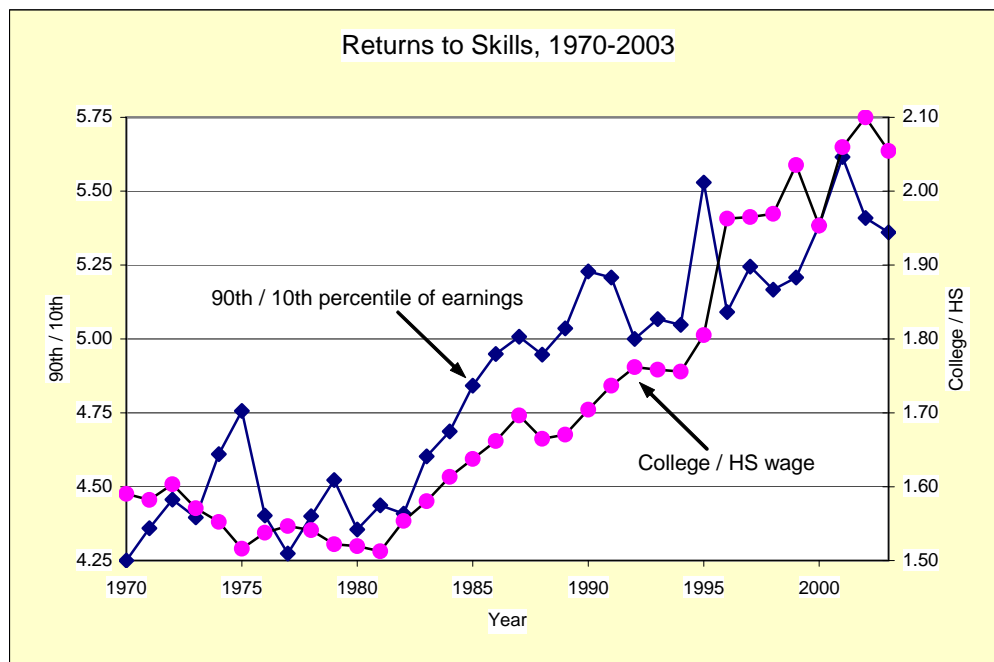
Source: Current Population Survey, Bureau of Labor Statistics.

Returns to Skills, U.S.
Figure 3.1

The series marked by diamonds (the left scale) shows a different measure of the value the labor market places on high skills. It was created by calculating the 10th and 90th percen-

tiles of the distribution of hourly wages among U.S. workers each year. The 10th percentile is the wage level that 10% of U.S. workers earn less than; it is a measure of what relatively low-skilled workers are paid. The 90th percentile is the wage level that 90% of U.S. workers earn less than; it is a measure of what relatively high-skilled workers are paid. Comparing these two each year gives us an idea of how the distribution of overall pay has evolved over time. The figure plots the ratio, which shows how pay of relatively high skilled workers evolved compared to pay of relatively low skilled workers.

The pattern is quite similar to the college / high school comparison – there has been a dramatic rise in the returns to investments in skills in the U.S. economy over the last several decades. Earnings of those in the 90th percentile rose from about four times that of those in the 10th percentile in 1970, to about five and a half times as much by 2003.

Similar patterns show up in most advanced economies worldwide. If anything, some estimates suggest that returns to advanced skills may be even higher in less advanced economies. These findings are, of course, good news for the readers of this book – if the trend continues!

Outsourcing

Outsourcing of work is a controversial topic these days. There are two elements to outsourcing. The first is assigning some tasks to suppliers outside of the firm (obviously, this is greatly facilitated by the Internet and advanced communications technology). The second is the use of lower-wage workers overseas.

In advanced economies, outsourcing has traditionally been focused on the lowest skilled jobs, such as manufacturing. In recent years, however, outsourcing of middle and even some highly-skilled jobs has risen substantially. Many customer service centers now outsource work to call centers quite far away. Perhaps more interestingly, software engineering is now being outsourced in many cases, to places like India and Russia. In the 1980s, software engineering was a very prestigious and highly compensated occupation.

There are two reasons why outsourcing has crept into higher-skilled jobs. One is that some of what used to be high skilled is actually not that highly skilled now. Modern software engineering techniques such as object-oriented software enable relatively low skilled programmers to develop more advanced applications than would have been possible ten or twenty years ago.

The second reason is the high returns to skills. As any resource becomes expensive, buyers try to find other sources for the resource. Thus globalized labor markets, through outsourcing, temper the rising returns to skills in occupations for which outsourcing works well.

Figure 3.2 presents similar evidence for a more specific sample. It plots average earnings for U.S. engineers by level of responsibility. Level of responsibility was determined for a random sample of engineering jobs by professional analysts; think of it loosely as corresponding to how senior the engineer is in his or her firm. Thus, a Level 6 Engineer has greater engineering or other valuable skills than a Level 5 engineer, and so on.

Salary of Engineers by Level of Responsibility
Figure 3.2
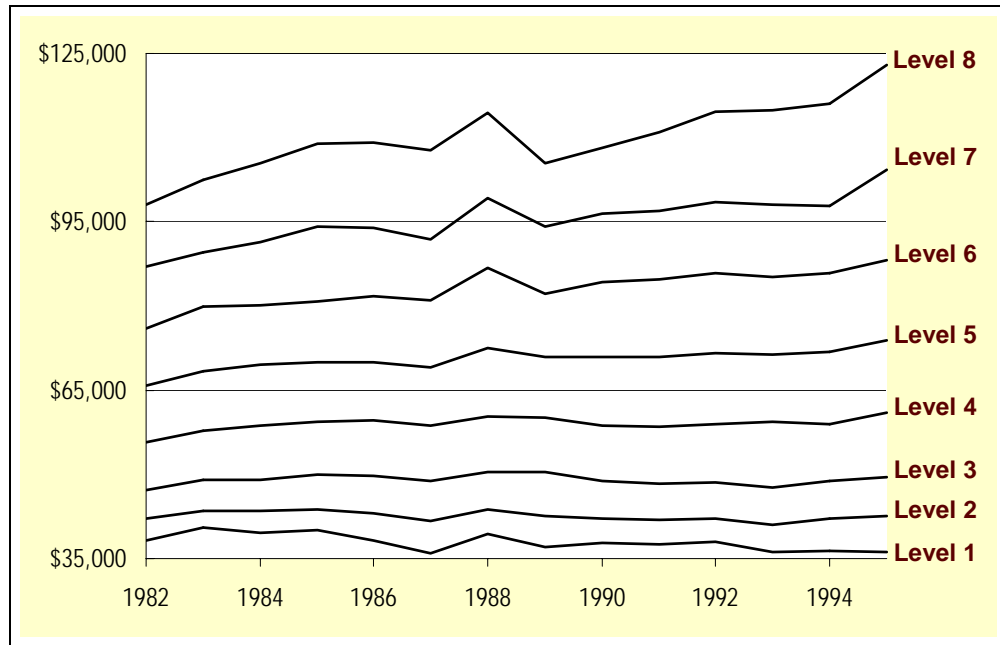
Source: Bureau of Labor Statistics

As can be seen, inflation-adjusted salaries have not changed much for lower-level engineers in the last two decades. However, the relative pay of engineers at higher levels has increased markedly over the same period. Once again we see that more highly-skilled workers are paid relatively more now than they were before.

Why has the labor market valued high skilled workers so much more than low skilled workers in the last few decades? Several explanations have been examined by researchers. The most important seems to be the increasing use of advanced technology, including computers, in the workplace. (We return to this issue in Section III of the book.) As discussed in Chapter 1, capital tends to be complementary in production with a skilled workforce. Greater use of technology, and more effective technology, increases the value of having highly-skilled workers. This increases the demand for skilled workers, which increases their labor market value.

Investments in On-the-Job Training

Let us now turn to on-the-job training. This investment is like education in many ways. It increases worker skills and raises productivity. This benefits both the employer and the worker. There may be direct costs (books or other resources, compensation for trainers, etc.). There may also be indirect costs, of two kinds. First, formal on-the-job training may take the worker's time and attention away from regular duties, lowering productivity. Second, putting a worker who is not fully trained into a job, and having them learn as they do the job, lowers productivity compared to putting a fully-trained worker in the job.[6]

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[6] However, this ignores the potential effects on intrinsic motivation and continuous improvement that we discuss in Chapter 7.

Thus, the implications are similar to our discussion of investments in education. For example, firms and workers have an incentive to invest more in on-the-job training for younger workers, and younger workers will tend to be more interested in applying for jobs that offer extensive training opportunities. Since the investment is being made on the job, additional interesting implications arise, which are derived now.

We first start by considering when a possible investment in on-the-job training would be economically profitable. That is, will the gains in productivity exceed the costs of the investment? We will distinguish between the gains in productivity in the worker's current job, or in jobs with other employers. For the moment we will defer the question of who pays for the investment and receives the return (the worker or the firm). Once we decide what investment should be made, we can return to the question of how the worker and firm might contract to make that investment.[7]

A real example from the personal experience of one of the authors illustrates the basic idea. A small Silicon Valley startup provides enterprise software that does tax optimization. A typical employee in this company must know something about tax laws, as well as programming in Java. This is an unusual combination of skills. There are many firms that value both skills independently. However, few other employers who would value an employee with the same combination of expertise in tax law and Java as this firm.

Therefore, an employee who leaves the startup will have a difficult time finding a firm that can make use of all of the skills that he acquired in the first firm. The second job will value one of the skills, and perhaps even both, but not to the same extent or in the same proportion.

A similar question faces you in your job. To what extent should you invest in skills and knowledge that help you in this job and a career in this firm? To what extent should you instead invest in training that would improve your job prospects in the outside labor market?

Consider an employee at the startup whose current productivity (in period 0) equals $10,000 per month. Imagine three options for on-the-job training, outlined in Table 3.3. One focuses completely on Java, another completely on tax, and a third splits the training time between the two in proportion to how the employer values those skills in this job. (These are meant to illustrate the general points. Of course there are many possible ways to mix the training.) Assume that the total costs of training (both direct costs and indirect through lost productivity while training) are the same for all three choices, $5,000. Ignore discounting, just to keep things simple.

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[7] For students of economics, this is an application of "Coase Theorem" logic. We first focus on how economic value can be created. Only after that do we consider how this value is split between the worker and the firm. Of course, this approach will not work if there are bargaining costs, as we will see.

	Task	Potential increase in productivity	Stay		Leave	
			Weight	Value of training	Weight	Value of training
100% Java	Java	8	40%	3.2	80%	6.4
	Tax	0	60%	0	20%	0
				3.2		**6.4**
40% Java, 60% Tax	Java	4	40%	1.6	80%	3.2
	Tax	6	60%	3.6	20%	1.2
				5.2		4.4
100% Tax	Java	0	40%	0	80%	0
	Tax	8	60%	4.8	20%	1.6
				4.8		1.6

Returns on Investments in Java & Tax Skills
Table 3.3

For example, consider the first option, which raises the employee's proficiency in Java. If he worked only on Java projects, productivity would rise by $8,000 per month. However, in this firm he does not spend all of his time on Java. Instead, his job involves spending about 40% of his time on Java, so productivity would rise by only $3,200. His productivity on tax-related tasks would not change, since he receives no tax training.

How would the training affect his productivity if he were to find a job at a new firm? That depends on the kind of job that he can find elsewhere. Since the combination of Java skills and knowledge of tax law is quite unusual, and Java skills are more highly sought after in Silicon Valley than tax skills, it is more likely that the best job he could find elsewhere would also emphasize Java. However, even if a new job is 100% Java programming, it probably involves a focus on somewhat different Java techniques than the ones he emphasized in the training offered by the tax software startup. After all, the on-the-job training will probably focus on how he can program the tax software more effectively.

Therefore, it is unlikely that he can get the full benefit of the Java training in some other job, though he may be able to come close. Assume that the Java training would have about 80% as much effect in a new job as it would in his current job, so that his productivity in an alternative job would rise by $6,400 on average.

Now consider the opposite type of training, which emphasizes only tax. This would raise his productivity at tax-related tasks by $8,000 per month. However, in his current job, he spends about 60% of his time on such work, so productivity would rise by $4,800. If another job that he might find is likely to emphasize tax work only about 20% of the time, the training would raise his productivity at other jobs by about $1,600 per month on average.

The third alternative is to spend some of his time on each form of training. In this example, we assume that the training is more effective if he does a little bit of both kinds, so that the total increase in productivity would be $5,000 for each skill, or $10,000 total per month. The reason for this is the familiar idea of diminishing marginal productivity: the more that you focus your study on one topic, the less you learn with each new hour of study. However, this assumption is not important for the conclusions.

If he obtains mixed training, productivity rises in both tasks. Total productivity rises by $5,200, more with his current firm than in the outside market. That is because the training

is designed to match his current job's skill mix, *not* the average skill mix required by the labor market.

Our question to answer: What is the best on-the-job training for this employee? The answer depends on where he is most likely to be employed after the training, because the jobs emphasis the two skills differently. The optimal investment maximizes expected productivity. If he expects to stay at the current firm, he should train in both tax law and Java programming. If he expects to quit this firm, he should focus only on Java. The answer depends on the likelihood that he will switch firms.

Suppose that he believes that there is some chance that he will stay with the current firm, but also some chance that he will leave (or his firm will go bankrupt, etc.). What is the best kind of training then? If the odds that he will stay with this firm are high, it is a mix of tax and Java programming. If the odds that he will leave are high, it is 100% Java programming.

This illustrates a very natural way to think about investments in skills on the job. The optimal skills for you to invest in will be quite different if you expect to stay with your current firm for a long time, or if you expect to leave. If you expect to stay at the current firm, your best strategy will be one that focuses training on the skills that your employer values the most. If you expect to leave, your best strategy is to invest in skills that the *labor market* values the most.

General v. Firm-Specific Human Capital

In our discussion of the programmer, Java and tax skills had value with both the current employer, and other employers. However, the value of the skills learned on the job was more valuable with the current employer than elsewhere. There are two extreme possibilities: the training is equally valuable inside and outside the firm, or it has no value at all outside the firm. These two cases are often called *General Human Capital* and *Firm-Specific Human Capital*. Most training falls somewhere in between, as in the example.

General human capital is skills or knowledge that a worker can acquire that raise productivity *equally* at both the current employer, and with many other employers. In other words, there is a "thick" labor market for the skills. Most skills are closer to this type. An MBA is GHC because the ability to be a good manager has value to thousands of possible employers. Knowledge of a foreign language such as Mandarin would be another example. A good rule of thumb is that most skills that you can acquire outside of the workplace, such as at a university, are general human capital.

Firm-specific human capital is the opposite of general human capital: it raises productivity at your current employer, but does *not* raise your value to other firms at all. It is more difficult to come up with examples of purely firm-specific human capital. Most knowledge that improves your productivity at one firm is very likely to help you in at least *some* other jobs at *some* other employers. Nevertheless, there are some examples of training that is largely firm-specific in value. If your firm has an unusual machine that they have designed for their own use, knowledge of how to operate the machine raises your productivity in this job, but would be of no value if you switched employers. Any idiosyncratic process or method might be firm-specific human capital.

Many examples of training that is more firm-specific involve intangible knowledge. If your firm has a strong and unusual corporate culture, knowledge of the culture helps you in this job, but is probably useless elsewhere. An understanding of informal networks and power

relationships inside your firm is quite similar. Finally, if you have developed close working relationships with clients, and deep knowledge of their particular organizations, that may be primarily firm-specific human capital – unless you can get a job with your client, or take your clients with you to a new job.

As our discussion of the Java programmer illustrates, however, the concepts of general and firm-specific human capital are usually not clear-cut in practice. Many skills have a value both inside and outside the firm, though the values may be different. For example, knowledge of Java raises productivity somewhat more in the current job compared to alternative jobs. To the extent that it raises productivity equally inside and outside the firm, it is more like general human capital. To the extent that it raises productivity more inside the firm, it is more like firm-specific human capital.

A better way to think about this distinction is to ask whether the value that the employer places on the employee's training is relatively idiosyncratic or not. To the extent that the firm values the worker's particular portfolio of skills similarly to other firms, that set of skills is largely general human capital. By contrast, to the extent that the employer values a set of skills idiosyncratically, the skills are largely firm-specific human capital. The startup's desired skill mix of Java and tax knowledge is quite unusual. Therefore, on-the-job training at that firm is more specific to that firm and less general. This distinction will be useful shortly when we consider who pays for the training.

Special Case: Intellectual Property

Suppose that you are a research chemist. Your firm provides you with a very expensive lab, supplies and equipment, and lab staff. These resources are superior to those that you could use in other jobs that are available to you. They require that you do research in a particular, obscure type of polymers that few other labs are studying, because they already have special expertise in manufacturing products that use this type of polymer. Is your investment in learning about this obscure type of polymer more like general human capital, or more like firm-specific human capital?

At first glance it would appear that this investment is largely firm-specific, because you and your employer probably shared the costs of investing in the intellectual property. Your relatively obscure skills may be less valuable in any other job that you can get. Moreover, your employer may have required that you agree to grant all patent rights to the firm, so that you cannot take any of your patents with you if you leave.

However, in some ways the investment is more like general human capital, because you may be able to take some of the benefits with you to a new employer. In general it is very difficult to fully assign the intellectual property rights to the employer. Even if you cannot take any patents with you, you may be able to take many of the insights and ideas, and they may be valuable to competing firms.

In other words, intellectual property has elements of both general and firm-specific investing. Like firm-specific human capital, it is typically a shared investment, with the hope of a shared benefit. The intellectual property often has a higher value if the employee stays at the current firm, since the skills and knowledge were designed to match with that firm's strategy. Therefore both have an incentive to try to maintain the working relationship. But like general human capital, the worker may be able to capture some of the benefits by quitting and going to a competing firm.

Non-Compete Agreements

Firm-specific investments, particularly intellectual property, sometimes cause firms to include employee non-compete agreements in employment contracts. These agreements attempt to prevent an employee from taking intellectual property with them if they quit the firm. Such agreements try to restrict the employee's next job in some way, typically for one year after quitting. Examples are clauses that state that the employee cannot work in a very similar job with a competitor, or cannot take clients to the new employer for one year.

Non-compete agreements are often quite difficult to enforce in court. Most courts frown on them, because of the long-standing principle (since the abandonment of practices like indentured servitude or slavery) that people should be free to work for whomever they wish. In order to make a non-compete agreement more likely to be enforced, the firm should make sure that the restrictive clauses are not too onerous, and do not last for too long a period.

Some courts have also imposed a requirement that employees be compensated in some way for signing a non-compete agreement. In fact, this may be necessary and appropriate, if an agreement is added to the employment contract of an existing employee after hiring, because the agreement reduces the value of the job to the employee.

Possible clauses: Some clauses that courts are more likely to approve:

- require that the employee give adequate notice and describe their new job duties before leaving, so that the firm has time to react;

- require that the employee train his or her successor and introduce them to important clients before they leave;

- prohibit the employee from recruiting colleagues to leave with him;

- require that some benefits vest gradually after the employee quits, contingent on the former employee acting in accordance with the non-compete agreement.

Alternative approaches: To the extent that non-compete agreements and legal property rights do not fully protect against an employee quitting and taking intellectual property with them, the first has several options to improve matters. First, pay for performance, especially if tied to the value of the intellectual property that the employee is developing, can better align incentives. It not only motivates the employee to stay, but also to increase the intellectual property's value.

Who Should Pay for Training?

Who will pay for, and benefit from, training investments? We will consider two cases: education, and on the job training. Education is general human capital, while on the job training can be either general or firm specific human capital. The conclusion is straightforward in the case of general human capital: the worker should pay for these investments. The case of specific human is more complex.

Education

Some part-time students have employers who pay for their schooling. Is this a good investment for the employer? In general the answer has to be no: most academic training has wide applicability at many different employers. This makes it general human capital. Imagine, for example, that a firm pays for our student considering finishing her college degree. Once she earns the credential, her market value will rise. In order to keep this employee, the firm will have to raise her salary. In other words, the employer is highly unlikely to capture most of the benefits from the schooling investment. By contrast, the employee almost certainly will enjoy most of the benefits from the schooling. For the rest of her career, her earnings will tend to be higher.

For this reason, it almost never makes sense for an employer to pay for schooling. Instead, the typical solution is for individuals (or their families) to pay for schooling, and to invest in it before entering the labor market if possible. The vast majority of students do not have their tuition paid for by an employer.

That said, some students do have part or all of their tuition paid for by their employer. These are the exceptions that prove the rule. However, it is worth briefly trying to explain these exceptions as well. There are several reasons why a firm might pay some of the tuition costs of some employees.

Implicit Cost to Employee & Benefit to Employer

It is possible that the employee is, in fact, paying for the tuition, by accepting lower salary at the job in order to get access to the tuition benefits. In fact, it is not unusual to see employers impose a contractual obligation on employees to pay back the tuition if they quit the firm within a few years of graduation. This cost of quitting makes it possible for the firm to capture some of the benefits of the investment, by paying the employee less than market value for a few years once they are educated.

Matching

If the firm offers the tuition benefit only to a few select employees, an explanation might be that these employees are a strong match for this employer. The firm expects that these employees will stay at the firm for many years, and may wish to groom them for key positions. In such a case, the firm can expect to recoup some of the benefits of the schooling if the worker has some incentive to stay with the firm. Essentially, the firm and the employee split the profits from the investment in education. This is similar to our conclusion for firm-specific human capital below. However, the specificity is not in skills, but in the match.

Recruiting

We discuss Benefits in Chapter 14. Briefly, offering a certain benefit may generate useful self-selection in recruiting. UPS, for example, offers tuition reimbursement to its employees. Most of them do not attend expensive universities, so the program may not be very costly. A benefit may be that UPS attracts a harder working, more ambitious workforce. Another benefit is that the workforce will tend to be young, and UPS needs employees that can haul heavy packages as part of the job.

Arbitrage

If there are tax benefits to paying for education or training, the firm might have a cost advantage in paying for schooling compared to the employee.

Other than these kinds of unusual cases, in general firms do not, and should not, pay for investments in education of their workforce. Note that this is the same logic that we used in the last two chapters, when thinking about risky hires, screening, and signaling. The firm always faces pressure to match an employee's outside market value. Anything that raises the outside value will tend to force the firm to raise compensation. Education and general human capital are two important examples.

This is why firms generally do not run extensive formal education programs; rather, schools are organized as independent institutions. The Control Data Institute example illustrates this nicely. Wipro Technologies provides a contrasting approach that is not likely to work in most countries.

Control Data Institute

Control Data Corporation was one of the first builders of supercomputers. In the 1960s, their computers were some of the fastest in the world. In 1965, they established a division called the Control Data Institute to train operators for their computers. CDI provided some of the best training in the industry, which is not surprising since CDC built the computers the training was for.

CDC found that a substantial fraction of employees who had trained at CDI quit to work for competitors or clients. That is because the training was largely general human capital, since it had wide applicability in the labor market. In 1989, Control Data decided to spin off the Control Data Institute as an independent training company.

Wipro Technologies

Due to explosive growth in technology companies and extensive on-the-job training in software design, which is largely general human capital, Indian software companies find it very difficult to retain employees. Most require new hires to sign contracts pledging that they will stay with the company for a specified period of time. Wipro Technologies in Bangalore takes that a step further.

Wipro requires that new hires provide a deposit of 75,000 (is the symbol for Indian rupees; 75,000 equals about $1,400) before they can receive their employment letters. The money is deposited in a bank. Employees who are unable to place the deposit may borrow it from the bank.

The deposit, with any interest earned, is refundable to engineering employees who work for Wipro for at least twelve months after completing Wipro's three month training program. Employees with science degrees are given six months of training, and are required to work for Wipro for eighteen months before their deposit is returned.

Wipro reports that this program has not adversely affected its ability to recruit on college campuses.

Source: rediff.com, January 22, 2005.

On-the-Job Training

General Human Capital

Now think about who pays for on-the-job training. Consider first the extreme case where the skills are pure general human capital. That is, the new training is valued equally by both *other employers* and the current employer. In this case, the logic is the same as for education investments. When the worker gets the training, his or her market value rises. The firm will thus have to pay the worker a higher salary once the training is completed, or risk having the worker quit. For this reason, the general rule is that *if skills are completely general human capital, the worker should pay for 100% of the investment, and receive 100% of the benefits.*

Human Capital that is Partly or Fully Firm-Specific

The more realistic case is where on-the-job training is valued differently (and more) by the present employer than by the labor market. Our programmer investing in Java or tax skills is one such example. In that case, the worker's outside value is lower than his inside value after the training, even though the labor market does value the training. Most on-the-job training has this flavor; it tends to be at least somewhat focused toward the current job's skill requirements. What happens in this case?

To think about this, consider the investment for our software programmer as graphed in Figure 3.3. Assume that the probability that he will stay at the current firm is high enough that the best investment choice is the middle option, which provides training in both Java and tax laws. There are two periods, training and post-training, and we have kept things simple by ignoring discounting. If the worker gets no training, productivity is H = $10,000 per month, the dashed line, in both periods.

If he receives the training, it costs $5,000 in direct and indirect costs (C + F) during the first period. Thus, his net productivity will be H − C − F = $5,000. This is represented by the solid line during the training period. The cost of the training is represented by the red shaded area between the dashed line and the solid line during that period.

After the training is received, the worker's productivity rises to $15,200 at his current firm. It rises to $14,400 in the labor market as a whole. These figures are calculated as the initial productivity, $10,000, plus the increase due to training. In Figure 3.3, these two productivities are the solid lines above the dashed line in the post-training period. The return on the investment if the worker *leaves* the firm is represented the by lighter green shaded area between the solid line at $14,400 and the dashed line at $10,000. The return on the investment if the worker *stays* at the firm is represented by that area *plus* the darker green shaded area above it: it is the total area between the solid line at $15,200 and the dashed line. Because the return on the education investment it is larger if he stays, this investment is somewhat specific to this firm.
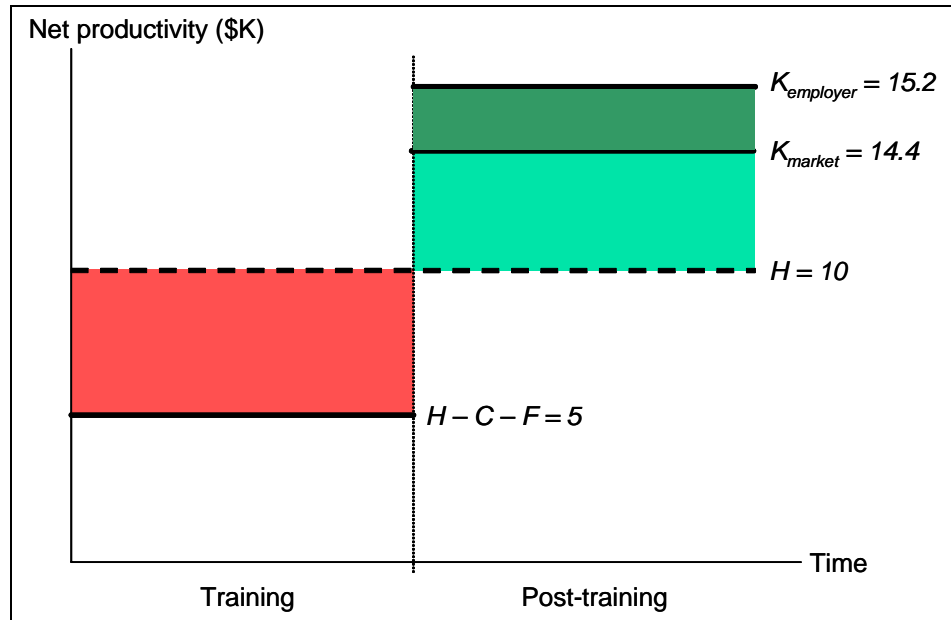
Investing in General Human Capital
Figure 3.3

This is a profitable investment for the firm only if there is strong reason to believe that he will stay at this firm. There is an incentive for the worker and the firm to figure out a way to make this investment, and have the worker stay at this firm in the second period.

Suppose that, like education and purely general human capital, the worker pays for the investment, expecting to earn the returns in the second period. In other words, assume that the firm agrees to pay the worker a salary equal to his productivity in both periods. Under that contract, the firm earns no profit or loss in either period. In the first period, the worker suffers a loss (pay is $5,000 less than he could earn elsewhere). However, in the second period he earns a profit (pay is $5,200 more than he could earn elsewhere).

Consider the situation *after* the investment is made (so that it is now a sunk cost). What might the firm do now? If it pays $15,200, it pays more than it has to, to keep the employee. The employee can only earn about $14,400 elsewhere. Therefore, the firm may be tempted to only pay a little more than $14,400 after the investment is made. The worker may have to seriously consider this lower level of pay, since the firm can threaten to fire the worker, and he can only get $14,400 elsewhere.

In other words, *the firm may be tempted to renege on its promise, and renegotiate after the investment is made*. Why? Because if it does pay less than $15,200 it is able to capture some of the profits from the investment that the worker made!

If you are a worker deciding whether or not to accept the contract in the first place, you may foresee this risk. If you do, you will be unwilling to make the investment. That would be a shame, because this could be a profitable investment. Yet you may choose not to invest since you are worried that the firm will try to take some of the profits after you invest.

This is a general concern that arises in many investment contexts, which economists often call the *Hold-Up Problem*. The problem arises if one party makes an investment and expects to earn the benefits later, but a second party is tempted to renegotiate after the in-

vestment is made. If this risk is foreseeable, the investment may not be made, for fear of losing some or all of the returns if forced to renegotiate later.

If you are unwilling to pay for the investment, can we solve the problem by having the firm pay for the investment and earn the reward instead? In other words, what would happen if the firm agreed to simply pay the worker what he would get if there was no investment ($10,000 in each period), but provide the training? Then the firm would pay the cost, since productivity would be less than pay during training. The firm would also capture the benefits, since productivity would be higher than pay after training.

You can already answer this for yourself: it runs the same risk of renegotiation. Once the investment is made, the employee may be tempted to try to renegotiate pay that is higher than $10,000. After all, his market value has risen to $14,400, so there he can credibly threaten to quit. Moreover, his value to this employer is $15,200, so he might even ask for pay that is close to that amount. The firm will be tempted to negotiate with him, since they would lose $5,200 in profits if he left. But if they do, the employee will get some of the profits from the firm's investment!

No matter who makes the investment and hopes for the return, the other side has an incentive to break its promise and try to renegotiate after the training has been paid for. The investor may be forced to renegotiate, because if the relationship is severed, the investor has more to lose. Unfortunately, this renegotiation risk will lower the expected returns on the investment, possibly to the point where neither is willing to make the investment.

How can we solve this problem? There are two general possibilities. One is to rely on the trustworthiness of one or both parties; we discuss that below and in Chapter 15. A second is to *split the cost and the return* on the investment. An example of how to do so is shown in Figure 3.4. In this case, the costs are split by paying a wage W_1 during training that is somewhere between actual net productivity and what the worker could get elsewhere (if the split is 50-50, $W_1 = 7.5$). Splitting the costs reduces the risk of the investment in the first period, since there is less to lose. The benefits would then be split by setting W_2 after training somewhere between what the worker could earn elsewhere, and actual productivity (if 50-50, $W_2 = 14.8$). Splitting the benefits reduces (though it does not eliminate) the temptation to renegotiate. Moreover, since both would have something to lose if the relationship was broken, both have some incentive to avoid renegotiation.
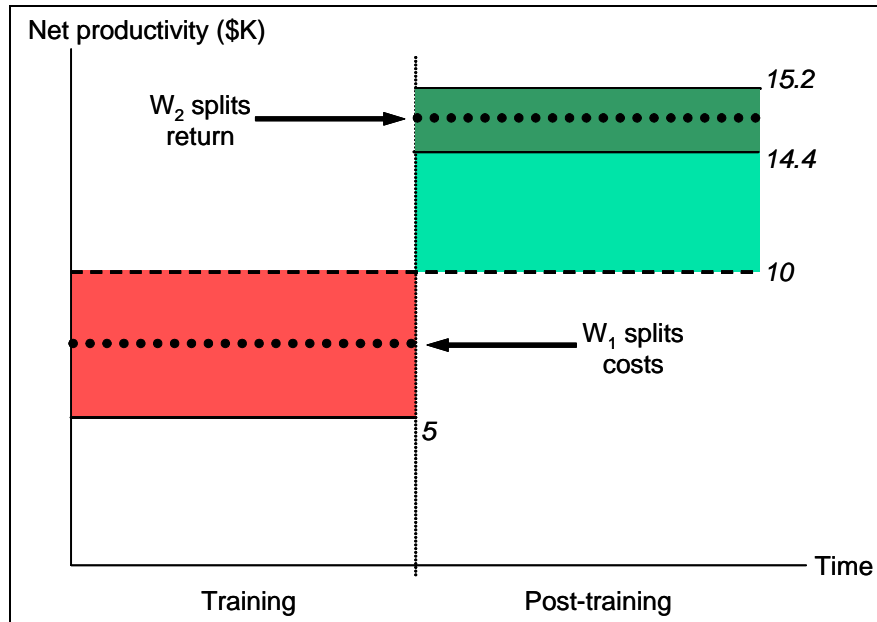
Investing in Firm-Specific Human Capital
Figure 3.4

Therefore, investments in on-the-job training that are idiosyncratic or specific to the firm are likely to be made differently than investments that are purely general human capital, or education: they are likely to be split by the worker and the firm. This means that pay would be less than what the worker could earn elsewhere, but greater than net productivity, during the investment period. Pay would then be greater than what the worker could earn elsewhere, but less than productivity, after the training was complete.

Implications of on-the-job training

On-the-job training has a number of important implications for the employment relationship. Now that we have analyzed the investment, and considered who pays for it and receives the return, we develop these implications.

Before we delve into these implications, you need to remember that on-the-job training will vary along a spectrum from training that is purely general – has equal value at other jobs outside this firm – to training that is purely firm-specific – has no value outside this firm. Education obtained at a university is almost always purely general human capital. On-the-job training is almost always a mix. Even training that is highly focused on the current job will tend to benefit the employee if they leave the firm, just not as much. Therefore, we will talk about training as being relatively more or less general or specific.

Turnover

One of the most important implications has to do with turnover. If training is completely general, the firm *does not care about turnover* (ignoring the costs of replacing the worker). The firm has made no investment, and is earning no return on the training, so it has nothing to lose if the worker quits. Similarly, the worker takes the full investment with him, so he also has nothing to lose by switching to another employer.

By contrast, the more specific to the firm is on-the-job training, the more the firm and the worker care about turnover. With shared firm-specific investments, both lose if the worker leaves. The larger the difference between productivity at this firm and elsewhere, the higher the loss. Thus, when employers say that they are concerned about losing their investments in their employees, they must be talking about human capital investments that are relatively specific to that firm.

This has an important effect on how a firm thinks about its employees. If on-the-job training is general or not important in the firm, then, excepting sorting considerations, employees are largely hired through spot-market type transactions. However, once specific investments play a role, a *relationship* arises between the worker and the firm. Both have some incentive to invest in and maintain the relationship. The term that is often used for this is that such firms emphasize *internal labor markets.* The more idiosyncratic the skill mix that a particular firm requires of its workforce, the more does this view of employment become important. These ideas are discussed further in Chapter 15.

Investment

The lower is turnover in a firm, the more will workers tend to invest in a mix of skills that is a strong fit for the current job and employer. The higher is turnover, the more will workers tend to invest in skills that can be easily applied at other firms. Thus, firms that desire an unusual mix of skills will generally adopt policies to try to reduce turnover.

Investment patterns should change with tenure. The longer that an employee has been with the firm, the more likely is she to have already invested in skills that are closely matched to that firm. This increases his incentive to stay with this employer. That reinforces his tendency to invest even more in firm-specific skills. Thus, as job tenure rises, workers tend to become even more invested in their current employer.

Compensation

These ideas have implications for compensation patterns. First, pay will tend to rise with one's labor market experience, because most jobs provide some on-the-job training. Second, beyond this effect of total experience on earnings, those who have higher tenure in a firm will tend to have higher pay than those who do not, because their skills will tend to be more heavily oriented toward the mix that is appropriate for that firm, and because they will be earning some returns on their prior investments in firm-specific skills.

Second, the more firm-specific are employee skills, the more pay will they tend to lose if they switch jobs, because the skills will be more tuned to the current job instead of a potential new job. The higher the expected loss in compensation from leaving the firm, the lower the likelihood that the employee will leave the firm. This is because workers tend to invest more in skills that are specific to their current employer, the more that they expect to stay in that job.

Labor Market Thickness

Labor markets are sometimes characterized as "thick" or "thin." A thick market is one in which the worker finds it relatively easy to get a new job that values his or her skills well. A thin market is the opposite. To some extent, the thickness of the labor market depends on the occupation of the worker. There are many more jobs for lawyers than for academic economists in most cities. Thickness also depends on the business cycle. If an economy is in recession, few firms are hiring, so it is more difficult to obtain a job offer with pay similar to one's current job. The opposite tends to be true when the economy is improving, es-

pecially at the beginning of an upturn. Thickness is affected by the size of the local economy, if there are costs to the worker of moving elsewhere for employment.

Finally, thickness also depends on the employee's skill mix; the more idiosyncratic the skill mix, the thinner is the labor market for that particular employee. This logic illustrates that the concept of general v. firm-specific human capital is endogenous: it depends on how thick the labor market is. In markets that are thicker, all else equal, a worker's skills tend to be less firm-specific.

Firm Size

Workers in larger firms will tend to invest more heavily in a mix of skills that is specific to their employer, for two reasons. First, empirically larger firms tend to have lower turnover than smaller firms. Second, larger firms are more likely to be able to find alternative work for their employees who wish to change jobs. In fact, very large firms sometimes have relatively formal internal labor markets, in which the human resources department actively posts jobs and searches for internal candidates to fill open positions. To the extent that the skill mix is similar across jobs in the same firm, this in effect thickens the market for an employee's skills when they work for a larger firm.

Rent Sharing and Compensation

The concepts of education investments and signaling allow us to now briefly discuss the overall level of compensation. By "compensation," we mean cash and other benefits paid to the employee. Benefits have value to the employee, so an employee will be willing to accept some amount of lower salary in exchange for a given benefit.

How is the overall level of compensation determined? Abstractly, perfect competition between firms should imply that firms earn zero profits on their employees. This does not mean that they do not earn accounting profits, shareholder returns, and so on. It only means that the level of accounting profit that they earn from hiring employees is about the same as that earned by other employers.

Similarly, perfect competition between employees should imply that employees earn about the same at any firm.

When these two conditions hold, an employee and a firm would be largely indifferent about how they work for, who they hire, and turnover. This is analogous to the case of pure general human capital investments. The level of compensation would be the same at firms that have similar jobs, and would just equal the marginal value of the worker's output to the firm.

Obviously, this is not realistic, but it is a useful theoretical base case. In reality, of course, workers do tend to lose earnings if they switch employers. And, employers usually do not want to lose most of their employees. These observations suggest that both are earning some profits (in formal economics lingo, *rent*) from working with each other, compared with working with another employee or employer. This raises two questions. First, what are the sources of these rents? Second, do they imply that labor markets are not perfectly competitive?

In this chapter we have seen two reasons why a worker and firm might earn some extra profit if the worker stays at this firm. The first was matching: if a worker is, for any reason, a

particularly good fit for one employer, then there is some benefit to the employee staying at that firm. That is, in effect, a violation of perfect competition, because it implies that either the worker or the firm cannot find a perfect substitute for their employer or employee. In that case, some monopoly profits would be accruing.

Firm-specific human capital is the second condition in which a worker and firm generate extra profits if they stay together. However, in this case labor markets can still be perfectly competitive for both workers and firms. The bidding would occur at the time the initial job offer is negotiated. For example, firms might compete with each other over the training opportunities that are offered to job applicants. Job applicants might compete with each other over the salaries or other job aspects that they are willing to accept from a given employer. Once the firm-specific investment is made, there is some profit from working together. However, there can be competition over the terms of the total investment.

There are other reasons why a worker and / or a firm might enjoy some rent for working with each other. For example, either party may have expended resources searching for a job or a new employee. Finding a new job or replacing the existing worker would be costly. Therefore, there is something to lose from ending this employment relationship, for both. This is quite analogous to matching and firm-specific human capital. Again, the profits from search and recruiting might be driven to zero by competition. These are another investment, similar to signaling and training. Once the costs are incurred and the job match is found, the return on the investment is earned. If search or recruitment costs are high, this would be another reason that there is some surplus for the worker and the firm to share, once they have agreed to work together.

The important word here is *sharing*. In cases where there are some rents or joint surplus to be earned from working together, there arises a question of how those rents will be shared between the worker and the firm. As we have seen, these rents are largely split *at the time of hiring*, when the explicit and implicit contractual terms are determined. How the rents are split depends on the outcome of this negotiation. That will depend to some extent on the bargaining sophistication of the worker and the firm. It will also depend on some economic factors that we have already seen.

One consideration for how the costs and benefits are shared is to improve incentives for either side to take the right action. Workers generally pay for signals, to motivate their efficient self selection in applying for jobs. By contrast, both share specific investments, to reduce incentives to renegotiate later.

Another consideration is the "bargaining power" of each side. If there is a lot of competition between firms, employees will tend to capture a larger share of any potential profits. If there are many workers who are very similar, employers may be able to capture a larger share of any profits, because the workers will compete with each other.

A third consideration is the reputation of each party; we discuss this briefly below, and more extensively in Chapter 15.

The main point of this section is that there are several reasons why, once employees and firms decide to work together, they may want to keep working together. These are sometimes referred to by terms such as rents, quasi-rents, or surplus. They affect incentives for turnover and complex employment contracting. They also mean that the overall level of compensation will often be somewhat indeterminate, since it will depend on a complicated bargain struck between the worker and the firm.

In some cases in later chapters, we will assume that labor markets are perfectly competitive to illustrate the arguments. In no case does this assumption really matter. It is merely a simplification to make the arguments more straightforward. When you see those cases, you can imagine that there may be other sources of surplus for the worker and the firm, and if so there may be some kind of bargain that splits the surplus between them.

Implicit Contracting

On-the-job training investments that are relatively specific to one's current employer, and intellectual property, are special cases of a more general phenomenon. Any time that two parties can make an investment that creates profits *only* if the parties continue to work together, we have a *relationship-specific investment*. This issue arises in many contexts in the business world. Consider two firms that have a joint venture with each other. If they discontinue the relationship, profits from the joint venture are lost. Similarly, two partners who start a firm together also engage in a relationship-specific investment as they build the firm (if the firm has more value as long as they stay together).

Our analysis of training that is more firm-specific concluded that the firm and employee will share the investment. Splitting the benefits reduces the risk of the Hold-Up problem, which may happen after on party makes an investment hoping to earn benefits later, but the second party tries to renegotiate after the investment is made. Unfortunately, this problem cannot be completely eliminated by splitting the benefits.

We saw a similar issue caused by lack of trust in Chapter 2. Probation periods involve a promise by the firm to give the job applicant pay higher than productivity after probation, as a way to motivate self selection. This means that the firm might suffer a loss on the employee after probation.[8] What we did not discuss then is the concern that the firm might be tempted to renege on its promise to employees once they have been sorted. If there is a non-trivial chance that this might occur, high ability workers would be unwilling to apply for the job in the first place.

Thus, we have another situation where Hold-Up concerns might prevent our solution from working properly. This concern can arise in any situation where there is a relationship-specific investment. Is there anything that we can do to reduce Hold-Up problems?

In the case of a joint venture, there is a direct solution: the two firms can merge. Once they merge, they have no conflict of interest, and the investment will be made.[9] Obviously, merger is not possible in the case of employment, so this is of little help for on-the-job training.

An alternative is to write a formal contract specifying what the firm and employee pay or receive under all circumstances (e.g., severance pay, or non-compete agreements). This could be used to give both incentives to not break their promises.

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[8] Not necessarily an accounting loss, but an economic loss. They would be paying the employee more than would be paid to employees of similar productivity at other firms that did not use such a probation system.

[9] The example of Fisher Body Works is a staple of MBA strategy courses. The story is that General Motors wanted FBW to build a factory specialized to work with GM – a relationship-specific investment. The story then is that in order to solve the Hold-Up problem, GM eventually bought FBW. Apparently most of these facts are incorrect, and the overall story is a fable (Casadesus-Masanell & Spulber, 2000). Nevertheless it does illustrate how a merger can solve the problem.

A related approach is to rely on government regulations or common law. In most economies, employment is highly regulated. Some of these regulations may protect either the firm or (more likely) the employee from attempts at renegotiation. For example, in most societies firms do not have complete control over the management of employee pension funds. This reduces the risk to employees that earnings they are promised now will be taken away later.

Unfortunately, the employment relationship is so complex and unpredictable that it is usually impossible to write a contract, design a law, or make a judicial ruling that can cover all possible contingencies. What else can be done?

An important way to reduce Hold-Up problems is to rely on *implicit contracting*. In our examples, the firm in effect promises employees that they will be rewarded later if they perform well or invest in skills that are idiosyncratic to this firm. If the employee has enough reason to trust that the firm will keep its promises, he may be willing to do so.

This approach is called implicit contracting because it is distinctly different from formal contracting or regulation – it is the part of the employment relationship that is difficult or impossible to enforce through the legal system.[10] When the legal system is not available, parties to a relationship-specific investment must rely on trust, reputation, and similar mechanisms to impose some reliability on the relationship.

We will see this issue arise several times. For example, most incentive systems require some element of subjective evaluation. Since subjective evaluations cannot easily be independently verified, implicit contracting becomes an important part of managing incentives. The topic is discussed more extensively and formally in Chapter 15; this is only a brief introduction.

Summary

In this chapter we have analyzed investing in worker skills. Education and on-the-job training are some of the most important investments that can be made in an economy. Historically, and especially so in recent years, these investments have paid high interest. We discussed what factors affect decisions about investments in education.

Education increases human capital. There are types of human capital, general and specific. The former is skills or knowledge valued equally at many employers (having a thick market). The latter is skills or knowledge that have unusual value at a particular employer. Training can involve some learning that is more like general human capital, and some that is more like firm specific human capital.

We then discussed the question of who should pay for the training. We argued that a worker should pay for training that is general, accepting lower compensation than could be earned elsewhere during the training period. The worker will then enjoy the return on the investment through raises and promotions received later.

To the extent that this is true, the firm is in effect *selling a service* – training – to the worker. We saw similar intuition earlier, when the firm sometimes provides a service to the worker by being particular effective at sorting through and identifying the most talented workers. This intuition is interesting, because it flips the employment relationship around. It is not

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[10] Other terms that are sometimes used are *relational contracting*, and *psychological contracting*.

just the worker that sells a service to the firm, but often the firm sells something of value to the worker as well. We will see this again in the contexts of job design and pay for performance. This illustrates the fundamental point that a healthy contract between the worker and the firm is one that maximizes the total benefits, to both the worker and the employees. This should be the first consideration, with analysis of how to split those benefits only analyzed second (and depending on issues like incentives, competitive pressures on the firm, and labor market constraints).

Having the worker implicitly pay for on the job investments in general human capital means that not every firm should invest in its workforce's skills. To the extent that there is a thick market for its employees, workers should invest in those skills instead, and the firm should care little about turnover.

When human capital is firm-specific, the question of who pays for the training is complex. If the employee does, she runs the risk that the firm will attempt to renegotiate or renege on promises of higher pay after the training period. If the firm pays for the training, it runs a similar risk from the employee. This is an example of the Hold Up problem, which may occur when one party tries to renegotiate terms after a relationship-specific investment has been made.

However, employees are more productive if their skill mix closely matches the demands of the job. Since most jobs are somewhat idiosyncratic, this means that optimal on-the-job training usually is somewhat firm-specific. When that is so, a host of new considerations arise. Workers and firms will tend to split the costs and benefits of the investment, in order to mitigate Hold-Up problems. Turnover therefore becomes costly for each; they have an incentive to maintain a long-term relationship. The longer that they have worked together, the more that they will tend to have invested in each other, only reinforcing such effects.

Investments in skills vary in the extent to which there is a thick market of firms that value them. When the market is thick, the skills are toward the general human capital end of the spectrum. Most skills of this kind are provided by specialized organizations like universities, rather than on the job. Such investments are almost always paid for, and the returns enjoyed by, the worker. (Societies often subsidize these investments.) However, some skills are most effectively learned on the job, by actually doing the work. When that is the case, the firm may provide that training to the worker.

Since contracting over complex employment relationships is typically incomplete, when there are relationship specific investments, reputation and trust become an important way in which firms and employees can improve the value of their economic relationship. Thus, where skill investments should be more idiosyncratic and matched to a given employer, the employer will adopt policies that foster an internal labor where employees are hired at the bottom and spend long careers working their way up the corporate ladder in that firm. Where skill investments are more typical of those needed by other employers, by contrast, a firm may adopt more of an aggressive weeding out approach, since turnover will not be costly. In short, different contexts require different approaches to managing the employee-employer relationship.

In the first three chapters of this book, we have seen a sequence, from a simpler to a more complex economic relationship between the worker and the firm. We started by imagining that workers are paid on a spot market, with wages roughly corresponding to productivity. The analysis almost immediately led to thinking about multiperiod contracts, to exploit the option value of risky hires, and to sort employees. The next step was to make investments, often jointly, in worker skills. Finally, we add the notion of implicit contracting over the employment relationship.

The concept of implicit contracting gives us an important piece of the puzzle for modeling organizational design. Much of what is sometimes thought of as the "soft" side of personnel management falls into this category. While it is difficult to develop a comprehensive formal model of all of the issues that arise, in Chapter 15 we will be able to provide an economic framework that improves your thinking about issues such as reputation, trust, and corporate culture.

Review Questions

1. Why is it a good rule of thumb that skills typically taught at universities are general human capital?

2. Think of jobs that you have worked in. Was the skill mix more firm-specific or general? Why?

3. If a firm requires that its employees invest in a mix of skills that is very specific to that firm, will there be any cost to the firm? Should a firm ever try to design jobs so that employees develop readily marketable skills. Explain.

4. Some firms hire employees at lower levels, train them extensively, and nurture long-term relationships with them. Others aggressively weed out employees. What characteristics of firms would push them toward one of these extremes or the other? Why? Try to list as many characteristics as you can think of.

5. What is the Hold-Up problem? Why does it happen? Can you give specific examples (say, from the sports or entertainment industries)? What are possible ways to avoid such problems?

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Appendix

In this appendix we present a simple model that illustrates some of the points about investments in on-the-job training. For details, see Lazear (2003).

We abstract from bargaining over the investment. Assume for simplicity that the firm and the worker share the costs and benefits of the investment. Furthermore, since we abstract from bargaining, we will treat the investment decision as being made by the employee. Of course, if there is efficient bargaining, the optimal investment decision will arise through the bargaining between the firm and the employee.

A worker invests in skills J (Java) and T (tax), at cost $C_J \bullet J + C_T \bullet T$. Different employers have different relative values for the skills. Let λ be the weight that the firm gives to skill J, and $1-\lambda$ the weight given to skill T. Thus, the potential earnings that a worker can earn at the current firm equals:

$W = \lambda J + (1-\lambda)T$.

Wages will be determined similarly at other firms, but the weights λ will vary from firm to firm. There are two periods. In the first, the worker invests in on the job training. In the second he may or may not switch employers, and works with no further investment. The probability that the worker stays at the current firm next period equals p. Thus, the worker chooses J and T to maximize net earnings:

$$\max_{J,T} p[\lambda J + (1-\lambda)T] + (1-p)[\bar{\lambda}J + (1-\bar{\lambda})T] - C_J \cdot J - C_T \cdot T,$$

Where $\bar{\lambda}$ is the expected weight put on Java skills at potential other employers. The first-order conditions are:

$$p \cdot \lambda + (1-p) \cdot \bar{\lambda} - C_J = 0,$$

$$p(1-\lambda) + (1-p)(1-\bar{\lambda}) - C_T = 0.$$

Investment is a weighted average of the relevant skill-values inside the firm and outside, where the weights depend on the probability of separation. The intuition should be clear. If p = 1 so that continuation in the firm is certain, the only skill value that matters is λ, the current employer's relative valuation of skill J. If p = 0 so that separation is certain, the current firm's valuation does not matter. In that case only $\bar{\lambda}$ matters.

Define the optimal values of skills invested in as J* and T*. Now consider what happens to a worker who switches to another firm after investment. We denote the wage in the second firm by W', and the weight given to skill J in the second firm by λ'. The change in earnings is:

$W' - W = (\lambda' - \lambda)(J* - T*)$.

The sign for this equation is uncertain. The typical case would be where the probability of separation is relatively low, and the worker invests with an emphasis on the skills that the current employer values. However, if the probability of separation is very high, or the cur-

rent firm's relative valuation of skills is not too unusual, the worker's investment will tend more toward $\bar{\lambda}$. If so, leaving the firm might lead to an increase in earnings. In any case, it can be shown that the change in earnings from switching employers decreases with the probability that the worker will leave the firm next period (Lazear 2003).

It is straightforward to show that an increase in market thickness leads the worker to invest in a way that is more consistent with the current firm's relative valuation of skills. The reason is that when the market is thick, the worker in effect gets additional random draws of λ's from other firms. The worker is therefore more likely to find an alternative job that is similar to the current job, which reduces the extent to which the original employer's valuation of skills is idiosyncratic. In other words, the firm-specificity of human capital is endogenous with respect to market thickness.

Finally, we could extend the model to three or more periods. Consider a worker who is two or more periods away from retirement. They have relatively less incentive to invest in skills that emphasize the current employer's valuation. This is because, with more than one period remaining, the probability that the worker will move to another employer is higher. This has an interesting implication: a worker's on the job training should become increasingly firm-specific as tenure at the firm lengthens: investments become more idiosyncratic, and less generally applicable in the labor market.

Managing Turnover

"You are *the weakest link. Goodbye."* Slogan of popular, ruthless British TV game show *The Weakest Link*.

Introduction

One theme of this text is that there is no one best approach that works for all firms. In the previous three chapters we developed an economic analysis of recruiting, structuring the job offer (pay, probation, and eventual screening for promotion), and investment in skills. Firms differ quite a bit in their overall strategy for to these policies. In some firms, turnover is viewed as healthy, as it brings in "new blood" and facilitates sorting to find the most talented. In others, turnover is costly, because of investment in employee skills that match the idiosyncratic needs of the firm's business.

In the process we developed several economic tools that have many applications inside and outside employment. These included adverse selection, signaling, and relationship-specific investments.

In this chapter, we finish this first section of the text by using these tools to analyze some related issues in the management of employee careers. The theme in the first two chapters was bringing employees into the organization. The theme of Chapter 3 was developing their talents so that they can be more productive and advance over their careers. The theme here is turnover – under what circumstances is it desirable, and how can it be effectively managed. While we briefly return to the subject of recruiting when we think about trying to hire employers from a competitor, most of the analysis focuses on turnover.

Is Turnover Good or Bad?

There are two view about turnover of employees. One is the dramatic, hopefully rare need to layoff workers due to downsizing. The other is the general need to manage regular workforce flows in and out of the firm. We will talk about layoffs below. In this section, we consider the factors that affect a firm's optimal turnover when business conditions are normal. Every firm should have some employee turnover as part of its business; the question is how much, and of what kind.

In thinking about turnover, there is often a question about the appropriate level of analysis.[1] Should we think about turnover at the firm level overall, or differently for different

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[1] In fact, this issue is in the background in much of the analysis in this text: should we think about a "one-size fits all" set of personnel policies, or tailor them to different jobs, groups of workers, etc.? This is really a question about centralization versus decentralization, which is a topic of the next two chapters.

jobs? For example, should we think about the right level of turnover at the organizational level, or should it vary from one job to the next? In general, the answer is the latter. Different jobs within a firm have different characteristics. Some jobs may require substantial turnover, while for others the firm may want to keep turnover to a minimum. There may be patterns across the entire organization, if some of the issues discussed apply to many jobs in the firm, but that does not need to be the case. In fact, most firms have quite different turnover rates for different types of jobs, by occupation, hierarchical level, location, and so on.

Importance of Sorting

One of the most important reasons to encourage some turnover is sorting. Sorting allows the firm to increase workforce quality, by screening more candidates per period of time. The more chances that the firm gets to consider new job candidates, the greater the odds that more talented workers will be discovered. The concept of matching from Chapter 3 also applies, since additional sorting also increases the odds that a position can be filled by an employee who is a better match for the firm.

Of course, sorting is only valuable to the extent that differences in ability (or matching) are valuable. One such situation is when there is more to be learned about workers: abilities are more variable, and less is known about them. For example, turnover is especially likely to be useful for new hires that are young and have little track record. Turnover is also desirable, to some extent, for employees who have been promoted to new positions, since there is uncertainty about whether they will fit with the new job. These are ideas that we saw in Chapters 1-2.

Sorting is also valuable when small differences in talent or matching lead to large differences in productivity or costs. Thus, jobs where talent is particularly important are good candidates for higher turnover, to continuously sift candidates to find the best ones.

Putting these ideas together, it becomes clear why turnover tends to be so important, especially early in the career, in leading professional service firms and academia. These are firms that are filled with knowledge workers. Ideas and creativity matter, and small differences in ability can be leveraged effectively. These, kinds of firms often have fairly aggressive probation and up-or-out systems to that they can continually sort for the most skilled employees available.

Technological Change

An important benefit of turnover is that it brings "new blood" into the organization. New employees are more likely to have new insights, bring different perspectives, and understand the latest technological developments.

Thus, turnover should be higher in industries where technology advances more rapidly. Computers and telecommunications are two obvious candidates. Some of the turnover can be the hiring of workers from other firms. This benefits your firm because you can obtain some of the new ideas and innovations from competitors (because of imperfect employee non-compete agreements). There is also likely to be a benefit from hiring *younger* workers in these settings. Younger workers learned the latest techniques in college or graduate school. Thus, we would expect that wages would not grow as rapidly with tenure in industries where much of the innovation occurs through university research.

There may also be an optimal mixing of younger and older workers. While younger workers bring fresh ideas and technology, older workers have deeper understanding of the

business, and are likely to have invested in knowledge that is specific to the firm. They have more ability to profitably apply the new ideas that younger workers bring. In a sense, there is an opportunity for the two groups to cross-train or collaborate with each other. To the extent that skill requirements are specific and cannot be learned at school (say, because the business is somewhat unusual), there will be greater benefit to matching younger workers with older workers to provide this training.

Organizational Change

Organizational change also generally benefits from turnover to bring in new ideas. Current employees are experts at the firm's current way of doing business. Unfortunately, if the firm needs to change methods, they are almost certainly no longer the best fit. This is particularly true for senior management.

We can flip this argument around as well. As we will see in chapters 7-8, sometimes firms can become highly optimized to a certain way of conducting their business. When this is the case, they are more likely to hire employees at the bottom and promote from within, to develop specific human capital. However, such firms may face a substantial problem if the industry changes dramatically, because their management is "in-bred" and have little experience with alternative methods. They may not even realize that they face this problem, because they have been successful in the past and have little exposure outside their current firm. To avoid this inward focus, it can be helpful to continuously bring in at least a few employees – at all levels – with outside experience.[2] Firms that continuously bring in outsiders are more likely to recognize when times change, and adapt effectively.

Hierarchical Structure

Higher turnover may be necessary when the organizational structure dictates that the hierarchy narrows rapidly at some level. Take a quick look back at Table 2.1 at the beginning of Chapter 2. The second column shows the percentage of Acme's workers at different levels. The hierarchy narrows dramatically between Levels 4 and 5 (roughly speaking, where middle management becomes top management). Some turnover is inevitable here, because there will be very few promotion opportunities for Level 4 managers. Some managers may become frustrated and quit to pursue other opportunities.

In fact Acme may want to encourage this. Otherwise, as Level 4 becomes clogged with managers who cannot be promoted further, promotion slots decline for Level 3 managers, and this effect will eventually trickle down the hierarchy to Levels 2 and 1. This will reduce incentives, because promotions are an important form of pay for performance. Moreover, Acme's best workers are most likely to be lost if promotions are not available. A promotion system is like a pipe, in which a continuous flow both in and out is the goal.

Specific Human Capital

As we saw in Chapter 3, on-the-job training does not generate turnover costs if the training is purely general. By contrast, the more specific to the firm is the training, the higher are the turnover costs. Typically, these costs will be borne by both the worker and the firm, because of sharing of the investment.

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[2] A good example is a company that tries to expand its operations to a different country for the first time. Its management is unlikely to have a sophisticated understanding of the many issues that arise in a business that operates across borders, unless it hires some employees that have that kind of experience.

Therefore, firms with more idiosyncratic businesses, methods, or cultures are more likely to want to have low turnover. Similarly, in jobs where valuable intellectual property is developed, it is important to try to reduce turnover. Finally, in positions where workers develop strong client relationships, turnover can also be quite costly.

Retention Strategies

A variety of tools can be used to reduce turnover. The most obvious it to increase compensation. Of course, that is simple but expensive. But for key employees, in some cases you may have to respond if they receive outside job offers (see the next section).

For your key employees, consider treating them as partners. These are the small number of employees who create the most value or innovation for your organization. They are the most likely to possess valuable intellectual property or customer relationships that they might take with them if they leave. Losing such employees can be very damaging – especially since they may go to your competitors and compete directly against you.

To avoid such problems, you might offer them stock, options, or other pay for performance directed at their particular area of business. In the extreme, such key employees might be made partners. After all, in some cases those employees *are* the business, and can take it with them. It is this consideration that explains why so many professional service firms are organized into some form of partnership. The bottom line is that *you must pay key employees their market value or you will probably lose them*.

Defections at Ecolab

Ecolab is a leading provider of commercial and industrial cleaning products and services. In 1993, it was one of two dominant firms in the industry, along with Diversey. Ecolab's most profitable business involved large, complex contracts with major clients. Sales personnel expended great effort and resources to woo these clients.

Jack Ford was Senior Vice President at Ecolab. After being passed over for promotion, he approached Diversey with five of his Vice Presidents. They formed a partnership with Diversey in which Ford's group shared 50 percent of the profits.

Ecolab immediately sued Ford and his group for violation of their non-compete agreements, and won an injunction preventing the defectors from contacting old customers pending the court's final decision. Seven months later, Ecolab prevailed against 5 of the 6 former employees. The exception was that Ford's non-compete agreement was deemed to last too long (two years), and was reset to one year by the court. Ford was ordered to pay Ecolab's legal costs of $400,000.

As soon as the non-compete agreements expired, Ford and his colleagues approached former customers to try to steal business from Ecolab. They were not very successful, however. Diversey's performance was poor, its president resigned. and they had 450 layoffs. Eventually the non-U.S. parts of Diversey were sold to Unilever, and the U.S. operations were spun off in a management buyout.

Source: Nanda (1996)

What other retention strategies can you employ? You may be able to retain a specific employee by tailoring some benefits or characteristics of the work to that worker's tastes. For example, flexible working hours would allow an employee to pursue outside interests or meet family obligations more easily. If such flexibility is difficult for them to find elsewhere, they may be inclined to stay at your firm. Depending on how costly such flexibility is to you, it may be profitable for you as well.

Offering new opportunities to an employee with talent or a good match for your firm can reduce the likelihood that she will seek a new job. This might involve new training, job enrichment (Chapter 7), or early promotion. There are several reasons why this can help. First, new tasks or responsibilities make the job more interesting. Second, training increases the long-term value of the job. To the extent that the training is specific to the firm, it increases the incentive to stay with your firm (as in the last Chapter). Third, an early promotion can signal to the employee the value that you place on their long term employment at your firm.

One of the reasons employees leave jobs is because they feel that they have not been treated well. This can occur if they believe that their manager did not evaluate them correctly. It might be because they believe that certain promises (for training, promotion, or etc.) were not fulfilled. A healthy firm has a healthy working environment in which these kinds of issues do not arise often, and are addressed effectively when they do. This does not mean that there will not be some complaints and some disappointed employees. However, reducing the extent to which employees are treated arbitrarily can reduce turnover problems.

A simple example will illustrate some issues here. It is tempting when recruiting to overstate the value of the job. Doing so makes the employee more likely to accept the offer. However, overstating the value means that the employee will inevitably end up disappointed. Moreover, the employee may infer that the employer is untrustworthy. This effect can be corrosive to the work environment and raise turnover. Therefore, paying attention to implicit contracting issues, as described in Chapter 15, can be an effective way to reduce turnover of all employees.

An Unusual Recruiting Video

Cummins Engine is one of the world's largest manufacturers of diesel engines. In the early 1970s, Cummins adopted what was at the time a relatively new approach to organizing its Jamestown, New York plant. Workers were put in teams, and given substantially more tasks and responsibilities than traditional assembly line workers. (We will discuss this general approach in Chapter 7). The teams were expected to become relatively self-managed, even playing an important role in the hiring (and potential firing) of their members.

Because the work design was so different from other factories in the area, many recruits found their new jobs to be highly stressful. In some cases, the workers did not fit well with the new system. In one case, a team ended up firing one of their members because of such concerns.

The remaining team members found this incident to be so painful that, on their own initiative, they developed a recruiting video for Cummins to show to job applicants. The first screen on the video showed, in very large letters, the word *Stress.* The first few minutes of the video consisted of interviews with workers discussing how hard

they found the job when they first started, and the personal problems (in and out of work) that arose because of this.

Why would they design such a recruitment video? The point was to set accurate expectations for job applicants, to avoid painful turnover costs in the future. This was particularly important because of the unusual organization of the Cummins plant – new recruits had never seen anything like it elsewhere.

The second part of the video showed workers describing how they eventually got past the initial adjustment to the job, and found the work to be challenging and motivating (this is useful to remember when reading Chapter 7). But the primary point was to serve as an honest warning to job applicants that they would be better off not applying if they did not fit with this particular job. It was a very powerful recruiting video.

Source: author's personal knowledge of unpublished video.

Reducing Costs of Losing Key Employees

Some turnover is inevitable, but firms can employ a few strategies to make turnover less costly. In the last chapter we discussed non-compete agreements. They generally have limited effectiveness, because of the reluctance of courts to enforce strong clauses in them, and because it is impossible to control some information and ideas that an employee carries to a new firm. However, there are a few alternative approaches that can help.

First, turnover is most costly when the worker has complex, detailed knowledge that other employees do not share. Going back to our Silicon Valley software company that sells tax management software, if the primary routines in the program were written by one employee, the firm would be in serious trouble if that employee left. Software code can be extremely complex and hard to understand if you did not write it yourself.

This suggests some policies that can help avoid such a problem. First, have workers collaborate on key tasks so that key knowledge is not monopolized by one employee. Second, cross-train to reduce the risks even further. By having each worker train colleagues in what they do, and perhaps switch tasks periodically, each develops a broader knowledge of the product or process. If one person leaves, it is easier for others to fill in, and they will already be somewhat up to speed on the work.

Job design can also affect turnover costs. The more standardized jobs are, the less costly to the firm is losing one employee, because others can step into the void. Of course, not all jobs can be standardized, especially in smaller organizations.

Finally, a firm could have a general *knowledge management* strategy. That is, some attention can be given to procedures by which the knowledge that is created as part of conducting the work can be documented for reuse. As an example, some consulting firms set up databases to document new methods that their consultants have devised on projects. At the end of a new project each consultant is expected to write a description of new ideas, products, etc. that they have created on the project, and submit them to a manager who is responsible for knowledge management. That manager enters the description into the database, along with a set of keywords. Later, this knowledge can be accessed by others who search on appropriate keywords. They can then apply the ideas to new applications without having to figure out new solutions from scratch. To the extent that this system

works well, it saves the firm from having to reinvent approaches, and instead allows them to leverage what they have already created. And, it allows the firm to capture at least some of the knowledge of employees if they quit – as long as they documented what they learned.

Embracing Turnover

As we have noted before, turnover is not always a bad thing for an organization. In fact, some organizations *embrace* turnover. Here are two quick examples to illustrate why this might be beneficial.

The first case is professional service firms that have up-or-out systems. Because their employees work very closely with their clients, it is quite common for an employee who leaves to go to work for a client. This only reinforces the working relationship between the firm and its client, which benefits the firm.

Next consider Hewlett Packard. They are one of the original technology companies in Silicon Valley. As the Valley developed, many more technology companies entered the area, competing for HP's employees. In addition, many HP employees quit to start their own companies, often competing with HP.

For many years, HP's response when an employee quit was to encourage them in their new venture, and then emphasize that if she later wished to return, HP would welcome her back with open arms. Why might HP have such an approach?

First, such employees may well be some of the best in HP's workforce – that is why they have such good outside opportunities. HP's policy can increase the quality of its workforce because some may return later. Second, like the professional service firm, those employees who leave may bring future business to HP. Third, employees who leave HP, gain experience elsewhere, and then return may be particularly valuable because they have a mix of inside and outside experience. That is particularly valuable in an industry that is dynamic and constantly changing.

There is a broader benefit that may also accrue to HP from this approach. It is essentially taking the point of view that when its employees do well, it will also do well. By encouraging them to pursue successful careers, HP is probably able to recruit employees that are more talented and ambitious. It is also able to develop a reputation as an employer who cares about the interests of its employees, which is likely to increase motivation and reduce conflict in the workplace. This is a broad theme that we are seeing in this text: the interests of the firm and its employees are not in conflict, when thought about properly. We return to this at the end of the book.

Bidding for Employees

A difficult question is how to respond when an employee receives an outside offer and threatens to quit. We discuss those issues now. First, however, we consider the related question of whether or not you should try to "raid" employees from competing firms. Both illustrate that firms are engaged in an active "auction" market, bidding against each other for employees, especially for the most talented ones.

Raiding

You meet an employee of a competing firm and are very impressed. Should you try to lure her to your firm? How can you think about this issue carefully?

Suppose that you make an offer to this employee. When you bid, you are at a disadvantage: her current employer knows more about her capabilities than you do. If you win, there is some chance that you won because you over-estimated her ability. This is sometimes called the *Winner's Curse*, which can arise in many kinds of bidding situations. The problem is caused by imperfect information among bidders about the value of the prize. If you win, there is some chance that you did so because you overestimated the value. This is even more likely to happen if you are bidding against someone with better information than you have. Similarly, you might also end up overpaying for the new employee if her current employer overvalued her initially.

If her skills are relatively common in the labor market, you can use more traditional recruiting strategies, where you invite applicants to apply for the position. This may reduce the risks just described. Therefore, it is more likely to be profitable to raid an employee from a competitor when their skill set is relatively unusual.

Layoffs and Lemons

Firms have discretion over which employees to terminate, which implies that the idea of adverse selection can be applied to workers who have lost their job. From the perspective of the labor market, such employees are like used cars. A potential employer will worry that the worker is not of high quality (a "lemon"), because their prior employer let them go. This (and lack of specific human capital) can make it quite difficult for someone who is laid off to find a new job quickly, and may also imply that the new job is at much lower pay than the old job.

Studies have found that used cars that come onto the market because they were leased, but the lease contract expired, are much less subject to the lemons problem. The reason for this is that almost *all* cars that come off a lease contract will be sold as used cars, regardless of quality. There is little self selection, so they tend to be of average quality.

A similar result applies in the labor market. One study found that workers who are laid off when *all* workers lost their jobs – due to a plant closing, for example – were able to find jobs more quickly, and generally earned higher pay in their new jobs, then workers who were laid off in other situations. The workers who suffered from a plant closing were able to explain their job loss in such a way that it did not stigmatize them.

Source: Gibbons & Katz (1991)

The Winner's Curse also illustrates that you should avoid raiding an employee unless you have good reason to believe that she is more valuable at your firm than in her current job, and her employer is aware of this. When is that the case?

Generally, this condition is more likely to hold when recent changes have occurred to the employee, your firm, her firm, or the industry in general.

For example, workers who have recently completed an education program (such as an MBA) are ripe for the picking. Chances are that the new degree recipient can be more productive in a job other than the current one. The current firm may be able to offer a new job with more responsibilities, but it is just as likely that the current firm does not have an opening in a higher-level position that makes optimal use of the new skills. In fact, our experience with our own part-time MBA students is that a large majority switch employers within a short time of graduation (yet another reason why firms should generally not pay for employee MBAs!).

Workers that are employed in changing firms, and especially in declining firms, may be good targets. The worker is less likely to be a good fit for that firm, and is probably valued less by the employer, than previously.

Along similar lines, workers employed in industries undergoing rapid technological change are likely to be good candidates for raiding. Some firms experience change more rapidly than others in such industries. Workers who are talented, but located in a firm that is behind the leader, are excellent targets.

Is it always better to be a raider? Not at all. If that were the case, all firms would raid each other's best employees and nobody would hire unproven talent. Firms that hire directly from the labor market's pool of applicants get a more random sample. Some workers will be very qualified, and some less so. As long as the firm does not pay more than average productivity, it can survive quite well with that approach. Raiders hire a non-random sample of workers; they tend to hire the most able. Thus, they end up paying higher wages.

Offer Matching

Bidding for a worker is common. Some employers refuse to match outside offers. An announced policy of "no offer matching" is designed to discourage employees from attempting to raise their pay by obtaining outside offers. When is that a reasonable approach?

Assume first that the employee's only benefit from the job is compensation (salary and benefits). If that is the case, a worker will have some incentive to search for new jobs as long as the search costs are lower than the expected benefits from finding a better offer. Suppose that the worker does obtain an outside offer, with total compensation that is higher than his current job.

If your firm has a policy of not meeting outside offers, he will quit and get a raise elsewhere. If, on the other hand, you do decide to meet his outside offer, he still gets a raise. In other words, he benefits from searching for a new job regardless of your policy. Thus, so far a policy of refusing to match offers does not deter employees from searching for new job opportunities.

There are two conditions, however, that *can* imply greater employee job search if the firm matches outside offers.

Large Non-Pecuniary Benefits

Suppose that the worker has a strong preference for your firm, perhaps because he likes his co-workers, the office's location, or the general work environment. Or, perhaps he finds this particular job to be challenging and interesting. These are quite similar to the idea of matching described earlier. In other words, this worker values other dimensions of the job in addition to compensation. Therefore, to some degree the worker is willing to stay in this

job even if it pays less than an alternative job. In the terms we used near the end of Chapter 3, this is a case where the worker is enjoying some surplus from working for your firm.

When that is the case, refusing to match offers can deter some job search. The reason is that, if you match some outside offers, the employee has some incentive to approach you with job offers that he does *not* intend to accept, in the hope that you will give him a raise. In this situation, if you refuse to match offers, the worker could only be made better off by a very good outside offer. Those are harder to find, so some job searching is deterred.

This suggests that when workers are "in it for the money" there is little to gain from a policy of not matching outside offers. However, in cases where matching or non-pecuniary characteristics of the job are important, such a policy can reduce compensation costs.

Underpaid Workers

Suppose that your worker is relatively underpaid. That is, you are earning most of the surplus from his employment, rather than him. That might happen, for example, if he is not well informed about his labor market value. In such a case, he has more to gain, and you have more to lose, when he searches more aggressively for outside offers. In this case as well, a policy of refusing to match offers might be profitable for the employer.

The Downside of Refusing to Match Offers

Of course, there is also a downside to a policy of not matching outside offers. Sometimes your most valued employees will receive offers, and you will lose them. For this reason, even firms that have policies of not matching outside offers are likely to secretly match outside offers for their key employees. In other words, the policy does not have to be binary; there can be some flexibility for special cases.

Layoffs & Buyouts

Unfortunately, sometimes firms must downsize by laying off large groups of employees. If you had to lay off part of your workforce, how would you think through the issues? For example, should you target the most highly paid workers first? If you decide to offer buyout packages to motivate workers to leave on their own, how can you do so most effectively?

Who to Target for Layoffs

Should you lay off your most expensive employees? Those with the worst performance? The answer is not necessarily, but these are good places to start looking for candidates.

As we saw in Chapter 1, pay must be balanced against productivity. In the context of layoffs, one must be careful about laying off the most highly paid employees, because they are often the most productive as well. A better approach is to target those employees from which the firm is losing money relative to other employees. These could be high or low paid workers. That said, some highly paid employees have high compensation because outside offers were met, they are tough bargainers, or for other reasons. Therefore, highly paid but relatively unproductive workers are good candidates for layoffs.

A similar argument applies to employee performance. Again, employees with low performance ratings may have high productivity relative to their compensation, so one must be careful. However, low performance ratings usually imply that the worker is performing

poorly compared with others with similar skills and jobs. If that is the case, odds are very good that the ones with low performance ratings are being paid too much relative to more productive colleagues, and thus should be targeted for layoffs.

Specific Human Capital

An important factor in deciding who to target is the degree of firm-specific human capital. As we saw in the last chapter, to the extent that workers have human capital that is specific to the employer, both the worker and the firm are likely to be sharing the costs and benefits of training investments. This has an important implication for thinking about who to target for layoffs.

It is quite straightforward to state the result, but the analysis will be somewhat lengthy: When firm-specific human capital is important, the firm maximizes its profits by laying off from both ends of the age distribution first. These are the workers who have recently started with the firm, and those who are nearing retirement.

The intuition behind this result is presented in Figure 4.1. The top panel shows profiles of a hypothetical worker's earnings and productivity over the career, with an investment in firm-specific human capital. Productivity at the firm is labeled K_t. The wage is labeled W_t.
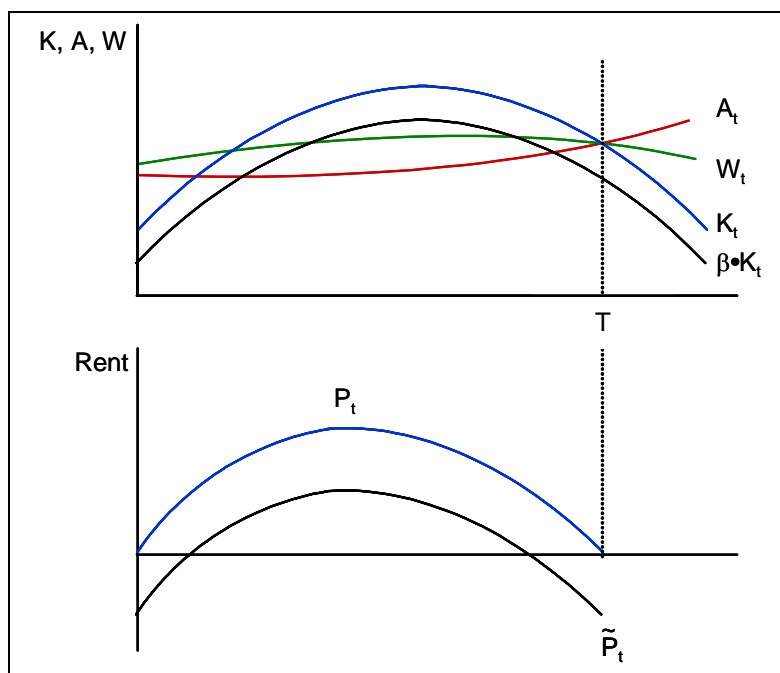
Earnings & Productivity Over the Career
Figure 4.1

The value of the worker's best alternative outside of the firm is labeled A_t. This depends on two factors. The first is the earnings that the worker could receive in another job. That is the most important factor for younger workers. The second is the value that the worker places on leisure. The older the worker, the more will he tend to value leisure. At some point, a worker's best outside alternative is retirement. Furthermore, eventually all workers would be better off by retiring. That is represented by a rising profile A_t. If the older worker's

outside earnings are less than what could be earned at this firm, then the optimal point of retirement is at $t = T$, where A_t rises above K_t.

In competitive labor markets, the present value of the W_t profile must approximately equal the present value of the K_t profile.[3] If $PV(W) > PV(K)$, the firm would lose money over the worker's career. If $PV(W) < PV(K)$, the firm would have difficulty recruiting workers. The present value of both should generally exceed the present value of the A_t profile, or the worker is employed at the wrong firm.

Though the present values of wages and productivity are equal at the time when the worker is hired, they are not thereafter. Since the worker's training is partly firm-specific, the worker and the firm will share the costs and benefits of the training. Thus both bear losses initially. Once the training is complete, both earn a return on their investment. At the beginning, $W_0 > K_0$ as the training begins. Therefore, at any point *after* $t = 0$, the present value of the productivity profile K_t is higher than the present value of the wage profile W_t. The difference represents the part of the return that is earned by the firm.

The amount of profit P_t going to the firm is plotted in the bottom panel of Figure 4.1. Profit is defined as the difference between the present values of K and W. What is the shape of P_t? First think about an employee who is about to retire. Although pay is below productivity, there is little remaining profit for the firm to earn since there is little time left in his career. Similarly, the firm loses little from an employee who is very new to the firm, because little training investment has yet been made. In the limit, $P_t = 0$ when $t = 0$ and when $t = T$. In general, the firm earns the greatest profits (in present value) on workers who have completed their training and have both high productivity and relatively long remaining careers – these are workers of medium age.

It is this point which provides the intuition behind this discussion. Imagine that productivity falls, perhaps because demand (and prices) for the firm's products has declined. This is shown as a drop in K_t to $\beta \bullet K_t$, where $\beta < 1$. At current wages, this corresponds to a downward shift in the present value P_t to $\tilde{P}_t$. It no longer pays to make investments in young workers. Similarly, it would be profitable to lay off older workers, since their present value to the firm is lower. The only employees that would be profitably employed in this circumstance would be workers with middle ages.

Costs of Layoffs

Laying off younger workers is unlikely to be very controversial. They are typically not legally protected. Moreover, they have invested little in firm-specific skills, so they are likely to lose little when moving to another job. Thus, a policy of FIFO (first in, first out, as in the accounting term) layoffs can effect the goal of reducing the number of young employees.

Laying off older workers is quite likely to be controversial, and may also be illegal. Older workers are protected by anti-discrimination regulations in most countries. Technically, the firm's lawyers might argue that the layoffs are based on net present values for each employee, but they are not likely to win that case. Thus, the firm may be subject to prosecution by the government, and discrimination lawsuits by older employees.

Moreover, older workers have invested in firm-specific skills, and are now enjoying the returns on their investments that were promised to them (usually implicitly) by the firm. Lay-

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[3] See the discussion of rent sharing near the end of Chapter 3.

ing off such workers may be perceived as a breach of trust by the employer, though this may be alleviated to the extent that the firm honors its pension commitments.

Is it truly a breach of trust? That is not so obvious. Any sensible implicit contract would surely provide for the right of the firm to lay off workers when business conditions become severe enough. This might be one of those times. While that may be true, it is still likely that the firm will face criticism (perhaps opportunistic) about breach of trust. Therefore, to the extent that the firm cares about its reputation as a fair employer, it should think carefully before implementing layoffs, either for older workers or more generally.

For example, suppose that the firm has a strong reputation in the labor market, and the current downturn is believed to be only temporary. In that case, the firm will care very much about its reputation, and implement layoffs in such a way that its reputation is damaged least. On the other hand, if the industry is declining dramatically, or if the firm needs to signal about the seriousness of its intentions (say, as a negotiating stance with unions), then dramatic action may be necessary.

Finally, a serious cost of layoffs is the litigation that may ensue. Because many economies provide protection for workers against wrongful termination, employees may sue if they are fired. Such litigation is costly is its own right, as would be any settlement to avoid legal costs. Moreover, if the firm loses the lawsuit, it will have to pay damages.

Buyouts

Because of the costs of layoffs, many firms opt to offer employees buyouts instead. A buyout is a contract between a worker and a firm. In exchange for some compensation, an employee agrees to end employment with the firm. Buyout agreements may include other clauses; e.g., the employee agrees to not sue the company for wrongful termination, and to not criticize the company in public forums.

Amazon's Non-Disparagement Clause

In early 2001 Amazon.com laid off 1,300 workers, offering severance pay of six to eight weeks of salary. Employees were required to sign a clause that prohibited them from making derogatory comments about the company, or their severance would be limited to two weeks of pay. After public criticism of this clause, Amazon removed the requirement from the buyout package.

The buyout package had another feature that is very unusual. Amazon set up a trust fund of $2.5 million worth of company stock, to be sold two years later and distributed to laid off employees. In effect, those laid off were given some options.

Why might Amazon have done this? One answer is that this was right before the tech market crash, so there was still great enthusiasm for options (and they were often used without much thought as a compensation tool; see Chapter 12). Another is public relations. A third is that Amazon wanted to tie the interests of those who were laid off to Amazon, both to discourage public disparagement, and perhaps because they hoped the layoffs to be temporary, and wanted to hire some back later.

Sources: internetnews.com; news.com.

If a firm does opt to award severance pay, should all employees be eligible? It depends on who is most likely to accept the buyout offer.

One concern is adverse selection. At any wage category some employees are more productive than others. In other words, some are relatively overpaid, and some (the better performers) are relatively underpaid. The more productive are also likely to also have better alternative employment elsewhere. If this is the case, then they lose the least in accepting the buyout, and are thus more likely to accept the buyout.

Consider the attempt by Stanford University in the 1990s to offer early retirement buyouts to professors older than 55 years of age. A number of professors accepted the offer. Unfortunately, in many cases the professors who departed were the most productive – because they found it easier to obtain good jobs at other universities than did less productive professors. This suggests that buyout packages should be carefully designed so that they target and motivate the desired groups to leave or stay, respectively. For example, the best performing employees might not be offered buyouts, or might be offered buyouts that are less lucrative, if possible.

Similar considerations apply to how buyout packages might vary with the employee's age. As described above, the main concern will generally be the most senior workers. Of that group, those close to retirement have little to lose from leaving the firm, since they have already earned most of the return on their investment in skills. They require only small buyout packages. Those further from retirement usually require larger buyouts. To illustrate this, Table 4.1 presents a hypothetical situation consistent with Figure 4.1.

Age	W	A	K	PV(W)	PV(A)	PV(K)	βK	PV(βK)
25	$30	$20.0	$20.0	$145.5	$99.3	$145.5	$14.0	$101.8
26	30	20.1	23.2	145.5	99.9	158.1	16.2	110.6
27	30	20.3	26.2	145.5	100.5	169.9	18.3	118.9
28	30	20.4	29.1	145.5	101.1	181.1	20.4	126.7
29	30	20.5	31.8	145.5	101.7	191.5	22.3	134.0
30	30	20.6	34.4	145.4	102.3	201.2	24.1	140.8
35	30	21.3	45.0	145.4	105.3	238.6	31.5	167.1
45	30	22.5	55.0	144.3	110.5	258.7	38.5	181.1
55	30	23.8	50.0	134.0	109.1	211.3	35.0	147.9
56	30	23.9	48.7	131.0	105.8	191.2	34.1	141.3
57	30	24.0	47.2	127.3	103.2	179.6	33.0	125.7
58	30	24.1	45.6	122.5	99.7	166.8	31.9	116.7
59	30	24.3	43.8	116.6	95.3	152.7	30.7	106.9
60	30	24.4	41.9	109.1	89.5	137.2	29.3	96.0
61	30	24.5	39.8	99.6	82.0	120.1	27.9	84.0
62	30	24.6	37.6	87.7	72.4	101.1	26.3	70.8
63	30	24.8	35.2	72.7	60.2	80.0	24.6	56.0
64	30	24.9	32.7	53.8	44.7	56.5	22.9	39.5
65	30	25.0	30.0	30.0	25.0	30.0	21.0	21.0

Analysis of Which Workers to Lay Off
Table 4.1

In this table all values are expressed in $1,000s. The table shows the wage (assumed for simplicity to be a constant $30,000), the value of the worker's best alternative A_t, and productivity K_t. The table also calculates the present values of each.[4] Notice that, as in Figure 4.1, the present values of K and W are equal for new and retiring workers. As described above, competition forces this result, all else equal. Finally, the last two columns imagine that the value of the worker's productivity falls by 30 percent ($\beta = 0.7$) because of a decline in demand for the firm's products.

In deciding on whether or not to accept a buyout of amount B, the worker will compare what he can earn if he stays in the firm, PV(W), to what he can earn if he takes the buyout, B + PV(A). This means that the buyout will be accepted only if it is higher than the profit that the worker earns from staying:

Profit to the worker from staying (rejecting a buyout) = PV(W) – PV(A).

In the table, the present value of wages is higher than the present value of the best alternative for all workers. All workers would have to be offered a buyout to be willing to leave.

The profit to the firm if the worker leaves is the difference between the present values of compensation and productivity:

Profit or loss to the firm from having the worker leave = PV(W) – PV(K).

(After production falls, this expression changes to PV(W) – PV(β•K) in our example.) If this is positive, the firm would like the worker to leave. In that case, the expression equals the *maximum* profitable buyout B that the firm can offer. If it is negative, the firm would prefer to keep the worker. In the table, all workers were profitable to the firm before the value of productivity fell. After productivity fell, workers aged 57 and higher or 30 and lower are no longer profitable for the firm. These are the ones that the firm would like to target.

We are now in a position to give the rule for optimal buyouts. As long as the gains to the firm from losing the worker exceed the losses to the worker from leaving, there is room for a deal to be made. The firm can offer a buyout that increases its profits, and also makes the worker better off when they leave. Putting these together, we can make a deal as long as:

PV(W) – PV(K) > PV(W) – PV(A),

or in other words:

PV(A) > PV(K).

Our result: *a buyout is possible if the present value of the worker's alternative exceeds the present value of the worker's productivity at the firm.* Indeed, this should make intuitive sense to you. Thus, low output and good alternatives make buyouts feasible.

It is important to recognize that the individuals that the firm would like to lay off are not necessarily the ones for whom a buyout offer is possible. While the firm would like to lay off those aged 57 and older or 30 and younger (after productivity falls), a deal cannot be struck with all of them. Only workers 62 and older have alternatives sufficiently attractive to make an offer feasible. The firm loses money on those between ages 57 and 61, but not

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[4] The interest rate is about 25%. The principles illustrated are valid regardless of the interest rate.

enough that a buyout would be a better option, given the amount of buyout that they would require. Similar logic applies to those aged 30 and younger.

Implementation of Buyouts

Window Plans

Often, announcements of buyout offers are a surprise, and workers are given only a limited time to accept the offer. Such plans are often called *window plans* because there is a small period or "window" during which the buyout is available.

There is a very good reason for such practices. Recall that the buyout that the firm is willing to offer the worker depends on the difference between the wage and productivity. The lower his productivity, the more anxious is the firm to be rid of him, and the higher is the buyout offer the firm is willing to make. If a buyout is anticipated, a worker has incentives to reduce productivity. A short fuse prevents the worker from strategically reducing productivity for any significant time period to gain a higher buyout price. It also reduces the change that the worker can find a suitable outside offer, since there is less time to search.

Threat of Layoff

Another way to increase acceptance rates for buyout offers is to credibly threaten to lay off some fraction of those who do not accept the offer. Suppose that the firm were to announce that it would lay off 50 percent of all workers who did not accept the buyout offer, chosen at random. If you were faced with this offer, how would it affect your incentives? It would make you more likely to accept the offer.

Think about it this way: suppose that if a worker loses his job, he expects that the next job will give him about $10,000 less in present value. Under the analysis given above, this is the minimum buyout that he will accept. However, if the firm threatens to fire half of those who reject the buyout, there is a 50 percent chance that he will lose $10,000 with *no buyout*. He is then willing to accept a buyout of only $5,000 (or even less, if he is risk averse). In general, greater odds of being laid off lowers the buyout that a worker requires. The Appendix proves this result formally.

Of course, there are costs to the firm of such a strategy – it will have to lay off some workers. We have already discussed these costs above. The firm needs to balance the benefits of lower buyouts against the costs of implementing some layoffs after the buyout window ends. However, threatening to lay off those who reject buyouts has two advantages for a firm: it increases the probability that a worker will accept a given buyout amount, and it reduces the buyout that is required to motivate an employee to quit.

Speed and Extent of Downsizing

An additional benefit from implementing layoffs quickly and by surprise is that it reduces the amount of organizational trauma that is experienced. Downsizing can be highly emotional, and organizations that go through the process tend to find that workers are extremely unproductive while it is ongoing. One of the reasons for this is that workers focus, quite naturally, on who will be laid off, when, and under what terms. This can be quite a distraction from ordinary business. Thus, it often pays to get the pain over with quickly, and unexpectedly.

For similar reasons, a firm should consider laying off more workers than seems apparent at first glance. If it can do so, it minimizes the odds that it will have to do so again soon (many downsizing firms go through several waves of layoffs before they are finished). An additional advantage is that it makes it possible to thoroughly "clean house" in areas of the organization that need radical restructuring. The reason for this is that the costs of firing a worker tend to be lower when implemented in the context of a larger set of layoffs.

Retirement Bridges

The minimum buyout price necessary for a worker who is close to voluntary retirement is relatively small. However, a buyout formula that offers less to 64-year-olds than to 56-year-olds might run into legal difficulties. A provision that is less likely to encounter legal challenges, but has a similar effect, is a *retirement bridge*. A bridge gives a worker seniority credit for the purpose of pension calculations as if he had stayed on until the normal retirement date. For example, if the normal retirement age is 65 and a worker leaves at 55 with 18 years of service, he is treated as if he had 28 years of service for the purpose of calculating retirement benefits. Since the number of years awarded by the bridge declines with age, older workers are in effect given a smaller buyout award than their juniors.

Job Placement Services

Firms sometimes set up job placement services for workers they lay off or offer buyouts to. Is this rational, or does it merely reflect the employer's guilt about layoffs, or perhaps an attempt at improving public relations?

The practice may not only be good for public relations, but may also result in cost savings. Improving the odds that workers can find outside work lowers the buyout price that they will require. To the extent that the firm can help severed workers find new jobs, their alternatives are better and the firm may be able to offer lower buyout prices.

Whether this logic holds, however, depends on the firm's efficiency in securing new employment for its workers. The service should be offered only if the firm can provide it (or contract with an outplacement agency) more cheaply than the worker can buy a similar service himself. Otherwise, it would be cheaper for the firm to simply pay for outside services that a worker purchases (e.g., through some kind of voucher system). In most cases, that is probably the best route. Placement agencies specialize in relocating workers, and the firm is unlikely to do a better job (especially when distracted by the downsizing).

In either case, however, the point remains. Offering outplacement services in-kind or by reimbursement may lower the costs of implementing buyouts.

Summary

There is a fundamental tension in the operation of any company's internal labor market, between the desire to sift through employees to find the best fits, and the desire to build employee loyalty. Sifting improves overall quality. Loyalty improves motivation, reduces turnover costs, and encourages firm-specific skill investments. A healthy firm balances these two desires to achieve some of both goals. The right balance varies from company to company, depending on the relative importance of each of these factors.

In this chapter we analyzed this tradeoff using the tools developed in Chapters 1-3. We saw that recruiting and turnover are intimately related. Understanding optimal turnover,

and how to motivate it, requires use of several economic concepts. These include adverse selection, investment, and incentives.

Turnover has many benefits. It allows the organization to continuously update its talent. Not only does this increase quality; it also keeps the firm's skills from depreciating. In changing environments with technological advancement, this can be quite important. Turnover also makes it less likely for a company to fall into the trap of becoming too inwardly-focused. A company may be very good at what it does, but unaware of how the industry is changing, and thus may find it difficult to adapt. Employees with diverse outside experiences make this less likely to happen. A final benefit of turnover is that it frees up promotion slots, allowing the company to advance and motivate its best employees.

Turnover also has many costs. A prosaic one is the costs of recruitment for the firm, and job search for the worker. A less prosaic one is that both will lose the value of any specific skill investments they have made. A more subtle effect is that, if turnover is higher, both will be less willing to make such investments in the first place.

This chapter completes the first section of the textbook. After analyzing the employee career "pipeline" of recruitment, investment, and turnover, we now consider what the firm will do with the employee. In other words, we turn to issues of job and organizational design in Section II.

Review Questions

1. Google recently held an IPO (initial public offering). Because of this and the extensive use of employee stock options, many of Google's employees are now multi-millionaires. What retention problems do you foresee for the company? (Yes, it's a nice problem to have!) What, if anything, might Google do?

2. You and a friend from school are starting a consulting firm together. You want to organize it as a partnership. Realizing that things don't always work out as intended, how might you structure the partnership agreement to protect you and your friend from future conflict? How will that affect that ways that you each conduct business in the new firm?

3. If you receive a job offer, should you always tell your employer?

4. You are the CEO of Ecolab at the time that Jack Ford and his management team quit to work for your major competitor, Diversey. Is this a threat? How can you tell? How would you react? Once the threat is passed, what might you do to avoid such events in the future?

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Appendix

Here we prove that if the firm threatens to lay off a fraction p of workers who do not accept a buyout offer, it can offer lower severance payments.

Recall that the profit to the worker from staying (rejecting a buyout) is:

$$PV(W) - PV(A) > 0.$$

That expression is positive, or she would quit on her own. Now consider the worker's decision (assume risk neutrality). If she accepts a buyout, she receives B plus her alternative value PV(A). If she rejects a buyout, she continues in her employment with probability 1–p, earning PV(W). However, with probability p she is laid off, and earns PV(A).Therefore, she will accept the buyout if:

$$B + PV(A) = (1-p)PV(W) + p \bullet PV(A).$$

Therefore, the minimum buyout that she will accept is:

$$B^* = (1-p)[PV(W) - PV(A)].$$

This expression is largest when p = 0, and $dB^*/dp < 0$. A greater threat of being laid off makes the worker more likely to accept a given buyout offer, and reduces the amount of buyout that she is willing to accept.