CHAPTER 13

Insurance Policies

In this chapter we will:

- Gain an overview of the unemployment insurance systems in the OECD
- Learn the characteristics of optimal unemployment benefits
- Study the kinds of policy measures intended to protect jobs
- Observe the effects of these employment protection measures on wages, unemployment, and productivity
- Understand why employment protection and insurance benefits should be designed together

INTRODUCTION

Public unemployment insurance systems were created in many European countries at the beginning of the twentieth century. In this area, the purpose of state intervention is to insure workers against the risk of unemployment, a burden the state was forced to assume because imperfect information hinders the creation of private insurance systems providing compensation for job loss. Chiu and Karni (1998) have in fact shown that the imperfection of the information available about the preferences of agents for leisure, and about the effort they may be making to hunt for a job, can tend to an equilibrium in which no unemployment insurance is provided by market forces, even though the agents are risk averse. It is therefore necessary for collectivities such as trade unions, or the state itself, to step in and operate a system of unemployment insurance. Such systems are found today in all industrialized countries. For that matter, the state also intervenes to provide social assistance, redistributing income in favor of the most disadvantaged workers—those who are generally faced with more frequent and lengthier spells of unemployment than other workers.

Compensation for job loss has had to weather a long-standing and well-rehearsed critique. Essentially, benefit payments are said to reduce the incentive to look for a job, increase the reservation wage (see chapter 5 on job search), and exert upward pressure on wages (see chapter 7 on bargaining). These mutually reinforcing effects are said to increase the duration of unemployment. Overall, then, we are led to expect that generous unemployment benefits do have a positive impact on the unemployment rate and do lead to a reduction in aggregate output. Yet this expectation needs to be put in context and clarified. In the first place, unemployment benefits give the unemployed the means to reduce their income loss and to better select from among the jobs that are offered to them. From this standpoint, benefits constitute a "subsidy" to the job search, and an increase in the amount paid out in benefits can improve the average quality of jobs and increase overall production. Any assessment of the "right" level of unemployment benefit ought to take into account the advantages just mentioned, along with the well-known disadvantages. This is the core problem addressed by all the research on optimality in unemployment insurance systems at which we will be looking in this chapter.

There exists another and more indirect way of insuring workers against the risk of job loss: governments may choose to protect existing jobs, for example by using binding administrative regulations to make layoffs more costly for firms. The literature adopts the term "employment protection" to denote all policy measures that hinder firms from altering at will the terms of their labor contracts with their employees. The stricter the employment protection measures in place, the more "rigid" labor markets are characterized as being. Comparison of the employment performance of the OECD countries and the various approaches they take to regulating their labor markets has attracted a great deal of attention. It is widely believed that "rigidity" in these markets is responsible for unemployment. But is that really the case? The search and matching model set out in chapter 9 proves particularly useful when it comes to addressing this question. It represents the dynamic functioning of an imperfectly competitive labor market and describes behaviors with enough precision to allow us to study the impact of employment protection measures.

Section 1 offers an overview of unemployment insurance systems and studies the question of optimality in unemployment insurance in theory and in practice. Section 2 begins with an overview of the range of employment protection measures and continues with an analysis of their impact, using a matching model where job destruction is endogenous. It concludes by laying out the main empirical results on the topic. Section 3 examines the complex interplay between unemployment protection and unemployment insurance. It shows that "optimal" employment protection should cause firms to internalize the social costs incurred when they destroy jobs—social costs that depend in turn on the generosity of the unemployment benefit.

1 UNEMPLOYMENT INSURANCE

In the area of unemployment insurance, the OECD countries have adopted widely varying regulations, especially regarding eligibility, the amount of benefit paid, and its duration. Such wide variation leads to the question of optimality in unemployment insurance: how long should a job seeker continue to receive it? Basically, the question of optimal unemployment insurance comes down to determining the amount and the time profile of unemployment benefit that will maximize the welfare of job seekers under the budgetary constraints of the agency in charge of managing the unemployment insurance system. Most often the agency in charge cannot check thoroughly on whether its unemployed clients are making appropriate efforts to find a job. The agency is faced with a "moral hazard" problem in that perfect insurance, in other words complete replacement of the unemployed person's lost income, might also rob him of any incentive to look for a job energetically.

We study this question with the help of a simple static model, highlighting the parameters that have to be known in order to calculate the optimal level of unemployment benefit. We then examine this question utilizing the standard job search model set forth in chapter 5 and assuming that the amount of unemployment benefit remains constant over time. Finally, we relax this hypothesis in order to study the optimal time profile of unemployment benefit.

As a preliminary to these theoretical developments, we take a broad look at the unemployment insurance systems existing in the principal OECD countries.

1.1 An Overview of Unemployment Insurance Systems

This section gives an overview of unemployment benefit in several OECD countries. The main parameter of unemployment insurance is the replacement ratio, in other words the ratio between the amount of the benefit payment and the last wage earned. But a large proportion of those who lose their jobs do not receive benefits from the unemployment insurance system because they have not paid contributions for long enough. So we must always bear in mind the distinction between assistance payments, which are conditional upon the income of agents, and insurance payments, which depend on the contributions agents (and their employers) have paid into the unemployment insurance system while they were in work. We also discuss short-time work, which resembles a system of insurance against unemployment in that it allows employers to reduce the hours worked by employees rather than lay them off.

1.1.1 Insurance vs. Assistance

The income of a job seeker most often combines payments from an insurance system and ones from a social assistance fund. Unemployment insurance systems generally pay benefits for a limited period, from several months to several years, to persons who have already been employed and paid into the fund (Grubb, 2001; Venn, 2012). The amount of benefit is often linked to the wage earned in the most recent job. Payments made by the social assistance fund, on the other hand, are means-tested and are classified as unemployment assistance. Like unemployment insurance benefits, unemployment assistance benefits are conditional upon job search and availability for work (which sets them apart from most kinds of social assistance). But unlike insurance benefits, they are generally of unlimited duration and independent of past earnings. To social assistance payments made specifically to job seekers we must add the various allowances (family allowance, housing allowance, single-parent allowance, etc.) that may be paid to any member of the labor force when she meets certain means criteria. These allowances may top up unemployment benefits, depending on household composition and income level.

Tables 13.1 and 13.2 present the main characteristics of unemployment insurance and assistance benefits in 15 countries in 2010. The variety of rules makes systems difficult to compare at first glance.

In the OECD, the average maximum duration of unemployment insurance benefits is 15 months, excluding Belgium, which is the only country with unlimited duration. In the United States the relatively high duration shown in table 13.1 is due to the temporary extension of benefits introduced in 2009 after the beginning of the Great Recession and which ended at the end of 2013. The normal duration in the United States is 6 months. In most OECD countries there is a ceiling for benefits, which is set at about 70% of the average wage.

In most countries payments are determined as a percentage of the earnings base, but there are exceptions, such as the United Kingdom. The third and fourth columns of table 13.1 show that this percentage varies from about 50% to 90%. However, these

Table 13.1
The rules of unemployment insurance schemes in selected OECD countries, in 2010.

Country	Maximum duration (months)	Payment rate (% of earnings base): Initial rate	Payment rate (% of earnings base): At end of legal entitlement period	Minimum benefit as a % of AW	Maximum benefit as a % of AW
Belgium	Unlimited	60	54 (after 1 year)	23.4	36.6
Canada	11	55	55	—	53.1
Denmark	24	90	90	43	52
France	24	57–75	57–75	28.1	227.5
Germany	12	60	60	—	91.7
Italy	8	60	50 (after 6 months)	—	45.6
Japan	9	50–80	50–80	—	52.7
Korea	7	50	50	20.8	39
Netherlands	22	75	70 (after 2 months)	30.4	79.9
Norway	24	62	62	15	60
Poland	12	Fixed amount (23.2% of AW after 3 months)		—	—
Spain	24	70	60 (after 6 months)	24.1	52.6
Sweden	35	80	70 (after 9 months)	22.6	48
United Kingdom	6	Fixed amount (9.9% of AW)		—	—
United States	23	53	53	13.3	41.2

Note: AW = gross average wage. The minimum/maximum benefits are for a single, 40-year-old worker without children; benefits may differ depending on family situation. All benefit amounts are shown on an annualized basis. The minimum/maximum gross benefits are expressed as a percentage of the gross average wage in the economy. In Australia there is no unemployment insurance scheme (as in New Zealand). For Canada, the duration of Employment Insurance (EI) benefits depends on the unemployment rate in the relevant EI region. The 11 months' duration shown here relates to an unemployment rate of 9% in Ontario. For the United States, the information reflects the situation of the Michigan unemployment benefit scheme. The payment duration has been extended in the United States due to high unemployment rates, up to 23 months. Emergency Unemployment Compensation and Extended Benefits are paid after exhaustion of regular unemployment insurance, which is 26 weeks.

Source: OECD Taxes and Benefits calculator (www.oecd.org/els/social/workincentives).

Table 13.2
The rules of unemployment assistance schemes in selected OECD countries, in 2010.

Country	Duration (months)	Payment rate	Maximum benefit as a % of AW	Test on Assets	Test on Income
Australia	Unlimited	Fixed amount	18	Yes	Family
France	6 months (renewable)	Fixed amount	15.6		Family
Germany	Unlimited	Fixed amount	10.2	Yes	Family
Spain	30	Fixed amount	20.6		Family
Sweden	14	Fixed amount	22.6		Individual
United Kingdom	Unlimited	Fixed amount	9.9	Yes	Family

Note: AW = average wage. The maximum benefit is for a single, 40-year-old worker without children; benefits may differ depending on family situation. All benefit amounts are shown on an annualized basis. In Spain, benefits are only paid to people with dependents unless aged over 45. The maximum gross benefits are expressed as a percentage of the gross average wage in the economy.

Source: OECD Taxes and Benefits calculator (www.oecd.org/els/social/workincentives).

differences across countries do not necessarily reflect differences in net replacement income: most countries calculate benefits on the basis of gross earnings; some do so on the basis of net earnings (e.g., Germany); yet others use pretax but post-social-security-contributions earnings as a base (e.g., Denmark). Also, benefits may be taxed at different rates. Ceilings may reduce replacement rates at higher wage levels; for instance, the maximum gross benefit represents more than 200% of the average gross wage in France, but only 37% in Belgium. In some European countries, payment rates decrease over time (Belgium, Italy, Netherlands, Spain, and Sweden). This characteristic will be discussed below in models of optimal unemployment insurance.

Unemployment assistance schemes do not exist in all the countries included in table 13.1. Where they do exist, payments are usually at a fixed rate and the amounts are much less than unemployment insurance (for comparability purposes, the maximum benefit a single person can get on an annual basis is expressed as a percentage of the national average gross wage in the fourth column of the table). Unemployment assistance is also conditional upon means testing, based on either family income and/or assets (e.g., ownership of a dwelling; see the last columns of table 13.2). In some countries people must exhaust their insurance entitlement before becoming eligible for assistance (e.g., France) and in many countries the only requirement is to be jobless and actively looking for work. Where unemployment assistance does not exist, the unemployed with no, or no more, entitlement to insurance have only general minimum-income schemes to turn to, if these exist.

1.1.2 How to Measure the Generosity of an Unemployment Insurance System

The OECD has constructed a synthetic indicator of the generosity of unemployment benefit: it is based on the replacement ratio. But to determine the effective level of compensation, the researcher must not neglect social assistance benefits either. Last, in order to have complete knowledge of any system of unemployment benefit, it is necessary to take into account the eligibility conditions and the sanctions imposed for half-hearted job search.

The OECD Synthetic Indicator of the Replacement Ratio

The OECD synthetic indicator of the generosity of unemployment benefit is an average of the entitlements of single, unemployed persons and of those living in couples, with or without children, whose spell of joblessness has lasted from zero to five years. This indicator is either a gross replacement ratio, equal to the ratio of gross benefit payments to gross wages, or a net replacement ratio, which takes into account payroll deductions, taxes, and transfers for both benefits and past wages. Figure 13.1 gives an overview of the path of gross replacement ratios over time in several OECD countries. On average, this ratio was about 23% in the OECD countries in 2011. We see that the replacement ratio exhibits an increasing trend on average, notably in Europe over the period 1961–2011. Still, this average trend masks strong disparities. In general, the countries with low replacement ratios are also the ones where this ratio remains most stable over the last five decades of the twentieth century: Canada, Japan, and the United States (excepting the period since 2009, due to the temporary extension of benefits under crisis conditions). Conversely, Denmark, France, and the Northern European countries at the beginning of the 1970s, as well as Austria, France, and Spain at the beginning of the 1980s, increased their replacement ratios, though these leveled off in the 1990s. Germany remained stable at a high level until the beginning of the 2000s, but following the Hartz reforms the generosity there has decreased significantly, while the United Kingdom saw a significant decline in the synthetic indicator of entitlements for the jobless over the whole period.

Net replacement ratios are significantly higher than gross ones. They provide a more comparable assessment of the generosity of systems across countries because in many countries taxes on benefits are distinct from taxes on wages, due to the progressivity of taxes and income redistribution policies. The average net replacement ratio is around 50% higher than the average gross ratio for the OECD countries as a whole (about 34% in 2011 over a five-year spell of unemployment). Figure 13.2 shows the net replacement rate for singles, over a five-year spell (averages for three levels of past wages: 67%, 100%, and 150% of the average wage), for 16 countries. As for the gross ratio, general social assistance payments are excluded from the calculation, and only unemployment assistance schemes are taken into account. France has the highest ratio during the first year at 68%, and the second highest over the five years, behind Belgium (54%). Replacement ratios over five years are also high in the Nordic countries and Germany, but still about half of those of France or Belgium. In the United States and Canada, net replacement rates are comparable to those in most European countries in the first year of unemployment but decline quickly after the first year, resulting in low period averages. In the United Kingdom, replacement rates are flat over five years and appear to be low because housing, family benefits, and other social assistance supplements are excluded. No data are available to compare net replacement ratios over the long run. Nonetheless, given the strong correlation between net ratios and gross ratios, it is likely that the average net ratio has risen since the beginning of the 1960s in the OECD countries.

The synthetic indicator masks in part the linkage between the duration of unemployment and the amount of the benefit payment. In many countries, unemployment benefits taper off as the jobless spell lengthens. Taking the case of singles with no children, figure 13.2 shows that benefits fall off very steeply in the United States, and that the replacement ratio is relatively generous in Japan for the first year but then falls off sharply

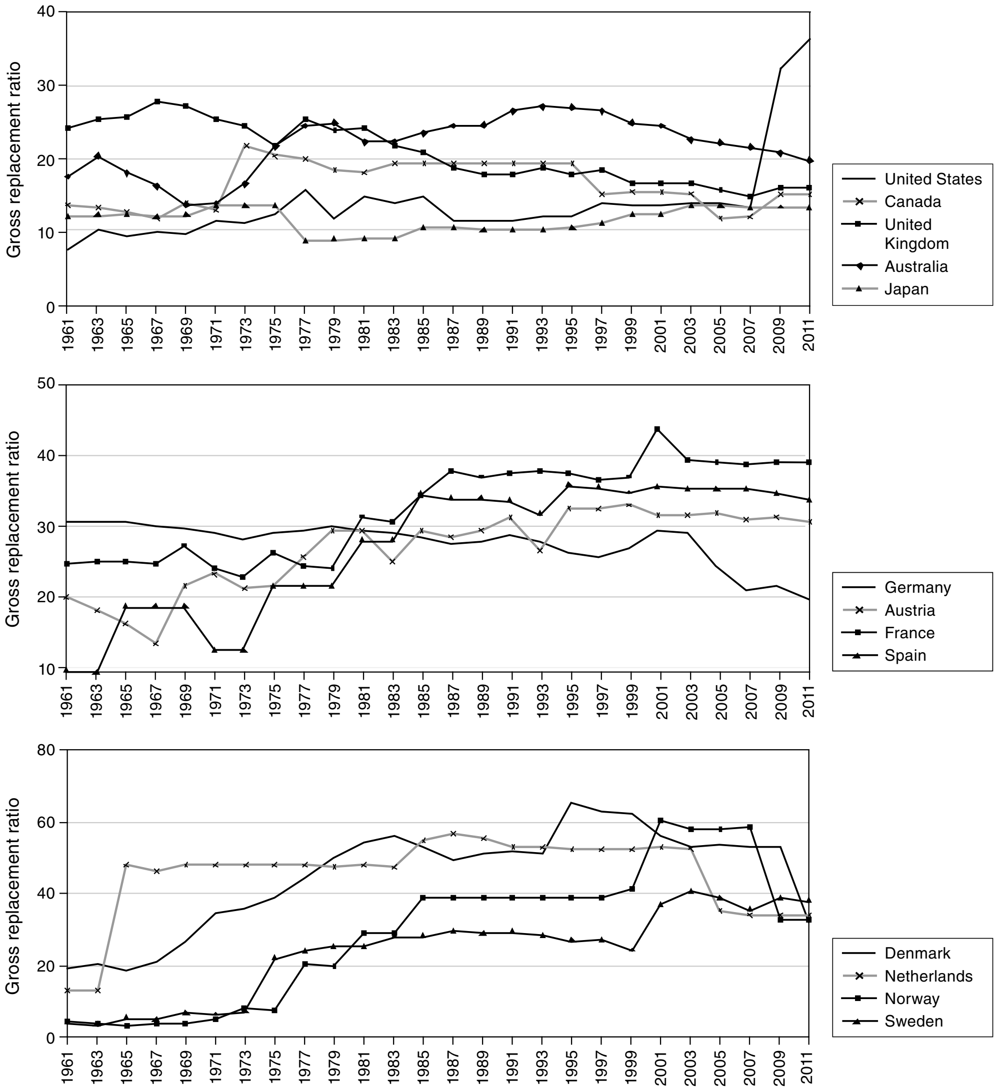

Figure 13.1
The synthetic indicator of entitlement to unemployment benefits (gross replacement ratio in percentage).

Note: The OECD summary measure is defined as the average of the gross unemployment benefit replacement rates over five years, for two earnings levels (67% and 100% of the average production wage), three family situations (single, one-earner couple, two-earner couple), and three durations of unemployment. It includes unemployment insurance and unemployment assistance benefits. For the years 2007–2011 the gross replacement ratio is based on the average production wage.

Source: OECD Tax-Benefit Models (www.oecd.org/els/social/workincentives). Gross replacement rates, uneven years from 1961 to 2011.

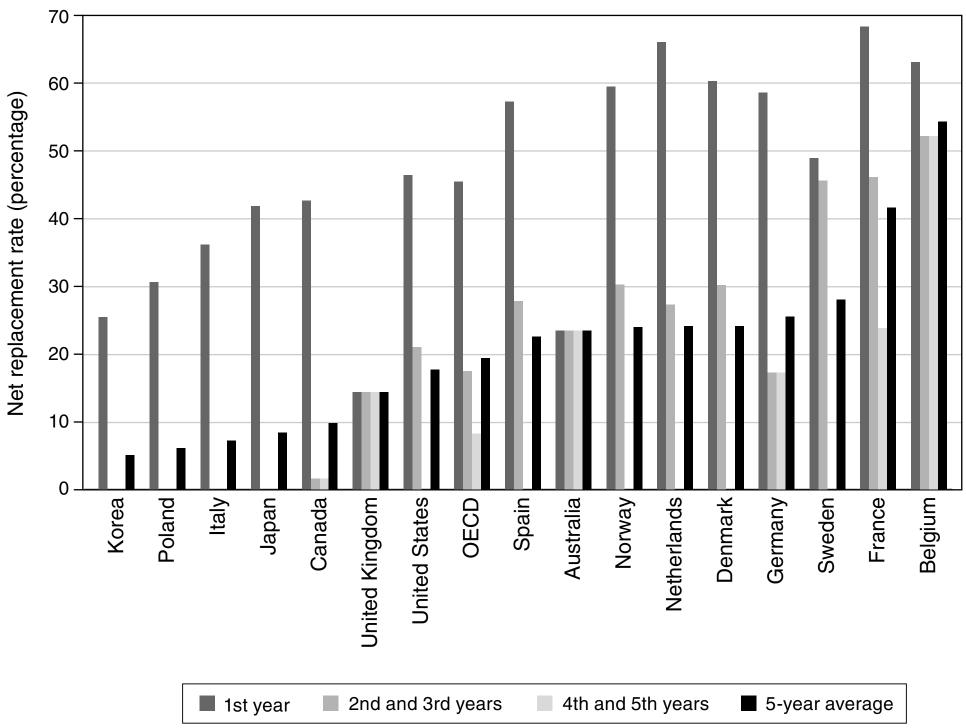

FIGURE 13.2
Net replacement rate for unemployment benefits only for single person in 2011 (in percentage of past earnings).

Note: Includes unemployment insurance and unemployment assistance benefits but not general social assistance or housing schemes. Rates are averages of replacement ratios at three levels of income (67%, 100%, and 150% of the average wage). Calculations consider cash incomes only, as well as income taxes and mandatory social security contributions paid by employees. The rate is equal to zero for some countries and some years, since we ignore assistance or housing benefits that could replace income at the end of unemployment benefit entitlements. OECD refers to the nonweighted average of rates for the OECD countries. Countries are ranked according to their 5-year average rate.

Source: OECD Tax-Benefit Models (www.oecd.org/els/social/workincentives).

at the beginning of the second year of unemployment. This tapering off in replacement ratios generally reflects a shift from unemployment insurance to social assistance.

The Effective Level of Compensation

Unemployment insurance and assistance benefits are often complemented by family benefit, as well as housing benefit and even some social assistance supplements in cases where unemployment benefits alone are not enough to reach the minimum income threshold set by social assistance programs. Assuming that households are eligible for these benefits, and adding them to unemployment benefits, can substantially change the level of compensation of the unemployed, as shown by the simulations in figure 13.3. These simulations reflect the replacement rate for four family types because the amount of the social assistance supplements often varies with the family composition. Whereas the five-year average net replacement rate is only 27% without housing and social assistance allowances (but still including family benefits for families with children), the rate goes up to 50% when other types of benefits are included (again for eligible recipients)!

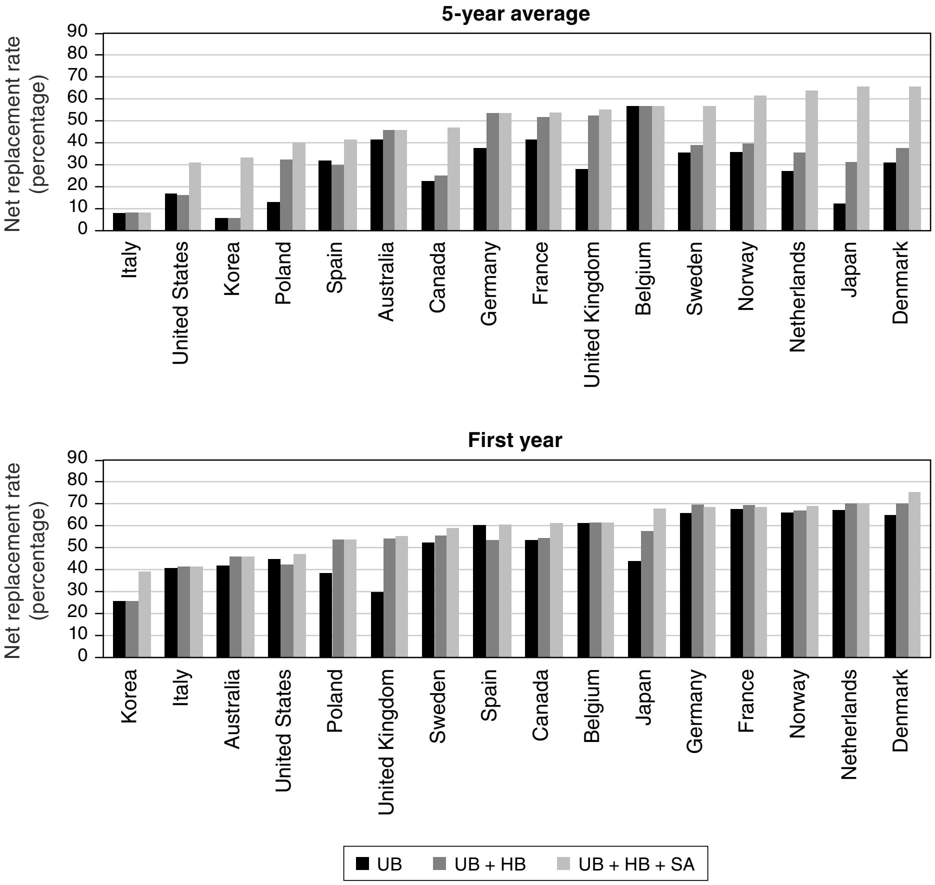

FIGURE 13.3
Net replacement rates for unemployment benefits, housing, and social assistance allowances for four family types in 2011 (in percentage of past earnings).

Note: UB = unemployment benefits and family benefits (when applicable); UB + HB = unemployment benefits, family benefits (when applicable), and housing benefits; UB + HB + SA = unemployment benefits, family benefits (when applicable), housing benefits, and social assistance. The rates are an average for four types of families (single, couple with one earner, lone parent with two children, couple with one earner with two children), with in-work earnings equal to 67%, 100%, and 150% of the average wage. Any income taxes payable on unemployment benefits are determined in relation to annualized benefit values (i.e., monthly values multiplied by 12) even if the maximum benefit duration is shorter than 12 months. Children are aged 4 and 6 and neither child care benefits nor child care costs are considered. Calculations consider cash incomes only, as well as income taxes and mandatory social security contributions paid by employees.

Source: OECD Tax-Benefit Models (www.oecd.org/els/social/workincentives).

The difference in replacement rates, with or without housing and social assistance, is stronger over a five-year period than in the first year because in most countries unemployment benefits do not last longer than one or two years. Figure 13.3 shows that these additional benefits play an important role for some households in Japan, Korea, Poland, the United States, and the United Kingdom, even during the first year of unemployment.

The Eligibility Conditions and the Rules for Sanctions

The synthetic indicator also masks factors having to do with the conditions under which unemployment benefit is paid. These eligibility conditions concern not only the duration of the contribution period (for insurance benefits) but also the reasons for the job loss. Many systems provide for sanctions when a person quits voluntarily or is fired for cause. Figure 13.4 gives an overview of the extent of such sanctions in some OECD countries. Australia and New Zealand require no contribution record and impose relatively light sanctions for voluntary unemployment (unemployment benefits are noncontributory in these countries). Less than a year of employment is required in Canada, France, Japan, Korea, the Netherlands, the United States, and the United Kingdom. Nordic countries have relatively relaxed entitlement conditions once sanctions for voluntary unemployment are taken into account. Workers voluntarily unemployed are not eligible for unemployment benefit in many countries, including Canada, Italy, Korea, the Netherlands, Spain, and the United States. In other countries benefits are either reduced or delayed for a certain period.

The eligibility conditions for unemployment benefit also include aspects of job search, with many systems specifying that beneficiaries must furnish proof that they are actively looking for work, must not actually be working, and must accept jobs offered to them that are judged to meet the criteria defined by the unemployment insurance system (see Venn, 2012, for more detail). Benefit recipients are subject to more or less strict

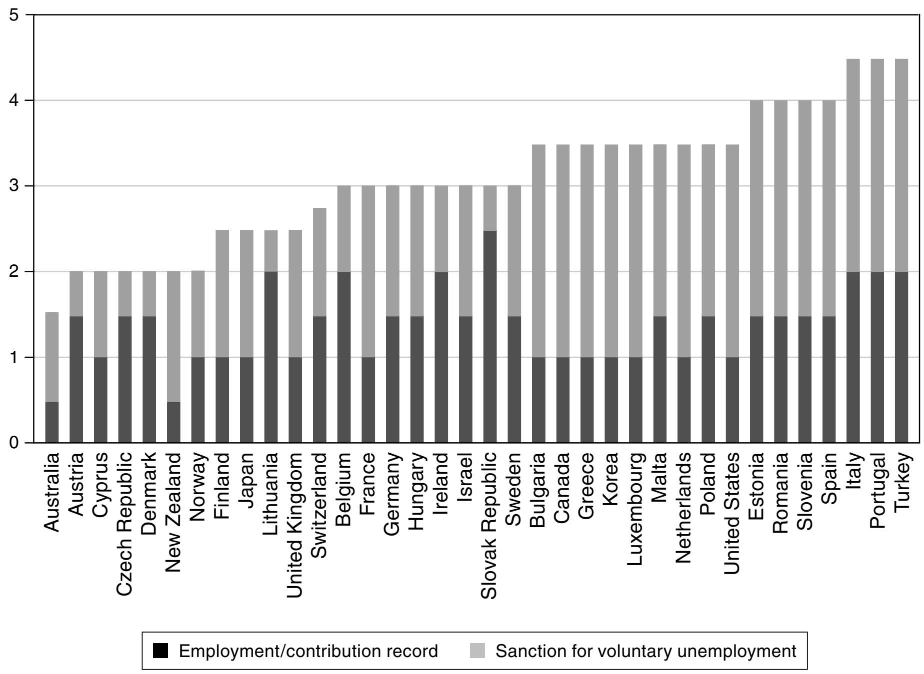

Figure 13.4

Strictness of entitlement to benefits in 2011. Indicator scored from 1 (least strict) to 5 (most strict).

Source: Venn (2012, figure 2, p. 15).

monitoring of their job search activities over the spell of compensated unemployment, and also to sanctions when they refuse offers or make half-hearted efforts to hunt for a job. As noted in chapter 5, section 2.2.5, the strictness of such sanctions varies widely in the OECD countries. In principle, the United States suspends benefits completely for an initial refusal of a job offer or refusal to participate in an active labor market program (ALMP), while suspensions are relatively short (one month or less) in Denmark, Germany, Japan, and Korea. In some countries, benefits are reduced for a fixed period (France, the Netherlands, Sweden) rather than suspended. Many countries have higher sanctions for benefit recipients who repeatedly refuse suitable job offers or participation in an ALMP without good reason: examples include Belgium, Denmark, Finland, and Sweden. The labor economist must bear in mind that it is difficult to assess the effectiveness of such sanctions. Enforcement is key in this matter. Observed low sanction rates in one country may mean either that sanctions are not seriously being applied or conversely that the threat exerted by sanctions is highly credible there. The impact of sanctions can only be assessed in experimental or quasi-experimental settings (see chapter 14). Overall, eligibility criteria and the rules governing sanctions are strictest in Portugal, Spain, and Italy and least strict in Canada, Denmark, Japan, and Sweden (Venn, 2012).

1.1.3 A High Proportion of Uninsured, Unemployed Persons

The OECD synthetic indicator is often used in international comparisons of unemployment benefit, but it is important to stress that it conceals wide heterogeneity. In particular, a large number of persons who are looking for work do not receive unemployment insurance benefit because they do not satisfy the eligibility conditions. As we have seen, though, they may receive transfers from the social assistance system, either in the form of unemployment assistance or through general social assistance schemes. Figure 13.5 gives an idea of the extent of this phenomenon, by representing the ratio of unemployment insurance recipients to the overall number of jobless persons (i.e., those not working, actively looking for a job, and available for work) over the period 2007–2010 for 33 OECD countries. This ratio is called the a "pseudo-coverage" rate.

Essentially, persons who do not benefit from unemployment insurance are new entrants into the labor market or have not paid into an unemployment insurance fund for a long time or have exhausted their entitlement to benefits after a long spell of joblessness. Scrutiny of figure 13.5 reveals that very few of those looking for work receive unemployment insurance benefit in the countries of Southern Europe. In Japan only 23% of the unemployed are compensated by insurance schemes, and in Germany only 33%. Overall, about 55% of the jobless in the OECD countries do not receive unemployment insurance benefit. Some countries feature high pseudo-coverage rates. For instance, in France about 85% of the jobless receive an insurance benefit, and the ratio is over 100% in Iceland because many unemployment insurance recipients do not consider themselves unemployed.[1] The pseudo-coverage rate is also above 50% in the United States, the United Kingdom, and the Northern European countries.

[1] The number of unemployment benefit recipients is not a subsample of the overall number of unemployed persons according to the ILO-OECD definition. Indeed, some benefit recipients may not declare themselves as unemployed in the Labor Force Surveys (i.e., not working, being available for work, and looking actively for a job). For this reason, the ratio of unemployment insurance recipients to the number of unemployed is called a pseudocoverage rate and may be over 100% in some cases.

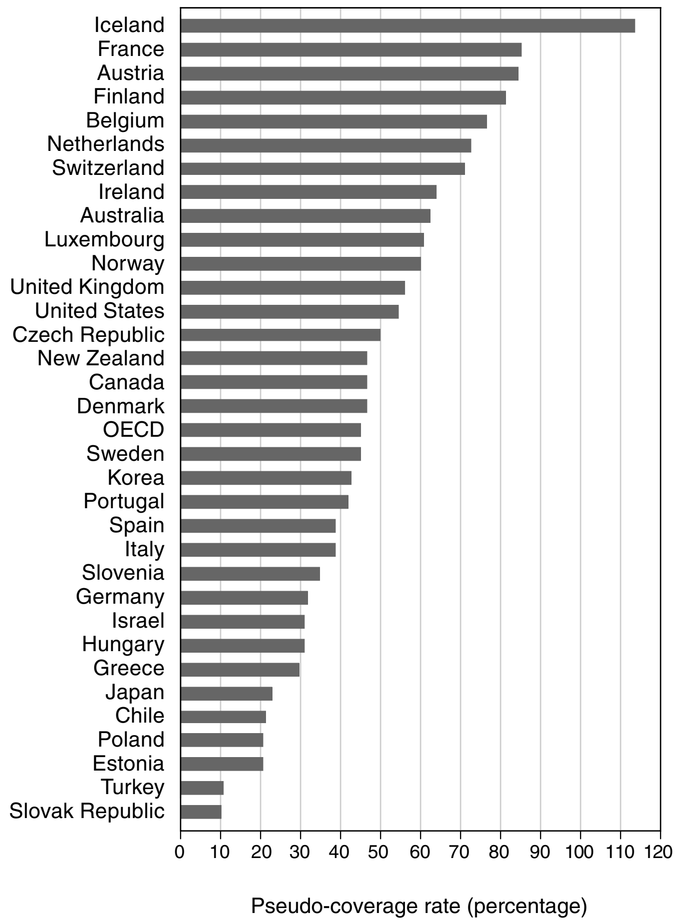

Figure 13.5

Average unemployment insurance benefits pseudo-coverage rate in 2007–2010 (percentage of the unemployed).

Note: The pseudo-coverage rate is the ratio of the number of unemployment insurance benefit recipients to the overall number of unemployed workers according to the ILO-OECD definition. For Australia and New Zealand, unemployment assistance schemes are considered as there are no insurance schemes in these countries. OECD refers to the nonweighted average of rates for the OECD countries.

Source: OECD Social Benefit Recipients database and Labor Force Survey database.

1.1.4 Short-Time Work

Short-time work (or short-time compensation) is an insurance scheme that aims at reducing layoffs by allowing employers to temporarily reduce hours worked while compensating workers for the forced drop in their income. The difference between this and unemployment insurance is that workers are not laid off. Either working hours are reduced or, in extremes cases, the labor contract is temporarily suspended. Compensation is usually delivered through the unemployment insurance scheme in the form of partial unemployment benefits, from special funds, directly by the state, or sometimes by a combination of these sources. Before the 2008–2009 crisis, short-time work schemes were already in place in 18 OECD countries. They were implemented in even more countries during the crisis, and now they are in operation in 25 of the 34 OECD countries, including most of the continental European ones. Among the Nordic countries, Denmark, Finland, and Norway have short-time work schemes, as do Canada, Ireland, New Zealand, and the United States among the Anglophone countries. In good economic times, the number of workers in these schemes tends to be very small. But in hard times, participation in these schemes can balloon very quickly. For instance, at the end of 2009, 1.3% of employees in the OECD countries were taking part in such schemes.

However, figure 13.6 shows that there are large cross-country differences in take-up rates, which range from zero in some countries to 3% of employees in Germany and Italy, and even 5.5% in Belgium (on average in 2009). Countries where employment protection of regular contracts is stricter (see section 2 below), such as Belgium, Germany, Italy, and France, tend to resort more to these schemes as an alternative to layoffs in bad times. In the 2008–2009 recession, unemployment did not increase in some European countries featuring widespread and generous short-time compensation

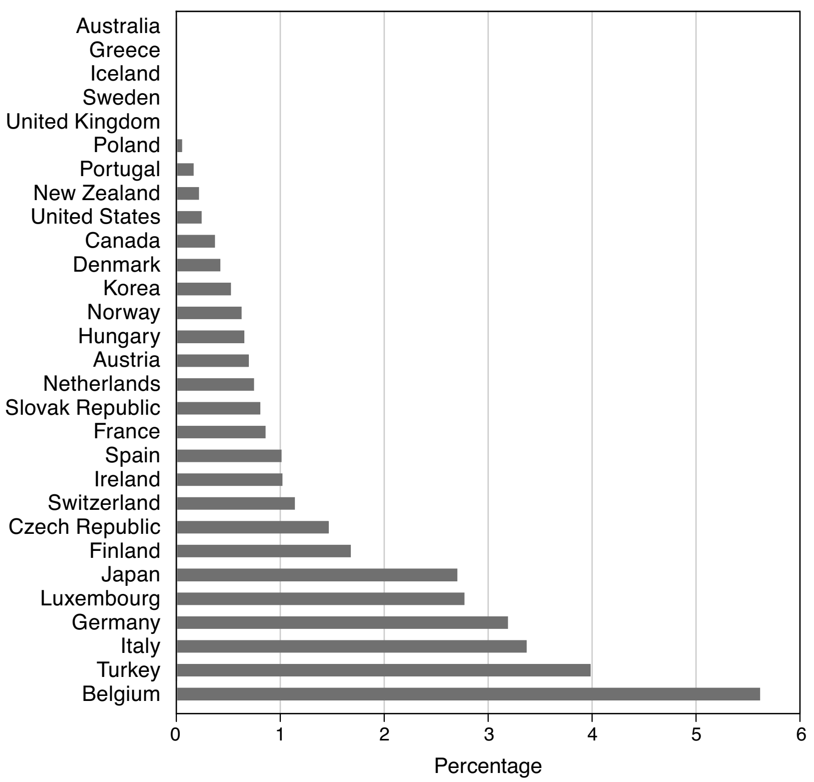

Figure 13.6
Participation rate of employees in short-time work schemes in 2009 (percentage of employees).

Note: In 2009 Australia, the United Kingdom, Greece, Iceland, and Sweden had no such schemes.

Source: Cahuc and Carcillo (2011, figure 1) based on OECD data.

programs as much as it did in other countries. The leading example is Germany, which makes particularly intensive use of a short-time work program (the *Kurzarbeit*). This success induced a renewal of interest in short-time work as a way to damp unemployment during recessions (Boeri and Bruecker, 2011; Cahuc and Carcillo, 2011; Hijzen and Venn, 2011; Brenke, Rinne, and Zimmermann, 2013), although the long-term consequences of these schemes for productivity are yet to be studied.

1.2 The Basic Analysis of Optimal Unemployment Insurance

In chapter 5 we looked at the impact of compensation in case of job loss on the duration of job search from both the theoretical and empirical standpoints. In that setting, compensation rules were taken as given. We now address the problem from a normative standpoint, seeking to illuminate the problem of determining these rules in an optimal manner. The canonical analysis of optimal unemployment insurance is that of Baily (1978). In his framework, there is an agency charged with setting the amount of unemployment benefit paid to job seekers and the amount of tax paid by wage earners. Knowing these two parameters, agents choose the intensity of their job search.

1.2.1 The Behavior of Agents

First we describe the behavior of suppliers of labor, then the behavior of the agency charged with managing the unemployment insurance system.

Workers

The model comprises two periods, with the length of each normalized to 1. Agents can neither save nor borrow (this hypothesis will be relaxed subsequently). During the first period, all individuals work, get an exogenous wage w, and pay a flat rate tax τ, which serves to finance the unemployment benefit b paid out to every job seeker. In the first period, every individual thus obtains a level of utility $v(w-\tau)$ with $v'>0$. It is assumed that all agents are risk averse, or in formal terms $v''<0$. At the end of the first period, individuals lose their jobs. They can then make a search effort that determines the duration of their job search during the second period. The more energetically they search for a job, the shorter this duration, denoted $D \in [0,1]$. Following Chetty (2006), we assume that search costs, the leisure value of unemployment, and the advantage of improved job matches flowing from additional search are captured by a concave, increasing function denoted $\phi(D)$. It is also assumed, for simplicity, that in the second period a job seeker pays no taxes. Knowing b and τ, every individual chooses a duration of unemployment D that maximizes his expected utility for the second period. On the assumption that the duration of unemployment is equivalent to the probability of being unemployed, the program of the second period of an agent's life is written:

$$\max_D (1-D)\,v(w) + Dv(b) + \phi(D)$$

Deriving with respect to D, we obtain the first-order condition:

$$\phi'(D) = v(w) - v(b) \tag{13.1}$$

This condition defines the duration of job search as a function of parameter b; we denote it $D(b)$ and we assume that it falls in the interval $[0,1]$. It signifies that at the optimum, the agent selects a duration of unemployment that equalizes his marginal gain, $\phi'(D)$, and his marginal cost, $v(w) - v(b)$, expressed in terms of utility. As function ϕ is taken to be concave, ϕ'' is negative, and as v' is positive, the result is $D'(b) > 0$. A rise in unemployment benefit thus leads directly to an increase in the duration of unemployment.

The Agency

The objective of the agency charged with managing the system of unemployment compensation is to determine the amount of unemployment benefit and the flat-rate tax that will maximize the expected utility of an unemployed person under the constraint of a balanced budget. Assuming that there is no discounting, the program of the agency takes the following form:

$$\max_{b,\tau} v(w-\tau) + [1 - D(b)]\, v(w) + D(b)v(b) + \phi\,[D(b)] \tag{13.2}$$

subject to $\tau = D(b)b$.

The budget constraint is easily grasped. If we assume that the size of the active population is equal to 1, τ represents the sum total of the taxes levied on wage earners. With this hypothesis, D represents the number of job seekers. The budget constraint of the agency expresses the fact that the mass of taxes collected from wage earners in the first period is paid out in full to the job seekers. The agency's budget is thus balanced.

The budget constraint allows us to eliminate τ from the maximization criterion. The program of the agency consists of maximizing the expected utility of the agent with respect to the unemployment benefit, for the level of tax that balances the budget, and for the search effort the agent chooses to make. The expected utility of the agent is then written:

$$W(b) = v\,[w - bD(b)] + [1 - D(b)]\, v(w) + D(b)v(b) + \phi\,[D(b)]$$

In deriving this expected utility, and employing condition (13.1) that defines the duration of unemployment chosen by agents,[2] we can calculate the impact of a small hike in unemployment benefit on expected utility:

$$W'(b) = -\left(1 + \eta_b^D\right) D(b)v'\,[w - bD(b)] + D(b)v'(b) \quad \text{with } \eta_b^D = \frac{bD'(b)}{D(b)}$$

The term $\left(1 + \eta_b^D\right) D(b)v'\,[w - bD(b)]$ represents the marginal cost of a hike in the amount of benefit b, a cost borne by the wage earners who finance the unemployment insurance system. The marginal cost of raising the tax to finance an increase in b is given by the direct cost v' plus an added term $\eta_b^D v'$ arising from the increase in unemployment duration that follows the hike in b. This marginal cost increases with η_b^D, the elasticity of unemployment duration with respect to unemployment benefits. The term

[2] In other words, we make use here of the envelope theorem. See appendix A, section 1.5, at the end of the book.

$D(b)v'(b)$ represents the marginal gain flowing from a hike in the amount of benefit b, which increases the utility of the unemployed job seeker. At the optimum, the marginal cost of a hike in the amount of benefit b must be equal to the marginal gain, or:

$$\left(1+\eta_b^D\right) v'\left[w-bD(b)\right] = v'(b) \tag{13.3}$$

It is worth pointing out that if the duration of unemployment were inelastic ($\eta_b^D = 0$), the optimal amount of benefit would offer perfect insurance to all agents, since we would have $w - \tau = b$. Conversely, if $\eta_b^D > 0$, then $w - \tau > b$ and agents are imperfectly insured against the risk of job loss. Thus the elasticity η_b^D, which signals the existence of the moral hazard inherent in paying out unemployment benefits, limits the capacity of the agency to insure against the risk of job loss.

1.2.2 THE BAILY FORMULA

Let us first establish the theoretical formula describing optimal unemployment insurance. It will then be possible to show that this formula holds good in a model where agents can save and borrow.

Three Parameters Defining Optimal Unemployment Insurance

Let us denote by $c_e = w - \tau$ and $c_u = b$ respectively the consumption of a tax-paying wage earner and the consumption of a job seeker. With this notation, equation (13.3) characterizing optimal unemployment insurance becomes:

$$\frac{v'(c_u) - v'(c_e)}{v'(c_e)} = \eta_b^D \tag{13.4}$$

A Taylor expansion makes it possible to bring out the main ingredients of optimal unemployment insurance. We have:

$$v'(c_u) - v'(c_e) \simeq (c_u - c_e)v''(c_e) + \frac{1}{2}(c_u - c_e)^2 v'''(c_e)$$

Let us denote by $\sigma(c) = -cv''(c)/v'(c)$ the coefficient of relative risk aversion and by $\rho(c) = -cv'''(c)/v''(c)$ the coefficient of relative prudence. Taylor's development can then be written:

$$\frac{v'(c_u) - v'(c_e)}{v'(c_e)} \simeq \frac{c_e - c_u}{c_e}\sigma(c_e) + \frac{1}{2}\left(\frac{c_e - c_u}{c_e}\right)^2 \sigma(c_e)\rho(c_e)$$

By substituting this expression in equation (13.4), we find that optimal unemployment insurance is characterized by:

$$\frac{c_e - c_u}{c_e}\sigma(c_e) + \frac{1}{2}\left(\frac{c_e - c_u}{c_e}\right)^2 \sigma(c_e)\rho(c_e) \simeq \eta_b^D \tag{13.5}$$

In the appendix to this chapter, we lay out in precise fashion the economic interpretation of the coefficients of relative risk aversion and relative prudence. The first corresponds to its intuitive meaning, the shunning of risk, whereas relative prudence measures how risk aversion varies. Kimball (1990) has shown that the coefficient of relative prudence is also an indicator of an agent's inclination to save up, and for this reason $\rho(c)$ is sometimes referred to as measuring the "precaution motive."

Limiting ourselves to a first-order Taylor expansion, which amounts to the assumption that $\rho(c_e)$ and $v'''(c_e)$ are negligible quantities, we obtain the original formula of Baily (1978):

$$\frac{c_e - c_u}{c_e}\sigma(c_e) \simeq \eta_b^D \tag{13.6}$$

This formula defines the optimal relative difference between the consumption of a person in work and the consumption of a job seeker. This difference diminishes with risk aversion and increases with the elasticity of unemployment duration with respect to unemployment benefits. When aversion to risk is greater, drops in consumption do effectively cause more drastic losses of welfare. From the second perspective, the rise in consumption on the part of job seekers is more costly when the elasticity of unemployment duration with respect to unemployment benefit is greater. Hence optimality would suggest reducing the amount of unemployment benefit when this elasticity is strong.

More generally, formula (13.5) shows that three parameters determine the optimal difference between the consumption of wage earners and the consumption of job seekers: risk aversion, $\sigma(c_e)$, the precaution motive $\rho(c_e)$, and the elasticity of unemployment duration η_b^D. These three magnitudes are what we might call "sufficient statistics" for determining the optimal difference in consumption between a wage earner and a job seeker.

Optimal Unemployment Insurance with Savings

A priori, one might suppose that the possibility of saving changes the characterization of optimal unemployment insurance (on this point see Baily, 1978). We will now discover that this is not the case. Let us return to the basic model but assume that each agent has the possibility of building up savings s in the first period, which she consumes in the second period, knowing b and τ perfectly. Each agent then chooses $s(b,\tau)$ and $D(b,\tau)$ solutions of the program:

$$\max_{s,D} v(w-\tau-s) + (1-D)\, v(w+s) + Dv(b+s) + \phi(D)$$

Let us designate by $V(b,\tau)$ the indirect utility associated with these solutions; the agency then chooses the pair (b,τ) that maximizes $V(b,\tau)$ under the budget constraint $\tau = D(b,\tau)b$. As before, this budget constraint allows us to view τ as a function of b, which we denote $\tau(b)$. The program of the agency then consists of selecting b in such a way as to maximize $V[b,\tau(b)]$. Employing the envelope theorem, we arrive at:

$$\left(1+\eta_b^D\right) v'[w-s-bD(b)] = v'(b+s) \quad \text{with} \quad \eta_b^D = \frac{bD'(b)}{D(b)}$$

Let us again denote by $c_e = w - s - \tau$ and $c_u = b + s$ the consumptions of a taxpaying wage earner and a job seeker respectively: we return exactly to equation (13.4) characterizing optimal unemployment insurance. The Baily formula (13.6) and the augmented Baily formula (13.5) therefore both remain valid. Evidently, whenever savings

s are greater than zero, the optimal value of unemployment benefit is not the same as in the model without savings (i.e., on the assumption that $s = 0$). Still, characterizations of optimal unemployment insurance grounded on the consumption gap between wage earners and job seekers retain all their validity.

More generally, Chetty (2006a) has shown, with the help of a more elaborate dynamic model, that the Baily formula (13.5) augmented by the precautionary saving motive retains validity in very general environments. For example, it holds good when we bring into account the insurance that flows from having a working spouse or when we assume that the chances of finding a job grow with the duration of job search.

1.3 The Optimal Level of Unemployment Benefit in Practice

If we dispose of both quantitative data on the parameters that determine the optimal gap in consumption between wage earners and job seekers and data on the relation between this consumption gap and unemployment benefit, we can in principle form an idea about the optimal setting of unemployment benefit by using either the simple Baily formula or the augmented version. Nonetheless, utilization of the Baily formula remains challenging in practice, since it requires the availability of data on parameters such as risk aversion, and the relation between consumption and unemployment benefit, that are very tricky things to estimate.

Under these circumstances, Chetty (2008) and Shimer and Werning (2007) have elaborated alternative formulas, the purpose of which is to characterize optimal unemployment insurance with parameters that are easier to quantify. Chetty (2008) proposes a formula that relies uniquely on elasticities in the duration of unemployment. Shimer and Werning (2007) obtain a formula that depends especially on the elasticity of the reservation wage.

1.3.1 The Application of the Baily Formula

It is a practical possibility—if we are in a position to assign quantitative values to the elasticity of unemployment duration, to relative risk aversion, and to the relation between unemployment benefit and the consumption gap between wage earners and job seekers—to form an idea of the optimal value of unemployment benefit, by employing the Baily formula (13.6). Gruber (1997) undertook this exercise on American data for the period 1968–1987 issuing from the Panel Study of Income Dynamics (PSID), a survey yielding information about expenditure on food consumption in households. Looking at individuals who lost their jobs between the two boundary dates of the survey, Gruber estimates by a simple regression, while controlling for a battery of individual characteristics, the relation between $(c_e - c_u)/c_e$ for food consumption and the replacement ratio b. He finds $(c_e - c_u)/c_e = 0.22 - 0.27b$ (Gruber, 1997, table 1, column 2). For the elasticity of unemployment duration, Gruber selects the value 0.9 deriving from the paper by Meyer (1990), who uses administrative data from the Continuous Wage and Benefit History (CWBH); these data cover men who received unemployment benefits in 12 states from 1978 to 1983. This elasticity is multiplied by the take-up elasticity of unemployment benefit (i.e., by how much the take-up increases when the benefit amount increases), equal to 0.48, which finally yields a coefficient $\eta_b^D = 0.43$. The Baily formula (13.6) then resolves into a simple increasing relation between the replacement ratio and the degree of relative risk aversion, or $b = (0.22/0.27) - (0.43/0.27\sigma)$, or again $b = 0.81 - (1.59/\sigma)$. With a degree of relative risk aversion of an empirical magnitude very likely inferior to 2 (Chetty, 2006b), the optimal replacement ratio would have to be very tiny indeed, inferior to 0.015! The fact is that according to the survey data used by Gruber, the average replacement ratio comes to 0.426. From this Gruber deduces that over the period in question, unemployment benefits in the United States were very likely too high with respect to the theoretically optimal setting yielded by the Baily formula.

But the Baily formula leaves out the reaction of precautionary savings, since it assumes $\rho(c_e) = 0$, and this may produce a strong underestimate of the optimal amount of benefit. For example, on the assumption that the utility function is of the CRRA (Constant Relative Risk Aversion) type, or $v(c) = \frac{c^{1-\sigma}}{1-\sigma}$, with σ lying in the interval $[1, 5]$ and $\eta_b^D = 0.5$, Chetty (2006a) calculates that the optimal unemployment benefit may sometimes be underestimated by more than 30% if the coefficient of relative prudence is left out of account. Hence it will be preferable to make use of relation (13.5) instead of the Baily formula (13.6).

Results obtained with this approach must be interpreted with care, inasmuch as there exists at present considerable reserve about the pertinent values of parameters issuing from some empirical studies based on samples that are not necessarily representative and not always well suited to the populations concerned.

1.3.2 Liquidity and Moral Hazard Elasticities

Chetty (2008) adopts an approach very close to that of Baily but which permits calculation of the optimal replacement ratio without bringing in the measurement of risk aversion or the relation between consumption and unemployment benefit.

Liquidity and Moral Hazard Effects

Let us consider a variant of Baily's basic model (see section 1.2 above) with a single period where it is assumed that agents dispose of an initial endowment $A \geq 0$. In this context, the choice of the optimal duration of unemployment is the solution of the program:

$$\max_D (1 - D)\, v(w - \tau + A) + Dv(b + A) + \phi(D)$$

Deriving with respect to D, we obtain the first-order condition:

$$v(w - \tau + A) - v(b + A) = \phi'(D) \tag{13.7}$$

Differentiating this formula with respect to w, we find:

$$\frac{\mathrm{d}D}{\mathrm{d}w} = \frac{v'(w - \tau + A)}{\phi''(D)} < 0 \tag{13.8}$$

We observe that a wage rise leads to a shortening of the duration of unemployment: the reason is that it increases the return to job search.

Next, differentiating (13.7) with respect to A brings us to:

$$\frac{\mathrm{d}D}{\mathrm{d}A} = \frac{v'(w-\tau+A) - v'(b+A)}{\phi''(D)} > 0 \tag{13.9}$$

We see that an increase in the endowment A increases the duration of unemployment, since it narrows the gap between the marginal utility of a wage earner and that of a job seeker. The existence of this gap is a measure of the inevitable imperfection of any attempt to insure against the risk of a drop in income caused by the loss of a job. At the limit, this gap is null when individuals can insure themselves perfectly. If they can, endowment A has no impact on the duration of unemployment.

Using the two previous formulas, the impact of unemployment benefit on the duration of unemployment can be written as follows:

$$\frac{\mathrm{d}D}{\mathrm{d}b} = -\frac{v'(b+A)}{\phi''(D)} = \frac{\mathrm{d}D}{\mathrm{d}A} - \frac{\mathrm{d}D}{\mathrm{d}w} \tag{13.10}$$

This decomposition shows that unemployment benefits raise unemployment duration by producing two different effects. The first term, $\mathrm{d}D/\mathrm{d}A$, corresponds to a "liquidity effect," for a higher benefit amount increases the agent's resources, allowing her to maintain a higher level of consumption while unemployed and reducing the pressure on her to find a job quickly. The second term, $-\mathrm{d}D/\mathrm{d}w$, is the "moral hazard effect," which reduces the wage (i.e., the gap between the wage and the unemployment benefit) and consequently the search effort. The liquidity effect implies that unemployment benefit reduces the need for agents to rush back to work because they cannot smooth out their consumption. The moral hazard effect implies that unemployment benefit subsidizes unproductive leisure.

Optimal unemployment insurance is always obtained by maximizing expected utility under the budget constraint of the agency and taking into account the relation—induced by job search behavior—between the duration of unemployment and unemployment benefit. This expected utility may be written:

$$W(b) = [1 - D(b)]\, v\,[w - \tau(b) + A] + D(b)v(b+A) + \phi\,[D(b)]$$

where $\tau(b) = D(b)b/\,[1 - D(b)]$ and $D(b)$ always designates the duration of unemployment flowing from the optimal search effort of the agent defined by condition (13.7). Note that the expression for $\tau(b)$ shows that the longer the unemployment duration, the larger the numbers of the jobless, and the higher the tax rate on workers needed to finance benefits.

Again using the envelope theorem and the two formulas (13.8) and (13.9), we can write the derivative of the marginal utility with respect to unemployment benefit in the form:

$$W'(b) = \left(\frac{\mathrm{d}D/\mathrm{d}A}{-\mathrm{d}D/\mathrm{d}w} - \eta_b^D\right) D(b)v'\left(c_e\right) \tag{13.11}$$

On the right-hand side of this equality there appears the relation between the liquidity effect and the moral hazard effect. When this (positive) term is multiplied by factor $D(b)v'(c_e)$, it represents the marginal gain from an increase in unemployment benefit. This marginal gain swells with the liquidity effect and shrinks with the moral hazard effect. The term $\eta_b^D D(b)v'(c_e)$ represents the marginal cost: it increases with the elasticity of unemployment duration with respect to unemployment benefit. Formula (13.11) shows that it is necessary to increase unemployment benefit if the relation between the liquidity effect and the moral hazard effect dominates the elasticity of unemployment duration with respect to unemployment benefit. If this is not the case, it is necessary to reduce unemployment benefit. The optimal level of unemployment benefit is attained when the marginal gain is just equal to the marginal cost (i.e., $W'(b) = 0$).

The expression (13.11) has the merit of characterizing optimal unemployment benefit solely on the basis of different elasticities of the duration of unemployment, which may be easier to estimate than the parameters employed in the Baily formula (13.6).

An Evaluation of the Optimal Amount of Unemployment Benefit

Chetty (2008) estimates the liquidity and moral hazard effects by adopting a range of strategies. He estimates the elasticity of unemployment duration with respect to unemployment benefit, or in other words, the total benefit effect, for liquidity-constrained and liquidity-unconstrained individuals. For liquidity-unconstrained individuals, who are able to smooth out their consumption perfectly when they lose their jobs, the total benefit effect is equal to the moral hazard effect, as portrayed in equation (13.10). For liquidity-constrained individuals, the total benefit effect is equal to the sum of the liquidity effect and the moral hazard effect. Therefore, the difference between the total benefit effect on the unconstrained and the constrained individuals identifies the liquidity effect. Chetty creates groups of individuals differentiated according to their liquid wealth, net of unsecured debt, at the time of job loss. He also considers groups of individuals differentiated by their spousal work status because those with a second income source are more likely to be able to borrow with at least one working person in their household. Another strategy consists in comparing the behavior of job losers who got severance payments with those who did not. The latter are more liquidity constrained.

The results obtained using these empirical strategies suggest that the link between unemployment benefit and unemployment duration is driven by a subset of the population that has limited ability to smooth out consumption. This pattern is suggestive of a substantial liquidity effect, which might explain 60% of the marginal effect of unemployment benefit on unemployment duration at current benefit rates in the United States. Chetty estimates that the ratio of the liquidity effect over the moral hazard effect that shows up in equation (13.11) is about 0.6, whereas η_b^D is about 0.5 for the U.S. economy. This suggests that unemployment benefit in the United States is a little below, but not far below, its optimal level.

1.3.3 Optimal Unemployment Benefits and the Reservation Wage

Shimer and Werning (2007) cast a complementary light on optimality in unemployment insurance by exploiting the intertemporal dimension of the job search model presented in chapter 5. This allows them to define the optimal level of unemployment benefit as a function of parameters differing from those of Baily (1978) and Chetty (2008).

The Reservation Wage with Taxes and Unemployment Benefits

In essence the model of Shimer and Werning (2007) coincides with the basic model of job search set out in chapter 5, with the addition of a budget constraint for the agency in charge of managing unemployment insurance and with the assumption that agents present aversion to risk. At every date a job seeker confronts a stationary distribution $H(.)$ of possible wages. If he receives an offer of wage w and accepts it, he pays a constant flat-rate tax τ at every date for as long as he stays with the firm. It is always assumed that the wage earner obtains an instantaneous utility $v(w-\tau)$ with $v'>0$ and $v''<0$. The expected intertemporal utility, $V_e(w)$, procured by a job paying wage w, is thus written:

$$rV_e(w) = v(w-\tau) + q\,[V_u - V_e(w)]$$

In this expression, V_u designates the intertemporal utility of a job seeker, and the exogenous constant parameters, r and q, designate respectively the interest rate and the job destruction rate. The foregoing equation can again be written in the form:

$$V_e(w) - V_u = \frac{v(w-\tau) - rV_u}{r+q}$$

From it we deduce that a job seeker accepts every wage w such that $v(w-\tau) > rV_u$, but that he keeps on seeking if $v(w-\tau) < rV_u$. The reservation wage, denoted x, is thus defined by:

$$v(x-\tau) = rV_u$$

As in the basic job search model from chapter 5, we assume that a job seeker has an exogenous constant probability, denoted λ, of receiving a wage offer at every date. Leaving aside the costs entailed by job search and assuming that at every date a job seeker receives a constant unemployment benefit equal to b, his intertemporal utility takes the expression:

$$rV_u = v(b) + \lambda \int_x^{+\infty} [V_e(w) - V_u]\,\mathrm{d}H(w)$$

From that it follows that the reservation wage is defined by the equation:

$$v(x-\tau) = v(b) + \frac{\lambda}{r+q}\int_x^{+\infty} [v(w-\tau) - v(x-\tau)]\,\mathrm{d}H(w) \qquad \textbf{(13.12)}$$

This equation defines the reservation wage x as a function of parameters (b,τ) characterizing the unemployment insurance system. We may thus denote it $x(b,\tau)$. Readers can easily verify that the reservation wage is increasing with b by following the same procedure as in chapter 5. They can also verify that the after-tax reservation wage, that is, $x(b,\tau)-\tau$, is decreasing with τ, which is explained by the fact that a hike in the tax diminishes the gain procured by accepting a job. On the other hand, the direction in which the reservation wage varies as a function of tax τ remains ambiguous.[3]

The Agency's Budget Constraint

The optimal level of unemployment benefit corresponds to a value of b that maximizes the intertemporal utility of the job seeker under the constraint that the net actualized cost of a job seeker be null. We begin by finding the expression of the costs generated by the unemployment insurance system. It will be convenient to define the net actualized cost of a job seeker, denoted C_u, and the net actualized cost of a wage earner, denoted C_e, in recursive fashion, with the system of equations:

$$rC_u = b + \lambda\left[1 - H(x)\right](C_e - C_u) \tag{13.13}$$

$$rC_e = -\tau + q(C_u - C_e) \tag{13.14}$$

Equation (13.13), describing the time path of the net actualized cost of a job seeker, is to be understood as follows: at every instant a job seeker costs b but has a probability $\lambda\left[1 - H(x)\right]$ of finding a new job, in which case she becomes a wage earner and her net cost to the unemployment insurance system then becomes equal to C_e. Equation (13.14) has the identical explanation: at every instant a wage earner pays in τ to the unemployment insurance system, but she can lose her job with a probability q, in which case she becomes a job seeker and her actualized cost to the unemployment insurance system then amounts to C_u. The constraint that the net actualized cost of a job seeker be null is obtained by setting $C_u = 0$ in equations (13.13) and (13.14). We thus arrive at the budget constraint of the agency:

$$bD = \frac{\tau}{r+q} \quad \text{with} \quad D = \frac{1}{\lambda\left[1 - H(x)\right]} \tag{13.15}$$

This budget constraint includes the average duration D of an episode of unemployment. The quantity bD represents the average cost of an episode of unemployment, while the quantity $\tau/(r+q)$ represents the actualized average gain of an episode of work. When r goes to 0, the budget constraint (13.15) indicates that the average cost of an episode of unemployment is equal to the average gain of an episode of work.

Since the reservation wage x is a function of variables (b, τ) characterizing the system of unemployment insurance—see (13.12)—the average duration of an episode of unemployment is also a function of (b, τ). We may therefore denote it $D(b, \tau)$. The budget constraint (13.15) then defines a relation, denoted $\tau(b)$, between the tax τ and the benefit b which is written as follows:

$$\tau(b) = (r+q)bD\left[b, \tau(b)\right] \tag{13.16}$$

[3] Deriving (13.12) with respect to τ we get:

$$\left\{1 + \frac{\lambda\left[1 - H(x)\right]}{r+q}\right\}\left(\frac{\partial x}{\partial \tau} - 1\right)v'(x-\tau) = \frac{-\lambda}{r+q}\int_x^{+\infty} v'(w-\tau)\mathrm{d}H(w)$$

This proves that $\frac{\partial x}{\partial \tau} - 1 < 0$. The net wage $x - \tau$ is thus decreasing with τ, but we cannot draw any conclusion about the sign of $\frac{\partial x}{\partial \tau}$.

Let us denote D_b and D_τ the partial derivatives of function D with respect to its two arguments. Deriving the last relation with respect to b, we find:

$$\tau'(b) = \frac{bD_b + D}{\frac{1}{r+q} - bD_\tau} \tag{13.17}$$

The definition of D, given by (13.15), entails that $D_b > 0$ since D varies like the reservation wage. Conversely, we can say nothing about D_τ, since the direction in which the reservation wage varies is ambiguous with τ. Henceforth we assume $\tau'(b) > 0$, which signifies that every hike in the tax enlarges the stream of income from which job seekers are compensated. This hypothesis amounts to stating that we are situated on the "good side" of the Laffer curve.

To advance our analysis of the properties of optimal unemployment insurance, we will assume, like Shimer and Werning (2007), that the utility function exhibits constant absolute risk aversion (CARA). Thus we set $v(c) = -\gamma e^{-\gamma c}$, where the constant $\gamma > 0$ represents the absolute degree of risk aversion. With this hypothesis, relation (13.12) defining the reservation wage is written:

$$e^{-\gamma x} = e^{-\gamma(b+\tau)} + \frac{\lambda}{r+q}\int_x^{+\infty} (e^{-\gamma w} - e^{-\gamma x})\,\mathrm{d}H(w) \tag{13.18}$$

We see that with a utility function of the CARA type, the reservation wage depends only on the sum $(b + \tau)$. Thus we have $D_\tau = D_b$, since $D = 1/\lambda\,[1 - H(x)]$ depends exclusively on x. That being the case, equation (13.17) takes the form:

$$\tau'(b) = \frac{D(1+\eta)}{\frac{1}{r+q} - D\eta} \quad \text{with} \quad \eta = \frac{bD_b\,[b, \tau(b)]}{D\,[b, \tau(b)]} > 0 \tag{13.19}$$

A New Formula to Characterize Optimal Unemployment Benefit

The optimal setting of unemployment benefit corresponds to a value of b that maximizes the intertemporal utility of the job seeker under the constraint that the net actualized cost of a job seeker be null. Now, to any amount of benefit b there corresponds an amount of tax $\tau(b)$ given by (13.16), and since $v(x - \tau) = rV_u$, the optimal unemployment benefit simply maximizes the net reservation wage $x\,[b, \tau(b)] - \tau(b)$. Designating by x_b and x_τ the partial derivatives of function $x(b, \tau)$ with respect to b and τ, we arrive at the first-order condition:

$$\psi(b) = x_b\,[b, \tau(b)] + \tau'(b)x_\tau\,[b, \tau(b)] - \tau'(b) = 0$$

If the utility function $v(.)$ is of the CARA type, the reservation wage given by (13.18) depends exclusively on the sum $(b + \tau)$. We then have $x_b = x_\tau$ and the first-order condition becomes:

$$\psi(b) = x_b\,[b, \tau(b)]\left[1 + \tau'(b)\right] - \tau'(b) = 0$$

As $\tau'(b)$ is given by relation (13.19), the unemployment benefit verifies:

$$x_b = \frac{D}{\frac{1}{r+q} + D}(1+\eta) \tag{13.20}$$

The left-hand side of this equality represents the (gross) marginal gain from an increase in unemployment benefit to the intertemporal utility of a job seeker, while the right-hand side represents the marginal cost of a simultaneous tax hike. To better grasp the significance of this optimality condition, let us consider an increase in the amount of unemployment benefit. Higher benefits reduce the cost of remaining unemployed and therefore raise the pretax reservation wage x. Thus, if the pretax reservation wage is very responsive to unemployment benefits, raising unemployment benefits has a strong positive effect on workers' welfare. This effect is captured by the left-hand side of (13.20). However, this increase in benefits is financed by a hike in the tax τ. The more responsive the duration of unemployment D to the amount of benefit, the greater the need to increase the tax. Condition (13.20) signifies that at the optimum these two effects have the same magnitude.

Shimer and Werning have shown that formula (13.20) holds good for numerous extensions of the basic model. In particular, it remains valid if agents are able to save or borrow and if an unemployed worker's search effort affects the arrival rate of job offers.

Another Evaluation of the Optimal Amount of Unemployment Benefit

Shimer and Werning (2007) use equation (13.20) to make an assessment of whether, in practice, the amount of unemployment benefit in the United States ought to be increased or cut back. It will be optimal to increase the amount if the marginal gain, represented by the left-hand member of (13.20), is superior to the marginal cost, represented by the right-hand member of this expression.[4]

To implement this test, though, researchers have to be able to produce reliable estimates of the magnitudes appearing in the formula (13.20). In this light, we may begin by remarking that at stationary equilibrium, exits from employment are equal to entries into unemployment. Denoting by u the unemployment rate, we thus have:

$$q(1-u) = \lambda\left[1 - H(x)\right]u = \frac{u}{D} \tag{13.21}$$

Shimer and Werning observe that between 1948 and 2005, the average unemployment rate in the United States was 5.6%, and the average duration of an episode of unemployment was 13.4 weeks. Setting $u = 0.056$ and $D = 13.4$ in (13.21) yields $q = 0.00443$. For the weekly interest rate, Shimer and Werning set $r = 0.001$, which corresponds to an annual interest rate of 5.3%. They thus obtain $r + q = 0.00543$ and so $D/\{[1/(r+q)] + D\} = 0.068$.

[4]More formally, it may be noted that the second-order condition of the agency's program dictates that we have $\psi'(b^*) < 0$ for the optimal value of unemployment benefit, and so, by continuity, $\psi'(b) < 0$ in a neighborhood of b^*. As we have $\psi(b^*) = 0$, if we observe that the left-hand side of equation (13.20) is larger than the right-hand side—i.e., $\psi(b) > 0$—then an increase in unemployment benefit is welfare-improving.

For elasticity η Shimer and Werning use, like Gruber (1997), the paper by Meyer (1990) which furnished the estimate $\eta = 0.88$. The right-hand side of equality (13.20) thus comes to $0.067 \times 1.88 = 0.126$. It remains to obtain an estimate of the left-hand side of equality (13.20), which comes down to estimating the variation in the reservation wage when unemployment benefit is increased. Shimer and Werning make use of the paper of Feldstein and Poterba (1984), who looked at how self-reported reservation wages respond to unemployment benefits. They study a supplement to the May 1976 Current Population Survey (CPS), which asked 2,228 unemployment insurance recipients "What is the lowest wage or salary you would accept (before deductions)?" Feldstein and Poterba estimate that x_b lies in the interval $[0.13, 0.42]$. Since the right-hand side of equality (13.20) is equal to 0.126, Shimer and Werning conclude that in the actual U.S. system, the marginal cost of unemployment benefit is lower than the marginal gain and that the amount of unemployment benefit ought to be increased. This result complements those presented previously. Overall, however, these results rely on estimates that are still very approximate and that would need to be made more precise in order to obtain more credible evaluations of the optimal level of unemployment benefit. As well, we have limited ourselves for now to a situation where the amount of benefit remains constant during the episode of unemployment—a configuration that is not necessarily optimal, as we will see in the next section.

1.4 Optimal Unemployment Insurance in a Dynamic Environment

A relevant analysis of unemployment insurance should focus on the time profile of the benefit payments, which can provide at least as much incentive as their amount. This is the reason most unemployment insurance systems limit the period during which the unemployed can receive benefits, and provide for such benefits to tail off, the longer that period lasts. Research in this area does suggest that a time profile in which the amount of benefit decreases with the duration of unemployment may be optimal, but not in every case. It also suggests that the gains procured by a tapering profile are limited rather than constant.

A related topic is the path of optimal unemployment insurance over the course of the economic cycle. Some countries, like Canada and the United States, tie the duration of benefit to the prevailing level of unemployment: benefits may be paid for a longer period when the unemployment rate is higher. Research, both theoretical and empirical, tells us something about the conditions under which this practice is efficient.

1.4.1 The Optimal Profile of Unemployment Benefits

The dynamic job models with moral hazard and job search of Shavell and Weiss (1979), Hopenhayn and Nicolini (1997, 2009), and Wang and Williamson (1996, 2002) do in fact prove that optimal unemployment benefit must necessarily decrease as the unemployment spell lengthens. However, Shimer and Werning (2008) have shown that this result does not always hold good when individuals can have free access to the borrowing and lending of a riskless asset in order to smooth out their consumption. Moreover, calibration exercises suggest that declining profiles provide only very small welfare gains when the unemployment insurance agency can tax and subsidize wages.

The Model of Optimal Unemployment Insurance

To establish the main dynamic properties of optimal unemployment benefit, we follow the model in discrete time of Hopenhayn and Nicolini (2009) where the optimal contract should minimize the average cost of a jobless person while at the same time offering him an exogenous level of expected utility $\bar{V}$.

At every period t, the effort an agent makes to find a job can take no more than two values: either the constant value $a > 0$, in which case the agent finds employment at rate p, where $p > 0$ is an exogenous constant; or the value 0, in which case the agent gets no job offers and remains unemployed. The "principal," in other words the agency charged with managing unemployment insurance, proposes a *contract* to every person entering unemployment (by convention, unemployment begins on date $t = 0$) specifying the values b_t of the unemployment benefit to be received if the person is still looking for a job at period $t > 0$, and the values g_t of the transfers to be received if employment resumes on date t. It should be noted that the benefit payments b_t, and the transfers g_t should employment resume, are both conditional on the length t of the unemployment spell. We may also point out that if $g_t < 0$, what we have is a tax; and if $g_t > 0$, a subsidy.

It is worth noting that the contract between the unemployment insurance agency and the job seeker is much like a relatively sophisticated experience rating system. The unemployment insurance contracts of the real world share some of the characteristics highlighted in our model. The tailing-off of benefit payments the longer the spell of unemployment lasts is a measure that is not unusual, even though the amount usually drops by just one level, from full to partial (see table 13.1). On the other hand, systems in which subsidies are received or taxes collected after a return to work, both of them varying with the length of the unemployment spell, are less common but do exist. Certain countries have put in place "return to work premiums" aimed precisely at encouraging the unemployed to find a job quickly. Premiums of this type exist in Japan, where the premium decreases as the spell of unemployment persists; it is paid to people who return to work with at least a third, or in some cases at least half, of their benefit entitlement period remaining (see Duell et al., 2010). In Australia and France it is possible, for a period, to retain a portion of one's unemployment benefit while working part-time. Finally, the United States has tried out similar systems locally, and it has been found that they do in fact encourage the jobless to find work more rapidly (a detailed study of these experiments can be found in Meyer, 1995).

As previously, we assume that effort is not verifiable. Suppliers of labor do not have access to financial markets and therefore they do not save or invest. All jobs offer the same exogenous constant wage w; there is no job seeking by persons already on the job; and jobs are never destroyed. This last assumption is not essential and is chosen to simplify the presentation. If a job seeker finds work after an unemployment spell of t periods, she receives a net wage of $(w + g_t)$ and keeps her new job indefinitely. Denoting $\beta \in [0, 1]$ the discount factor, the discounted expected utility of a person finding a job after t periods of unemployment, denoted V_e^t, is thus given by:

$$V_e^t = \frac{v\,(w + g_t)}{1 - \beta} \tag{13.22}$$

In this expression, $v(.)$ represents the utility of the agent during one period of employment. The function $v(.)$ is such that $v' > 0$ and $v'' < 0$, which signifies that the agent is risk averse. To this level of utility there corresponds a cost to the principal defined by:

$$C_e^t = \frac{g_t}{1-\beta}$$

Eliminating g_t between the last two equations, we see that the cost C_e^t can be expressed as a function of V_e^t, or $C_e^t = C_e(V_e^t)$. This relation simply conveys the fact that to every level of utility there corresponds a cost borne by the principal. It is easily verified that:

$$C_e'(V_e^t) = \frac{1}{v'(w+g_t)} > 0 \tag{13.23}$$

For what follows, it will also be helpful to note that $C_e''(V_e^t) > 0$, hence the cost function $C_e(.)$ is strictly convex.

The evolution of the expected utility of a job seeker making search effort a during period t, denoted V_u^t, is described by the following equation:

$$V_u^t = v(b_t) - a + \beta\left[pV_e^{t+1} + (1-p)V_u^{t+1}\right] \tag{13.24}$$

Equation (13.24) indicates that a job seeker making effort a during period t attains, over that period, the utility level $v(b_t) - a$. With probability p, he can then find a job that starts at period $t+1$ and procures an expected utility equal to V_e^{t+1}. With the complementary probability $(1-p)$, he remains unemployed and his discounted expected utility then amounts to V_u^{t+1}.

The Incentive Constraint

When the search effort is not directly checked on by the agency, the unemployed person has the opportunity to "cheat" by making no effort while continuing to receive unemployment insurance benefits. At each date, a job seeker chooses to make search effort a only if she thus obtains an expected utility V_u^t superior to the utility denoted V_s^t that she obtains by "cheating." The latter is defined by:

$$V_s^t = v(b_t) + \beta V_u^{t+1} \tag{13.25}$$

This equation indicates that a job seeker who does not make search effort a during period t receives unemployment benefit payments during this period—precisely because her effort is not verifiable—and attains a utility level equal to $v(b_t)$. She therefore has no chance of finding a job at date $t+1$ and so obtains the discounted utility expected by an unemployed person at this date.

To incentivize the job seeker to make effort a at any period $t \geq 0$, the agency must offer her unemployment benefits and a transfer giving her an intertemporal utility V_u^t superior to intertemporal utility V_s^t. Making the difference between equations (13.25) and (13.24), we find that the incentive constraint, $V_u^t - V_s^t \geq 0$, for all t, is finally written:

$$\beta\left(V_e^{t+1} - V_u^{t+1}\right) \geq \frac{a}{p} \tag{13.26}$$

This inequality shows that the need to give the unemployed an incentive to look for work obliges the principal to pay a "rent" at least equal to a/p when they do find work.

The Dynamic Properties of the Optimal System of Taxes and Benefits

We assume that the agency in charge of the unemployment insurance system minimizes its own costs, while both guaranteeing a certain level of utility to the job seeker and incentivizing him to hunt for work. When a job seeker has already undergone t periods of joblessness, the agency anticipates that it will still have to bear a cost of C_u^t before this job seeker finds work. The path of cost C_u^t is given by the following equation, the writing and the understanding of which both conform to (13.24):

$$C_u^t = b_t + \beta \left[pC_e^{t+1} + (1-p)C_u^{t+1} \right]$$

Since by convention entry into unemployment commences at date $t = 0$, the total cost of a job seeker amounts to C_u^0. The goal of the agency is to pinpoint the sequence of $\{b_t, g_t\}$ that minimizes C_u^0 while respecting the incentive constraint (13.26) and the participation constraint $V_u^0 \geq \bar{V}$, which ensures the job seeker a level of expected utility at least equal to $\bar{V}$. This level of utility is exogenous.

Hopenhayn and Nicolini (1997, 2009) came up with a very elegant way of solving this problem by making use of the linkage that exists between the cost of a program and the level of utility that it procures. With the notation $C_u^t = C_u(V_u^t)$, function $C_u(.)$ gives the (future) cost of a job seeker who has already undergone t periods of joblessness when the agency decides to procure him a level of (future) utility V_u^t. The policy of the agency must be time consistent, meaning that the policy adopted from any date t forward must minimize the cost to the agency from that date forward. Let us assume that the policy announced at date $t = 0$ does procure the sequence of utilities $\{V_u^t\}$ for a job seeker. The optimal policy is time consistent if at every date $t > 0$ it minimizes the cost to the agency while in fact offering the job seeker the announced utility V_u^t. For a given V_u^t, the policy put in place from date t forward must therefore be the solution of the program:

$$C_u(V_u^t) = \min_{b_t, V_e^{t+1}, V_u^{t+1}} \left\{ b_t + \beta \left[pC_e(V_e^{t+1}) + (1-p)C_u(V_u^{t+1}) \right] \right\}$$

subject to (13.24) and (13.26).

In light of the forms of the criteria to be minimized and those of constraints (13.24) and (13.26), we observe that it is indifferent whether the agency chooses a sequence $\{b_t, g_t\}$ from date t forward or chooses instead a triplet $\{b_t, V_e^{t+1}, V_u^{t+1}\}$. Everything unfolds just as it would if at date t the policy of the agency consisted of announcing the amount b_t of current unemployment benefit and the promised expected utilities (V_e^{t+1}, V_u^{t+1}).

Let us designate by μ and $\delta \geq 0$ the multipliers associated with constraints (13.24) and (13.26); the Lagrangian of the agency's program is then written:

$$\begin{aligned} \mathcal{L} = &\left\{ b_t + \beta \left[pC_e(V_e^{t+1}) + (1-p)C_u(V_u^{t+1}) \right] \right\} \\ &+ \mu \left\{ v(b_t) - a - V_u^t + \beta \left[pV_e^{t+1} + (1-p)V_u^{t+1} \right] \right\} + \delta \left[\beta p \left(V_e^{t+1} - V_u^{t+1} \right) - a \right] \end{aligned}$$

The first-order conditions are obtained by canceling out the derivatives of this Lagrangian with respect to b_t, V_u^{t+1}, and V_e^{t+1}. We thus arrive at:

$$\frac{\partial \mathcal{L}}{\partial b_t} = 1 + \mu v'(b_t) = 0 \Leftrightarrow \mu v'(b_t) = -1 \tag{13.27}$$

$$\frac{\partial \mathcal{L}}{\partial V_u^{t+1}} = \beta(1-p)C_u'(V_u^{t+1}) + \mu\beta(1-p) - \delta\beta p = 0 \Leftrightarrow C_u'(V_u^{t+1}) = \delta\frac{p}{1-p} - \mu \tag{13.28}$$

$$\frac{\partial \mathcal{L}}{\partial V_e^{t+1}} = \beta p C_e'(V_e^{t+1}) + \mu\beta p + \delta\beta p = 0 \Leftrightarrow C_e'(V_e^{t+1}) = -\mu - \delta$$

In addition, as V_u^t is considered as a parameter in this program, the envelope theorem entails:

$$\frac{\partial \mathcal{L}}{\partial V_u^t} = C_u'(V_u^t) = -\mu \tag{13.29}$$

Canceling out the multiplier μ in equations (13.27), (13.28), and (13.29), we arrive at:

$$C_u'(V_u^{t+1}) = \delta\frac{p}{1-p} + \frac{1}{v'(b_t)}, \quad C_u'(V_u^t) = \frac{1}{v'(b_t)} \quad \text{for all } t$$

The last equality appearing in this equation being true for all t, we have $C_u'(V_u^{t+1}) = \frac{1}{v'(b_{t+1})}$, and in consequence:

$$\frac{1}{v'(b_{t+1})} - \frac{1}{v'(b_t)} = \delta\frac{p}{1-p} \tag{13.30}$$

It can be shown that the multiplier δ associated with the incentive constraint (13.26) is strictly negative,[5] which signifies that this constraint is always binding. As $v'' < 0$, we deduce immediately that $b_{t+1} < b_t$. The sequence of optimal unemployment benefits must therefore strictly decrease with time.

In determining the properties of the sequence of transfers g_t flowing to those who do find a new job, the first thing to remember is that the cost function $C_u(V_u^t)$ is increasing and strictly convex.[6] As $\delta < 0$ and $C_u'(V_u^t) = \frac{1}{v'(b_t)}$ for all t, rule (13.30) describing the time path of optimal unemployment benefit entails $C_u'(V_u^t) > C_u'(V_u^{t+1})$. The cost function

[5] To assume that $\delta = 0$ would lead to a contradiction. If $\delta = 0$, we would then have $C_u'(V_u^{t+1}) = C_u'(V_u^t)$ and so $V_u^{t+1} = V_u^t$. We would also have $-C_e'(V_e^{t+1}) = \mu = -\frac{1}{v'(b_t)} = -\frac{1}{v'(b_{t+1})}$. Now we know following (13.23) that $C_e'(V_e^t) = \frac{1}{v'(w+g_t)}$, which entails $w + g_{t+1} = b_{t+1} = b_t$ and so $(1-\beta)V_e^{t+1} = v(w + g_{t+1}) = v(b_t)$. Additionally, (13.24) and (13.26) entail $V_u^t \geq v(b_t) + \beta V_u^{t+1}$, and since $V_u^{t+1} = V_u^t$, we would thus have $(1-\beta)V_u^{t+1} \geq v(b_t)$. As $(1-\beta)V_e^{t+1} = v(b_t)$, we arrive finally at $V_u^{t+1} \geq V_e^{t+1}$, which violates the incentive constraint (13.26). Therefore, we necessarily have $\delta < 0$.

[6] To show this, we can replace the control variable b by its utility index $v = v(b)$, which is a monotonous transformation. With this transformation, constraints (13.24) and (13.26) are linear. Since the inverse function $b(v)$ is convex, convexity of the value functions follows immediately from standard dynamic programming arguments; see Stokey et al. (1989).

being strictly convex, we have $C_u'' > 0$ and consequently $V_u^t > V_u^{t+1}$. The sequence of utilities expected over the course of an episode of joblessness is thus strictly decreasing. The same holds true of the sequence V_e^t of expected utilities from starting a fresh job, since, the incentive constraint (13.26) being an equality, V_u^t and V_e^t necessarily vary in the same direction. Finally, from (13.22) we see that g_t varies like V_e^t, so the sequence of transfers flowing to wage earners is likewise strictly decreasing, but we do not know if g_t is a tax or a subsidy.

These results show that the optimal profile of benefits ought to decrease with the duration of unemployment when individuals are consuming the whole of their current income. Shimer and Werning (2008) have shown, however, that the optimal profile is constant when agents can borrow freely and without limit or risk in order to smooth out their consumption, given preferences of the CARA type. Otherwise, when preferences are not CARA, the profile can be decreasing or increasing.

The Optimal Profile of Unemployment Insurance in Practice

The model utilized to this point shows that the amount of unemployment benefit ought to diminish as the jobless spell persists so as to manage the insurance system optimally while offering the unemployed a predetermined level of utility. Hopenhayn and Nicolini (1997) take the view, moreover, that job search effort is a continuous variable that can be assigned any positive value, a hypothesis that adds considerable complication to the analytic results, yet without changing their qualitative prediction. Hopenhayn and Nicolini have also calibrated their model by taking as their benchmark the unemployment insurance system in place in the United States over the period 1978–1983. In this system, the replacement rate is 66% and benefits are paid for a maximum period of 26 weeks. In their basic calibration, Hopenhayn and Nicolini posit a utility function $v(c) = c^{1-\sigma}/(1-\sigma)$, with $\sigma = 1/2$. They assume that the exit rate from unemployment depends on job search effort a, according to the formula $p(a) = 1 - e^{-\rho a}$, where ρ is selected in such a way as to reproduce the estimated unemployment benefit elasticity of the probability of exiting from unemployment. It thus becomes possible to calculate the value $\bar{V}$ promised at the moment of entering unemployment. Hopenhayn and Nicolini then compare two unemployment insurance systems that offer the same discounted expected utility $\bar{V}$. In the first system, which approximates reality more closely, the agency cannot make transfers (this hypothesis amounts to positing $g = 0$ at every date in the theoretical model). The second system reproduces the optimal solution of the theoretical model, in which the agency is able to give subsidies to or levy taxes on those who find a job.

Table 13.3 presents the results obtained by Hopenhayn and Nicolini. The last column of this table shows that unemployment benefits tail off sharply as unemployment persists when the insuring body cannot tax, or subsidize, wages. Conversely, if transfers to those who become employed are allowed, the rate at which benefit payments tail off becomes very weak, and the replacement rate very high: 94% after a spell of unemployment lasting 52 weeks (at that time horizon, the probability of being unemployed is close to zero according to the calibrations used in this model). The third column of table 13.3 also reveals that the transfers are subsidies when the unemployment spell does not exceed 6 weeks (the taxes appearing in this column are negative) and that they become deductions after 6 weeks of joblessness. Hopenhayn and Nicolini stress further that the

Table 13.3
The optimal profile of the replacement rate in the presence of moral hazard.

	System with tax on wages		System without tax
Weeks of unemployment	Replacement rate (%)	Tax on wages (%)	Replacement rate without tax on wages (%)
1	99.0	−0.5	85.8
2	98.9	−0.4	80.8
3	98.8	−0.3	76.3
4	98.7	−0.2	72.1
5	98.6	−0.1	68.2
6	98.5	0.0	64.7
7	98.4	0.1	61.4
8	98.3	0.2	58.4
12	97.9	0.6	48.2
16	97.5	1.0	40.5
26	96.5	2.0	27.7
52	94.0	4.5	13.4

Source: Hopenhayn and Nicolini (1997, p. 426).

optimization of the unemployment insurance system would make it possible to reduce overall costs substantially, compared to the system in place. According to their estimates, for the same promised expected utility at entry into unemployment, costs are reduced by 7% when transfers to wage earners are not authorized, and 28% when they are.

The contribution of Hopenhayn and Nicolini (1997) underlines the potential importance of the ways unemployment insurance systems are structured when moral hazard is present. Wang and Williamson (1996) have extended their model by assuming that the probability of job loss depends on the effort made on the job by employees. In this hypothesis, moral hazard extends not just to the search efforts of the unemployed but also to the assiduity at work of those who are employed, for they may be tempted to shirk in order to lose their jobs if unemployment insurance benefits are too high. It is therefore desirable to adopt an experience rating scheme in which wages can be taxed and where income received depends on the duration not just of spells of joblessness but also of spells of work.

The Profile of Unemployment Benefits and Wage Setting

It should be noted that all these results were obtained within a partial equilibrium framework in which the impact of unemployment insurance on wage setting is ignored. We have seen, especially in chapter 7 in relation to wage bargaining, that the income of the jobless exerts upward pressure on wages when employees and firms are engaged in wage bargaining. From this perspective, shortening the period over which benefits are paid reduces the discounted expected utility of the jobless and exerts downward pressure on the wage being bargained over, and this in turn reinforces the incentive effect of regressive unemployment benefit on search effort. The same thing does not necessarily apply, however, if we look at the effect of a different profile of benefit payments, with a *given budget* or *given tax rate*, which consists of paying more to the short-term unemployed and less to the long-term unemployed. Such a change of profile leads to an increase in the discounted expected gains of the short-term unemployed who have just lost their jobs at the expense of the long-term unemployed. For the same discount rate, intertemporal utility at the onset of a spell of unemployment rises, which increases the bargaining power of employees and thus promotes a rise in wages. Regressive benefits thus exert upward pressure on the rate of unemployment. For a given budget, the total effect of regressive benefit on unemployment is thus ambiguous: regressivity exerts an upward pressure on wages fixed through bargaining, which is unfavorable to employment, but it also intensifies the search effort of job seekers and lowers their reservation wage, which conversely promotes employment (Cahuc and Lehmann, 2000; Fredriksson and Holmlund, 2001). Changes in the rules regarding unemployment insurance thus have important impacts, and it is apparent that stricter rules may in certain cases have unfavorable effects in terms of employment. The reality is that the impact of the profile of benefit payments depends on the relative importance of the two effects just mentioned. When calibrated equilibrium models with an endogenous search effort, analogous to the matching model presented in chapter 9, are run, they suggest that rules providing for a rapid tailing-off of unemployment insurance benefits produce a positive but small effect on employment (Cahuc and Lehmann, 2000; Fredriksson and Holmlund, 2001).

1.4.2 Unemployment Insurance and the Business Cycle

Following the Great Recession, the question of unemployment benefit over the course of the cycle became the focus of much analysis. Should these payments be procyclical, contracyclical, or acyclical? In practice, and with reference to the formulas of the Baily, Chetty, and Shimer-Werning type reviewed previously, that comes down to determining how the elasticity of unemployment duration with respect to the amount of benefit varies with the economic trend, in other words with the unemployment rate.

Kroft and Notowidigdo (2011) carry out such an exercise on the basis of data on the unemployment rates in different states of the United States between 1985 and 2000. They estimate a hazard model where the effect of the amount of unemployment benefit on unemployment durations depends on the state unemployment rate (see chapter 5 for the estimation of duration models). They find that the elasticity of unemployment duration with respect to the level of unemployment benefit is 0.563 at the average state unemployment rate. But they also show that this elasticity varies widely with local labor market conditions, or more precisely that duration elasticity proves to be weaker when the local unemployment rate is high. The effect is of considerable magnitude, for Kroft and Notowidigdo estimate that a one-standard-deviation increase in the unemployment rate (an increase of 1.3 percentage points from a base of 6.2%) reduces the magnitude of the duration elasticity from 0.563 to 0.304 (a decline in magnitude of 46%). On the other hand, they do not find that the consumption term, $(c_e - c_u)/c_e$, drops in the Baily formula (13.6). In sum, Kroft and Notowidigdo find that the moral hazard cost of unemployment benefit is procyclical while the consumption-smoothing term is acyclical. In light of this empirical analysis, we ought to conclude that optimal unemployment benefit should be contracyclical: it should increase when the unemployment rate increases. Kroft and Notowidigdo estimate that a one-standard-deviation (1.3 percentage point) increase in the local unemployment rate leads to a roughly 14 to 27 percentage point increase in the optimal replacement rate, depending on the value of the coefficient of relative risk aversion. The policy decision in the United States to lengthen the duration of unemployment benefit during the Great Recession was thus "theoretically well-grounded" according to Kroft and Notowidigdo.

Landais (2013) approaches the question using administrative data from the Continuous Wage and Benefit History Project (CWBH) about unemployment spells in five U.S. states from the late 1970s to 1984. He takes advantage of the wide variation in labor market conditions across states and over time in the CWBH data to investigate how estimates of the elasticity of unemployment duration with respect to the unemployment benefit vary with indicators of state labor market conditions. The results suggest that increases in the state unemployment rate are associated with a slight decrease in this estimated elasticity. According to the specification adopted by Landais, the estimated elasticity varies between 0.38 when the state unemployment rate is at 4.5% (the minimum in the CWBH data) and 0.25 when the unemployment rate is at 11.8% (the maximum in the CWBH data). Landais (2013) thus concludes that the labor supply response to unemployment benefits is (weakly) procyclical. So this result is in line with that of Kroft and Notowidigdo (2011), although the cyclicality of the estimates is somewhat larger for the latter. These converging results reinforce the view that optimal unemployment benefit ought to be contracyclical (see also Landais et al., 2010).

The analyses of Kroft and Notowidigdo (2011) and Landais (2013) are analyses in partial equilibrium, inasmuch as they leave out of account the reaction of wages to variations in the amount of unemployment benefit. Jung and Kuester (2011) have integrated this dimension into a search and matching model with risk-averse workers, endogenous hiring and separation, and unobservable search effort. They show that the social optimum may be decentralized through a production tax, a vacancy subsidy, a layoff tax, or unemployment benefits. Using a calibration targeted to the U.S. economy, Jung and Kuester conclude that hiring subsidies, layoff taxes, and the replacement rate at which unemployment insurance is paid should all rise in recessions. In an analogous model, but in which the amount of unemployment benefit is taken as the sole variable of economic policy, Mitman and Rabinovich (2011) arrive at a more nuanced conclusion. They find that the response of benefits to a negative shock should be nonmonotonic: unemployment benefit should be raised in the short term (4–6 weeks after the shock) in order to provide short-run relief to the unemployed and stabilize wages, but subsequently it should be brought back down to below its prerecession level in order to speed up the subsequent recovery. Their conclusions rest on the hypothesis of rapid wage adjustment.

2 EMPLOYMENT PROTECTION

Employment protection legislation is a set of mandatory restrictions governing the dismissal of employees. Their stated purpose is to increase the stability of employment. Despite that, there is intense debate about their actual effects, which also influence the level of employment and labor productivity. Firing costs do indeed reduce job destruction, but they also exert a negative effect on job creation; so the effect on employment