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The Labor Market Implications of Unemployment Insurance and Short-Time Compensation*

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Unemployment insurance is a policy instrument designed to help alleviate the costs to individuals of losing their jobs for reasons beyond their control. It does more than that, however. Economic theory and empirical evidence demonstrate that the presence of unemployment insurance and the type of system adopted can have important effects on many aspects of the labor market allocation process, including wages, hours per worker, firm size, and both the frequency and the duration of unemployment. This leads naturally to debate over how to design an efficient unemployment insurance system. I intend to focus on one key question in this debate: How does unemployment insurance affect the decision by employers to utilize either temporary layoffs or work-sharing? The answer depends on the way in which unemployment insurance benefits are paid and the way in which taxes are levied to finance these benefits.

In particular, I consider two alternative systems for paying unemployment insurance benefits. In one system, workers receive benefits if laid off but nothing if their hours are cut back while they remain employed. In the other system, workers are not only paid benefits if laid off but are also paid a prorated fraction of these benefits, referred to as *short-time compensation,* if they remain employed but have their hours reduced. These two systems are not merely theoretical abstractions, but correspond to the way in which benefits are actually paid in different countries. In the United States and in Canada, at least until recently, workers have had to be unemployed to collect unemployment benefits, while short-time compensation has been used for some time in many European countries, including Austria, Belgium, Denmark, France, Germany, Italy, Luxembourg, the Netherlands, Norway, Sweden, and the United Kingdom (Best and Mattesich 1980, MaCoy and Morand 1984).[1]

It may be argued that the North American system, without short-time compensation, provides an incentive for the use of layoffs rather than work-sharing during economic downturns. Under the European system, which has short-time compensation, when economic conditions deteriorate, instead of laying off 20 percent of its work force, for example, the firm could reduce its workweek from five to four days and have its

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[1] In practice, in Germany, for example, at least a third of a firm's workers must experience at least a 10 percent reduction in hours for at least four weeks in order for any of them to receive compensation, and workers in occupations with irregular employment are excluded. The normal maximum duration of short-time compensation payments in Germany is six months, but these payments sometimes extend for up to two years. The typical experience is a cutback in hours of about 40 percent, for no more than three months (Best and Mattesich 1980, Meisel 1984).

employees draw partial benefits (20 percent of their full-time equivalent) on the fifth day.[2] Some policy discussions suggest that the resulting work-sharing would be preferable to layoffs. For example, Reid (1985, p. 151) says that "although [short-time compensation] merely redistributes employment, [unemployment insurance] benefits and leisure, it is both more efficient and more equitable than the alternative of full layoffs for some workers." Based on this line of argument, short-time compensation has been introduced into the Canadian system and several U.S. state systems during the past decade. (See Watford 1986 for a discussion of how federal policymakers have encouraged the adoption of short-time compensation by U.S. state systems.)

My purpose in this paper is twofold. First, I want to show that the use of short-time compensation does encourage firms to rely less heavily on layoffs and more heavily on work-sharing. Second, I want to show that both the European system with short-time compensation and the North American system without short-time compensation will tend to promote inefficiencies in the labor market unless the revenue side of the system is properly administered. The key parameter is the extent to which unemployment insurance taxes are experience-rated, where *experience-rating* refers to the practice of basing a firm's unemployment insurance tax bill on its actual layoff or hours-reduction practices. A system with short-time compensation does not encourage *unemployment,* which in this context means temporary layoffs, the way a system without it does. However, if taxes are less than completely experience-rated, then the system with short-time compensation encourages *underemployment,* which in this context means an inefficiently low level of hours per employed worker.

The main policy message that comes out of the theoretical analysis is that the use of short-time compensation will indeed encourage work-sharing, but that both systems can be made more efficient by adjusting experience-rating. To help convince the reader that the basic model underlying this message is empirically relevant, I also present some evidence supporting its fundamental prediction: In economies with short-time compensation, the number of hours per worker should vary more and the number of workers should vary less in response to fluctuations in economic conditions. To this end, I compare the United States and Canada with several European countries in terms of relative variability in the number of employed workers and hours per employed worker. Consistent with the model's implications, the data for those countries with short-time compensation tend to display less variability in the number of employed workers and greater variability in the number of hours per worker than do the data for countries without short-time compensation.[3]

The Model

The framework employed here is based on the standard labor-contracting model of Azariadis (1975). Unemployment insurance is parameterized as has become standard in the literature since the work of Feldstein (1976) and Burdett and Hool (1983), but here I also consider short-time compensation. The model is a version of the one used in Burdett and Wright 1989b, simplified to illustrate the essential points in a straightforward manner.

There is a representative firm with the production function $q = f(l,x)$, where q is output, l is labor input, and x is a random variable representing technological or other uncertainty affecting the relationship between l and q. (Capital is assumed fixed here and is subsumed in the notation.) I assume there are N possible values for x and let θ_j = prob(x=x_j), for j = 1, 2, ..., N. I make the usual assumptions on the production function, that the marginal product is positive but decreasing and that higher values of x index both a higher total and a higher marginal product of labor. Mathematically, these assumptions correspond to $f_1 > 0$, $f_{11} < 0$, $f_2 > 0$, and $f_{12} > 0$, where subscripts denote partial derivatives. I also adopt the standard specification that the labor input is given by $l = nh$, where n denotes the number of workers employed and h denotes the number of hours per employed worker.[4]

The firm is owned by a single individual, called the *employer,* who is interested in maximizing expected profit. A large number of homogeneous workers are attached to the

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[2] There has always been some use of partial benefits in most U.S. state systems, but such benefits have been roughly limited to the difference between full unemployment insurance and employed earnings. For example, a worker regularly earning $500 for a five-day week who is eligible for $200 of unemployment insurance in case of a layoff would receive no benefits for a four-day week paying $400 since this income already exceeds the $200 benefit. Under short-time compensation, a worker cut back to a four-day week would be compensated by 20 percent of the $200, for a total income of $440.

[3] It should be noted that in this paper I am only considering one aspect of unemployment insurance—its effect on the firm's decision to either reduce hours or lay off workers. I ignore the effect of unemployment insurance on the duration of search unemployment (Mortensen 1986). Another important simplification is that I take firm size as given; if this were made endogenous, the presence of unemployment insurance would influence not only decisions to lay off workers but also decisions to hire them in the first place. Hence, unemployment insurance can change the size of firms or the relative sizes of stable and risky firms (Burdett and Wright 1989a, Gaston and Wright 1991). A readable discussion of the impact of unemployment insurance in a broad context, as opposed to the narrower focus adopted here, can be found in Hamermesh 1977.

[4] In Burdett and Wright 1989b, the more general specification $l = l(n,h)$ is also considered; most of the interesting results can be derived in the special (but standard) case considered here. Economically, $l = nh$ means that reducing the number of workers by 10 percent has the same effect on output as reducing hours per worker by 10 percent. The implication in the present context is that, in the absence of unemployment insurance, both the firm and its workers prefer work-sharing to layoffs; hence, there will be no unemployment. More general specifications can give rise to unemployment in the model without unemployment insurance, but the use of $l = nh$ allows me to isolate the effects of policy exclusively.

firm for the duration of the period under consideration. I normalize the total number of workers to unity so that I can speak interchangeably of the number and the proportion of workers who are either employed or laid off. Each employed worker provides labor up to the maximum amount of time available in the period, which I also normalize to unity; that is, each worker has one unit of time to divide between labor, h, and leisure, $1 - h$. Workers also have common preferences described by a utility function defined over income and leisure, $u(y,1-h)$, that is strictly increasing and strictly concave.[5]

Government policy is parameterized as follows. Recall that h is the hours worked per person. Let $G = G(h)$ be the government unemployment insurance benefits received by a given worker. Under the North American system, $G = 0$ if $h > 0$ and $G = g$ if $h = 0$, for some constant g. Under the European system, $G = g(1-h/H)$ if $h < H$ and $G = 0$ if $h \geq H$, where H is meant to represent some notion of normal hours. To avoid deciding what constitutes normal hours here, I simply set $H = 1$. Although these representations are obviously highly stylized versions of any actual benefit scheme in North America or in Europe, they neatly capture the two extremes of no compensation and full compensation for reductions in hours.

As in much of the unemployment insurance literature since Feldstein 1976, I assume that taxes are paid by the employer according to the schedule $t = T + e\bar{G}$, where T is a lump-sum tax, $\bar{G}$ is total benefits paid to the average worker who started the period with the firm, and e is the experience-rating factor. If $e = 1$, the firm's taxes increase dollar-for-dollar with the benefits drawn by its employees or former employees, and the firm is said to be *completely* experience-rated. If $e < 1$, the firm is said to be *incompletely* experience-rated, and it gets unemployment insurance for its workers at an actuarially favorable rate. Although actual unemployment insurance tax policy is somewhat complicated in the United States, effectively $e < 1$ for many employers (Becker 1972, Topel 1983). In all other countries, $e = 0$.

A labor contract will be represented by an employment-compensation package that depends on the *state*—that is, on the realization of the random variable x. Therefore, a contract is given by four functions, $[n(x),h(x),w(x),b(x)]$, where $n(x)$ is the proportion of workers employed, $h(x)$ is the number of hours per employed worker, $w(x)$ is the wage rate, and $b(x)$ is a payment made to laid-off workers by their employer. One should think of $b(x)$ as a supplementary (private) unemployment benefit, or severance payment, that each laid-off worker receives in addition to public unemployment insurance. All workers are offered the same contract, since they are identical. However, when some proportion of the workers are not employed—that is, when $n(x) < 1$—I say that some of them are on *temporary layoff.* Since $n(x)$ is the proportion of workers that are employed (that is, not laid off), it is also the probability that any one of them is employed.

Hence, the expected utility of a representative employee in state x can be written as

$$(1) \qquad U(x) = n(x)u[y_e(x),\ 1 - h(x)] + [1 - n(x)]u[y_u(x),1]$$

where $y_e(x)$ denotes income while employed and $y_u(x)$ denotes income while unemployed. Income depends on government policy. Under the North American system, $y_e(x) = w(h)h(x)$, and under the European system, $y_e(x) = w(x)h(x) + g[1 - h(x)]$. Under either system, $y_u(x) = b(x) + g$. The employer's after-tax profit in state x can be written as

$$(2) \qquad \pi(x) = f[l(x),x] - n(x)h(x)w(x) - [1 - n(x)]b(x) - t(x)$$

where, again, $t(x)$ is the employer's total tax bill. This tax bill, of course, also depends on government policy. Under the North American system, $t(x) = T + eg[1 - n(x)]$, while under the European system, $t(x) = T + eg[1 - n(x)h(x)]$, after simplification.

Expected utility is $EU = \sum_j \theta_j U(x_j)$, and expected profit is $E\pi = \sum_j \theta_j \pi(x_j)$. An *efficient contract* is defined as a solution to the following problem:

$$(3) \qquad \text{maximize } E\pi \text{ subject to } EU \geq \bar{U}$$

and also subject to the constraint $n(x) \leq 1$ for all x. (For simplicity, I ignore all nonnegativity constraints.) Hence, an efficient contract yields the maximum expected profit for the employer given that workers must be guaranteed an expected utility of at least $\bar{U}$ in order for them to accept the contract. As the parameter $\bar{U}$ is varied, solutions to problem (3) generate the set of efficient contracts parameterized by how big a share of the pie goes to workers; but nothing depends on $\bar{U}$ for our purposes. That is, the model makes predictions about the efficiency properties of contracts, and these efficiency properties are independent of equity considerations.[6]

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[5] The assumption that workers' utility function is strictly concave means that they are strictly risk averse, in the sense that other things being equal they prefer the certain prospect of y units of income and $1 - h$ units of leisure to a random prospect which yields y and $1 - h$ on average. By contrast, the employer is assumed to be risk neutral here; most of the results go through if the employer is also risk averse, although the required notation is slightly more complicated. (See Burdett and Wright 1989b.)

[6] If $\bar{U}$ is chosen appropriately, then the efficient contract implies the same allocation as the competitive equilibrium allocation for the model. In other words, the use of the labor contract language is merely a convenience, and the entire analysis can be reinterpreted as a study of the effects of unemployment insurance in any market economy. One element of my model that might seem important is that there are two types of agents, some endowed with labor (workers) and some endowed with capital (employers). However, the main results also hold in models where all agents are identical; there is no essential need to incorporate a distinction between workers and employers (Wright and Hotchkiss 1988).

Absent unemployment insurance policy, this model implies full employment. That is, if $g = 0$, then an efficient contract entails $n(x) = 1$ for all states x. The intuition is straightforward. Due to the assumption that workers are risk averse, they always prefer work-sharing over layoffs. Since the technological assumption $l = nh$ implies that the labor input changes exactly as much whether n or h is reduced, the firm is happy to accommodate workers—at least in the absence of government intervention. Even with $g > 0$, the following is true in this model: under either a North American or a European unemployment insurance system, as long as $e = 1$, full employment results. Furthermore, as long as $e = 1$, fully efficient hours per worker also result.[7] These results are formally proven below.

PROPOSITION 1. *Under either the North American or the European system, for any value of g, as long as experience-rating is complete* (e=1) *an efficient labor contract will involve* $n(x) = 1$ *and* $f_1 = u_2/u_1$ *in every state x.*

Proof. The style of argument proceeds as follows: Assume that an efficient labor contract does not have the asserted properties, and derive a contradiction by constructing an alternative contract that dominates it in the sense of yielding greater expected profit at the same level of expected utility, or vice versa.

Consider the North American system, and assume that in some state x_0 the contract implies that $n(x_0) = n_0$, $h(x_0) = h_0$, $w(x_0) = w_0$, and $b(x_0) = b_0$, with $n_0 < 1$. Then the expected utility of a worker in state x_0 is given by

$$(4) \qquad U_0 = n_0u(h_0w_0,1-h_0) + (1-n_0)u(b_0+g,1).$$

Now consider changing the contract (in this state only) to a work-sharing contract with $n(x_0) = 1$, $h(x_0) = h^*$, and $w(x_0) = w^*$, where $h^* = n_0h_0$ and $h^*w^* = n_0h_0w_0 + (1-n_0)(b_0+g)$. This simply says all workers get the same average hours and income in the work-sharing contract as they got in the layoff contract. Since $u(\cdot)$ is strictly concave,

$$(5) \qquad U^* = u(h^*w^*,1-h^*) > U_0$$

and workers strictly prefer the work-sharing contract.

When $n(x_0) = 1$, $h(x_0) = h^*$, and $w(x_0) = w^*$, profit under the work-sharing contract in state x_0 is

$$(6) \qquad \pi^* = f(h^*,x_0) - h^*w^* - T$$
$$= f(n_0h_0,x_0) - n_0h_0w_0 - (1-n_0)b_0 - T - g(1-n_0)$$
$$= \pi_0.$$

Hence, profit under the layoff contract equals profit under the work-sharing contract, and therefore the employer is happy to adopt the work-sharing contract.

Since I have been able to construct a work-sharing contract that dominates the layoff contract, the latter could not be efficient. Hence, under the stated assumptions, efficient contracts entail full employment in the North American system. The argument for the European system is similar and is actually a special case of some results I will discuss later. The statement concerning the efficiency of hours per worker will follow directly from the first-order conditions to problem (3), which are discussed below. This completes the argument.

To reiterate, I have shown that the model with $e = 1$ implies full employment and efficient hours per worker. Although the proof is fairly lengthy, the intuition is simple: workers prefer work-sharing because they have concave utility functions, and the employer is happy to accommodate them, at least when experience-rating is complete (e=1). I now discuss cases in which experience-rating is incomplete.

The North American System

The next result shows that the labor contract entails layoffs for certain settings of e and g under the North American system. In other words, there can be unemployment here that is due exclusively to unemployment insurance.

PROPOSITION 2. *Under the North American system, if* $e < 1$, *then* $n(x) < 1$ *in any given state x if g is large enough.*

Proof. Choose some state x_0, and suppose the contract specifies that $n(x_0) = 1$, $h(x_0) = h$, and $w(x_0) = w_0$. I now show that it is possible to construct a contract with layoffs that dominates this as long as g is sufficiently large.

Expected utility in state x_0 is $U_0 = u(h_0w_0,1-h_0)$, and profit for the employer is $\pi_0 = f(h_0,x_0) - h_0w_0 - T$. Suppose I change employment and hours in this state to n^* and h^*, where $h_0 < n^* < 1$ and $h^* = h_0/n^*$. As long as n^* is not too much smaller than one, no matter how risk averse workers are, there will exist a compensating differential δ such that if workers are paid δ over and above what they were earning under the full-employment contract, then they will be just as well off under a contract with $n(x_0) = n^* < 1$. That is,

$$(7) \qquad U^* = n^*u(h_0w_0+\delta,1-h^*) + (1-n^*)u(h_0w_0+\delta,1)$$
$$= U_0.$$

If I set $w^* = (w_0h_0+\delta)/h^*$ and $b^* = w_0h_0 + \delta - g$, then equation (7) says that workers are just willing to accept the layoff contract.

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[7] *Efficient hours per worker* simply means that the marginal product of labor equals the workers' marginal rate of substitution: $f_1 = u_2/u_1$.

I now check profit. Under the layoff contract,

$$(8) \qquad \pi^* = f(n^*h^*,x_0) - n^*h^*w^* - (1-n^*)b^* - (1-n^*)eg - T.$$

If I substitute the above values for n^*, h^*, and so on, then after some simple algebra I find that

$$(9) \qquad \pi^* = \pi_0 - \delta + (1-n^*)g(1-e).$$

If $e < 1$ and g is large enough, then in (9) the third term is larger than the second term, which means that $\pi^* > \pi_0$. Hence, for $e < 1$ and g large, the full employment contract could not have been efficient.

Summarizing, a layoff contract necessarily dominates a work-sharing contract if $(1-e)g$ is large. This can be seen intuitively. Under the North American unemployment insurance system with $e < 1$, an employer can get the public sector to subsidize its operations if and only if layoffs are part of the contract. The subsidy g has to be large enough, however, because workers need to be compensated by the amount $\delta > 0$ in order to accept the risk of layoffs in the contract. Therefore, the subsidy has to be large enough for firms to pay this compensation and still come out ahead.

To further study the properties of an efficient contract, I investigate the marginal conditions for problem (3). The Lagrangian is given by

$$(10) \qquad \mathcal{L} = \sum_j \{\theta_j \pi(x_j) + \lambda[U(x_j) - \bar{U}] + \zeta(x_j)[1 - n(x_j)]\}$$

where λ is the multiplier on the constraint $EU \geq \bar{U}$ and $\zeta(x)$ is the multiplier on the constraint $n(x) \leq 1$. It is a straightforward matter to differentiate $\mathcal{L}$ with respect to the choice variables in each state x in order to derive the first-order conditions. These can be rearranged to yield several interesting results. (See Burdett and Wright 1989b for details.)

One result is that an efficient contract always satisfies the standard risk-sharing condition that the marginal utility of consumption should be the same for employed and unemployed workers and constant across states: For all x,

$$(11) \qquad u_1[y_e(x), 1 - h(x)] = u_1[y_u(x),1] = 1/\lambda.$$

Another result is that an efficient contract always implies that

$$(12) \qquad f_1(nh,x) = u_2/u_1$$

which is the standard efficient hours condition when $n = 1$. When $n(x) < 1$,

$$(13) \qquad f_1(nh,x)h = y_e - y_u - z + (1-e)g$$

where $z \equiv [u(y_e,1-h) - u(y_u,1)]/\lambda$. With $(1-e)g = 0$, this is the standard marginal condition for employment in models with layoffs. With $(1-e)g > 0$, however, employment is distorted.

This completes the analysis of the North American unemployment insurance system. I have shown that this system can encourage temporary layoffs if $(1-e)g$ is sufficiently high, even though the model implies full employment when $(1-e)g = 0$. Of course, the model does not exclude having layoffs in some states and full employment in others. The marginal conditions indicate that when $n(x) = 1$, the efficient hours condition $f_1 = u_2/u_1$ will be satisfied.[8]

The European System

Recall that under my stylized European system, not only are unemployment insurance benefits paid to laid-off workers, but short-time compensation is also paid to short-time workers. The next result shows that, under this system, an efficient labor contract always specifies full employment. Thus, the results above imply not only that unemployment insurance can cause unemployment, but also that the lack of short-time compensation is the essential factor.

PROPOSITION 3. *Under the European system, $n(x) = 1$ in every state x, for any values of the policy parameters.*

Proof. Suppose that in state x_0 the labor contract specifies $n(x_0) = n_0$, $h(x_0) = h_0$, $w(x_0) = w_0$, and $b(x_0) = b_0$ with $n_0 < 1$. Expected utility of a worker in this state is given by

$$(14) \qquad U_0 = n_0 u[h_0 w_0 + (1-h_0)g, 1 - h_0] + (1-n_0)u[b_0+g,1].$$

As in Proposition 1, consider changing the contract in this state so that $n(x_0) = 1$, $h(x_0) = h^*$, and $w(x_0) = w^*$, where $h^* = n_0 h_0$ and $w^* = w_0 + (1-n_0)b_0/h^*$. Since u is strictly concave, I again find that

$$(15) \qquad U^* = u(h^*w^*, 1-h^*) > U_0$$

which means workers prefer the work-sharing contract. Again as in Proposition 1, it is easy to check that profit is the same: $\pi^* = \pi_0$. Hence, the layoff contract could not have been efficient.

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[8] For the North American system, the first-order conditions can also be used to show that $h'(x) = 0$ and $w'(x) = 0$ for all x such that $n(x) < 1$. That is, when some workers are being laid off, the hours and wages of the rest of the workers do not change.

This argument shows that workers who are risk averse always prefer work-sharing to random layoffs. Under the technological assumption that $l = nh$, the employer is happy to accommodate them. This would also be true under the North American system, except for the fact that under the North American system the worker-firm partnership can get the public sector to subsidize its operations if and only if it utilizes layoffs. The employer is able to pay workers the compensating differential δ and still come out ahead using layoffs rather than work-sharing when the subsidy $(1-e)g$ is sufficiently large. Under the European system, layoffs are not necessary to take advantage of the subsidy because benefits are paid to short-time workers; therefore, an efficient contract under the European system necessarily yields full employment.

An unemployment insurance system with short-time compensation cannot in and of itself cause unemployment; but this does not mean that it does not affect the contract. As was true under the North American system, the first-order conditions here can be rearranged to yield several interesting results. (See Burdett and Wright 1989b for details.) In particular, the hours-per-worker condition is

$$(16) \quad f_1(h,x) = u_2/u_1 + (1-e)g.$$

For $(1-e)g > 0$, the marginal product of labor exceeds the marginal rate of substitution, a situation referred to in the literature as *underemployment.*

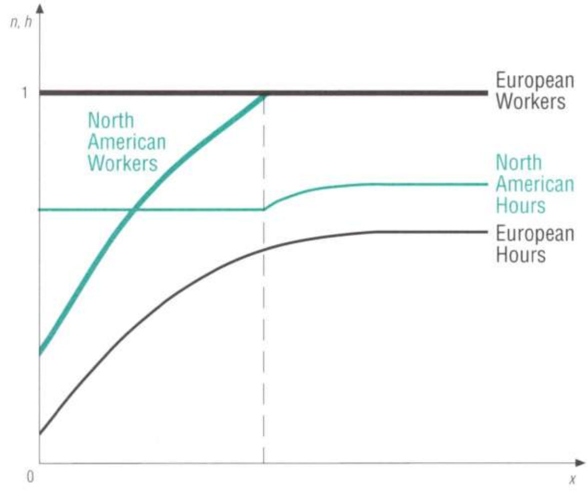
Therefore, although the use of short-time compensation does not encourage layoffs as long as $(1-e)g > 0$, it still distorts the labor input by affecting hours per worker. The recommendation that follows from all of this is that policymakers' attention would be better directed toward the tax, not the benefit, side of unemployment insurance. Complete experience-rating eliminates both the incentive for inefficient temporary layoffs under the system without short-time compensation and the incentive for inefficient hours per worker under the system with short-time compensation. Adding short-time compensation without increasing experience-rating from $e < 1$ to $e = 1$ merely substitutes underemployment for unemployment.

A Comparison

The fundamental difference between the two unemployment insurance systems is that, other things being equal, under the North American system there is greater reliance on temporarily laying off workers during economic downturns, while under the European system there is greater reliance on reducing hours per worker. The following proposition states this formally, and the figure illustrates the results. (The technical proof merely involves differentiating the first-order conditions and therefore is omitted; see Burdett and Wright 1989b for details.)

Predicted Effects of Unemployment Insurance

On the Number of Workers (n) and Hours Per Worker (h)



PROPOSITION 4. *Under the North American system,* $n'(x) > 0$ *and* $h'(x) = 0$ *in states with* $n(x) < 1$, *while* $h'(x) > 0$ *in states with* $n(x) = 1$. *Under the European system,* $n(x) = 1$ *and* $h'(x) > 0$ *in all states.*

Of course, the prediction of zero layoffs under the stylized European unemployment insurance system should not be taken literally since in fact unemployment could occur for several reasons. First, the assumption $l = nh$ is an extreme simplification, and some technologies imply layoffs even without policy distortions.[9] Second, actual unemployment insurance systems do not have perfect short-time compensation and are typically a blend of the two stylized systems. Third, the model in this paper is only meant to capture one type of unemployment—temporary layoffs—and it neglects other types, such as frictional unemployment. Nevertheless, the fundamental prediction of the model is this: In economies that use short-time compensation more extensively, downturns are more likely to be characterized by work-sharing rather than layoffs; and in economies that use short-time compensation less extensively, downturns are more likely to be charac-

[9] Note that the indivisible labor model used in Hansen 1985, Rogerson 1988, and elsewhere does not satisfy the assumption that $l = nh$.

terized by layoffs for some workers and constant hours for others.

Some Evidence

Some evidence in favor of this prediction has been provided by Hamermesh (1978, pp. 246–47), who found that in the United States, "when the demand for labor . . . falls from a cyclical peak, more widespread coverage of [unemployment insurance] induces a . . . greater reliance on layoffs, and a lessened reduction in the workweek." Additional evidence comes from the work of Bernanke and Powell (1986). They found that in the United States, postwar (and therefore post–unemployment insurance) employers have relied more heavily on layoffs than on reduced hours over the business cycle, while in the prewar (and pre–unemployment insurance) period, short workweeks were more common.

I now consider some cross-country evidence. Taking natural logarithms and first-differencing the identity $l = nh$ implies that $L = N + H$, where $L = \Delta\log(l)$, $N = \Delta\log(n)$, and $H = \Delta\log(h)$. Then, taking the variance of both sides of the equation $L = N + H$, I find that

$$(17) \quad \text{var}(L) = \text{var}(N) + \text{var}(H) + 2\text{cov}(N,H).$$

This simple technique decomposes variability in the total labor input into the percentage due to variance in the number of workers and the percentage due to variance in the number of hours per worker plus some covariance. (This procedure is similar to that used by Hansen in 1985, although he filtered his data using the Hodrick-Prescott technique rather than first-differencing.)

The table reports the results of this decomposition on nonagricultural employment for the 1970s for the United States and Canada, two countries that did not have short-time compensation during that period, and for ten European countries that did. For the United States and Canada, only a small percentage—about 8 percent and 5 percent—of the variation in L is due to H, while in the European countries the percentage is much larger—never less than 27. The percentage due to N is considerably greater in the United States and Canada than in most of the European countries, with the exception of Denmark and Italy. However, even in Denmark and Italy, the variance in hours H is still substantially greater than in the North American countries.

Conclusion

This paper has explored some implications of alternative unemployment insurance systems in a simple labor-contracting framework. The main finding is that the North American practice of paying benefits only to individuals working zero hours can encourage the overuse of temporary layoffs—at least if benefits are less than completely experience-rated—while the European practice of paying short-time compensation to workers on reduced hours does not. However, the European system can create a distortion in hours per worker, and this leads to underemployment if not unemployment. These predictions of the model have been shown to be generally consistent with the cross-country evidence. The policy implication is to alleviate distortions on the tax side of both the North American and the European systems by a more complete experience-rating of unemployment insurance taxes. Adding short-time compensation without increasing experience-rating merely substitutes underemployment for unemployment.

Given that the model demonstrates rather clearly the efficiency gains from complete experience-rating, why do actual governments deviate so consistently from such a policy? The answer must involve something not considered in this paper. One thing I did not consider here is the distributional aspect of unemployment insurance. To the extent that different agents in the economy receive different benefits from and pay different costs for unemployment insurance, distributional factors obviously exist; hence, political forces must be considered. For example, with less than complete experience-rating, unemployment insurance obviously subsidizes workers, firms, occupations, and geo-

Cross-Country Variability in Employment and Hours*

Type of Insurance System	Country	% Variance in Number of: Workers Employed (N)	Hours Per Worker (H)
Without Short-Time Compensation	Canada	94.4	5.4
	United States	63.2	7.8
With Short-Time Compensation	Austria	39.3	28.8
	Belgium	30.1	36.8
	Denmark	69.5	27.0
	France	37.6	28.8
	Germany	30.8	34.9
	Italy	88.4	34.1
	Luxembourg	30.4	81.7
	Netherlands	21.7	48.7
	Sweden	34.4	42.4
	United Kingdom	17.7	44.1

*The statistics are based on nonagricultural employment data during 1970–79.
Source: International Labor Organization

graphic regions of a country that are subject to greater-than-average fluctuations. Pursuing the implications of this idea would take me too far afield here, but interested readers may wish to refer to the analyses of Boadway and Oswald (1983) or Wright (1986).[10]

The approach to unemployment insurance and unemployment taken here may also have broader implications for the way we think about labor markets in macroeconomics. Recent work in the real business cycle paradigm, for example, finds that models with nonconvex labor markets are important for capturing certain aspects of the aggregate time series (Hansen 1985 and Prescott 1986). Without some nonconvexity, under standard assumptions, a representative agent equilibrium model generates fluctuations in hours but not in employment. Alternative models, such as the one studied by Hansen (1985), that simply assume labor time is indivisible are making an extreme assumption and one that leads to fluctuations in the fraction of employed workers but not in hours per worker.

As Heckman (1984, p. 212) puts it, the "numbers suggest that any serious empirical model of business-cycle labor market fluctuations must account for [labor input] variation at the extensive margin as well as at the intensive margin." Cho and Cooley (1988) and Kydland and Prescott (1991) have developed models with fluctuations in both margins based on technological considerations. The results here suggest that the particular form of social insurance may also help to explain fluctuations along both margins. Pursuing this avenue further has a potential advantage over assuming indivisibilities, fixed costs, or other nonconvexities because the relevant policy variables may be more readily quantifiable across economies.

[10] The political-economic models in those papers also explain why a public unemployment insurance system may be part of an equilibrium based on distributional considerations in economies where there is no other reason for the government to step in. The approach here, which is to use a model with no explicit redistributional effects or market failures, is motivated by a desire to focus on the basic efficiency implications of unemployment insurance in as simple a model as possible.

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