A supply-side explanation of European unemployment

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In this article, we offer a supply-side explanation of two striking patterns in European unemployment as compared with that of other member countries of the OECD (Organization for Economic Cooperation and Development).[1] (See figure 1 and table 1.) The first pattern is that of average *unemployment rates*. These were similar for European and non-European OECD countries during the 1960s and 1970s, but in the 1980s and 1990s average unemployment in Europe has persistently exceeded the average in the OECD by about 2 percentage points. Second, since the 1980s, the average *duration of unemployment* in Europe has greatly exceeded that in the rest of the OECD. We attribute these patterns to the incentive effects on labor supply of unemployment compensation arrangements, which are far more generous in Europe than in the rest of the OECD.[2] However, this view is challenged by the observation that unemployment compensation arrangements have been more generous in Europe *throughout* the post-World War II period, during the first part of which European unemployment was *not* higher than that for the rest of the OECD. We attribute the rise in unemployment in Europe after 1980 to a change in the environment that required increased adaptability of those workers forced to change jobs.

We show that during *tranquil times*, with less need for adaptability, unemployment rates were the same with a generous unemployment compensation system as they would have been without such a system. However, in *turbulent times*, when greater adaptability is required, a generous unemployment compensation system could propel the economy into a state of persistently high unemployment.[3]

The economic environment is generally perceived to have become more turbulent in the last two decades. The OECD (1994) sums it up as follows:

> In the stable post-World War II economic environment, standards of living in most OECD countries grew rapidly, narrowing the gap with the area's highest per capita income country, the United States. The OECD area's terms of trade evolved favorably; trade and payments systems were progressively liberalized, without major problems; GDP and international trade grew strongly.
>
> In the 1970s, the economic environment became turbulent. The two oil price rises, in 1973/74 and 1979/80, imparted major terms-of-trade shocks, each of the order of 2 percent of OECD-area GDP, and each sending large relative price changes through all OECD economies. Exchange rates became volatile after the breakdown of the Bretton Woods system of fixed exchange rates. Then there came, mainly in the 1980s, waves of financial-market liberalization and product market deregulation which greatly enhanced the potential efficiency of OECD economies, and also accelerated

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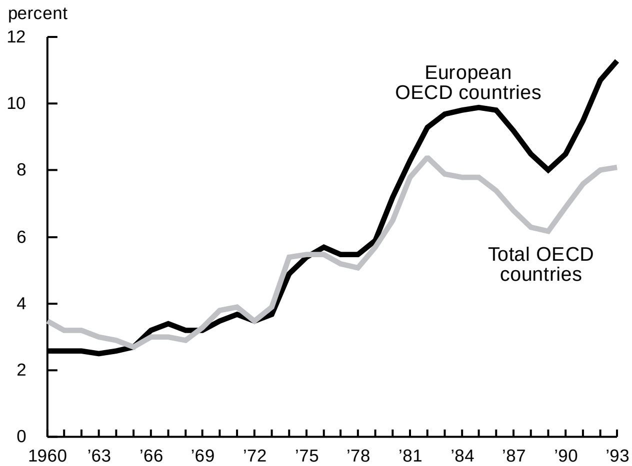
FIGURE 1

Unemployment rate in OECD as a percent of the labor force



Sources: Data for 1961–77 are from OECD, *Labor Force Statistics* (1984) and data for 1978–94 are from OECD, *Employment Outlook* (1995).

the pace of change. All these developments challenged the capacity of economies and societies to adapt. At the same time, the need to adapt was heightened by pervasive technological change, especially as the new information technologies appeared, and by the trend towards globalization.

Gottschalk and Moffitt (1994) and Moffitt and Gottschalk (1995) provide empirical evidence of increased economic turbulence. They show that greater earnings instability for individual workers accompanied the widening earnings distribution in the U.S. labor market, especially in the 1980s. In fact, half of the increased variance in earnings for white males can be attributed to transitory shocks that die out within three years.

Thus, we attribute the diverse unemployment rates observed in Europe and the rest of the OECD to the supply side of the labor market and a changing economic environment. We focus on how mechanisms intended to provide social insurance also encourage people not to work. A threat of adverse incentives haunts the delivery of social insurance and this threat becomes larger in times of economic turbulence. Social insurance works best when exposure to an event cannot be affected by the insured person (for example, acts of nature). Our starting point is that unemployment is only partly an act of nature, beyond the control of the worker. A worker makes efforts to leave a state of unemployment, and these efforts are influenced by arrangements for compensating the worker for being unemployed.

We use a *search model* that views the job market as an information processing machine.

TABLE 1

Standardized unemployment rates and long-term unemployment of 12 months or more in OECD

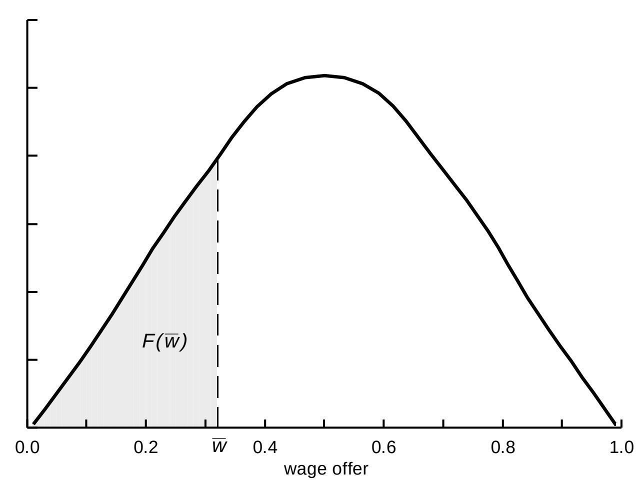
	Average unemployment rate		Long-term unemployment as percent of unemployment		
	1974–79	1980–89	1970	1979	1989
France	4.5	9.0	22.0	32.6[a]	43.9
Germany	3.2	5.9	8.8	28.7	49.0
Italy	6.6	9.5	--	51.2	70.4
Spain	5.2	17.5	--	32.8[a]	58.5
United Kingdom	5.0	10.0	17.6	29.5	40.8
OECD Europe	4.7	9.2	--	31.5[b]	52.8
Total OECD	4.9	7.3	--	26.6[b]	33.7

[a]Data for 1980.
[b]Average of data for 1979 and 1980.
Sources: The data are from OECD, *Employment Outlook* (1991), table 2.7, except for long-term unemployment in 1970 which are from OECD, *Employment Outlook* (1983), table 24.

The market tracks and sorts information used to match workers and jobs. Workers and jobs have diverse characteristics, and it is costly but valuable to find good matches. Market economies decentralize job matching, leaving firms to post vacancies and make offers and workers to accept or reject job offers. From both social and private viewpoints, the state of unemployment—waiting for something better—is partly an investment in the future.

FIGURE 2

Wage offer distribution



A search model of unemployment

Our work extends John McCall's (1970) basic search model to capture the effects we think differentiate Europe from the rest of the OECD. Our model is more complicated than McCall's and must be analyzed with a computer. However, many of the basic insights can be conveyed by describing first a graphical version of McCall's model of a *reservation wage*, then a graphical version of a model of *search intensity*.

McCall's basic model confronts an unemployed worker with choices about employment status and focuses on the incentives that the market and the state present to the worker. The model provides a framework for understanding how different policies affect incentives and outcomes.

Balancing benefits and costs of search

Each period, an unemployed worker draws a wage offer from a probability distribution of offers and decides whether to accept or reject it. Figure 2 shows a distribution of wage offers. We let $F(\overline{w})$ denote the probability that a randomly drawn offer is less than or equal to a given wage, $\overline{w}$, and the wage offer exceeds $\overline{w}$ with probability $1–F(\overline{w})$. In the simplest model, an offer provides the worker with the opportunity to work indefinitely at the drawn wage. The model also assumes that an unemployed worker receives unemployment compensation in a fixed amount per period for as long as he or she is unemployed. The worker's optimal policy is to set a *reservation wage*, at a level at which the worker is indifferent about accepting or rejecting an offer, then to reject offers falling short of the reservation wage, and to accept the first offer exceeding it. The model equates being unemployed with waiting for an acceptable offer. The worker compares the benefits of accepting an offer with the benefits of refusing it, remaining unemployed, and searching again next period. The benefits of refusing comprise any unemployment compensation the worker receives this period, plus the *option value* of searching again next period. The option value covers the possibility that the worker might eventually draw a better wage offer in the next period or a subsequent period.

Given a particular distribution of wage offers, we can compute and plot the present value of all benefits associated with a policy of setting a reservation wage of $\overline{w}$. To compute present values, we let r denote the one-period interest rate. Any benefits in the next period can then be expressed in today's value (present value) when multiplying by the one-period discount factor, $\beta = \frac{1}{(1+r)}$. Let $\Psi(\overline{w})$ be the total benefits of rejecting a job offer today, while setting a reservation wage of $\overline{w}$ for accepting a job in the future. By accounting for the various possibilities and weighting the associated payoffs by the probabilities of occurrence, we can compute $\Psi(\overline{w})$ as follows:

$$1)\quad \Psi(\overline{w}) = \gamma + (1 - F(\overline{w}))\ \frac{E_{\overline{w}}(w)}{r} + F(\overline{w})\beta\Psi(\overline{w}),$$

where γ is the level of unemployment compensation per period, and $E_{\overline{w}}(w)$ is the expected, or average, value of all wages exceeding a reservation wage of $\bar{w}$.[4]

The right side of equation 1 expresses the total benefits, $\Psi(\bar{w})$, as the sum of three terms: 1) γ, the unemployment compensation to be received this period; 2) the expected present value from next period onwards of receiving a wage exceeding the reservation wage, $E_{\bar{w}}(w)/r$, weighted by the probability $(1-F(\bar{w}))$ of receiving an offer next period exceeding $\bar{w}$; and 3) the value of restarting the search process next period, discounted one period by β, and weighted by the probability $F(\bar{w})$, of not drawing an acceptable offer next period. Equation 1 can be rearranged to become

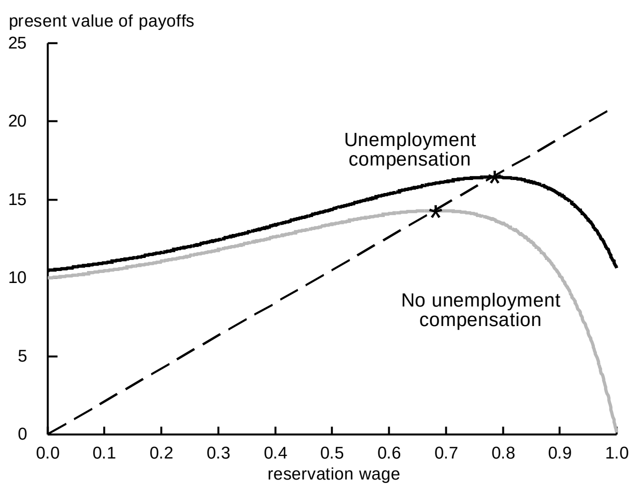
$$2)\quad \Psi(\bar{w}) = \frac{\gamma + (1 - F(\bar{w}))\dfrac{E_{\bar{w}}(w)}{r}}{1 - \beta F(\bar{w})}.$$

The optimal choice of reservation wage, $\bar{w}$, is the one that maximizes total benefits, $\Psi(\bar{w})$.

For the same wage distribution shown in figure 2, figure 3 plots the right-hand side of equation 2 for unemployment compensation, γ, equal to zero and greater than zero. Since unemployment compensation enters positively in equation 2, the curve with some unemployment compensation is higher than the curve without any unemployment compensation.

FIGURE 3

Expected present value of payoffs for different reservation wages with and without unemployment compensation



Notes: Stars indicate the optimal reservation wage for each unemployment compensation regime. The dashed line shows the present value of different constant wage streams beginning today.

Each curve shows how the benefits of the search vary with the reservation wage. For low values of the reservation wage, the benefits increase as the reservation wage increases, but they eventually fall for higher values of the reservation wage. In other words, the unemployed worker is better off choosing a reservation wage that is neither too low nor too high. A too low reservation wage is not optimal, since the worker would, on average, do better by searching more for a somewhat higher wage. On the other hand, a too high reservation wage does not maximize benefits, since the worker is then, on average, spending too much time pursuing the rare opportunity of getting a very high wage. By setting the derivative of $\Psi(\bar{w})$ to zero, we find that the optimal value of the reservation wage must satisfy

$$3)\quad \Psi(\bar{w}) = \frac{\bar{w}(1+r)}{r}.$$

The term $\frac{\bar{w}(1+r)}{r}$ is the benefit of accepting a wage $\bar{w}$ immediately (that is, the present value of receiving a wage $\bar{w}$ today and for all future periods). Thus, equation 3 says that the worker optimally sets the reservation wage to equate the total benefits of further search to the total benefits of immediately accepting a wage offer equal to the reservation wage. In other words, the worker is indifferent between continuing the search and accepting a wage offer that is exactly equal to the optimal reservation wage. Figure 3 confirms equation 3 graphically. In figure 3, for each level of unemployment compensation, the curve showing $\frac{\bar{w}(1+r)}{r}$ intersects total benefits $\Psi(\bar{w})$ at the highest value of $\Psi(\bar{w})$ (as indicated in the figure by a star). Figure 3 shows how an increase in unemployment compensation increases the reservation wage, because it shifts upward the curve of benefits of further search.

The reservation wage determines the probability of rejecting a job offer by summing probabilities attached to wage offers below the reservation wage (see figure 2).

The rejection probability $F(\bar{w})$ determines the mean duration of unemployment via the formula

$$\text{Duration} = \frac{1}{1 - F(\bar{w})} .$$

Increases in $F(\bar{w})$ increase the mean duration of unemployment. We study how particular policy and environmental features impinge on the reservation wage and the duration of unemployment.[5]

Variable search intensity

The basic search model assumes that one offer arrives per period, irrespective of the intensity of the worker's job search. We modify the model to let the worker influence the probability of getting a job offer by selecting the intensity of his or her search. To indicate the main factors affecting search intensity, we temporarily assume that the wage distribution is concentrated at a point, denoted w, so that all jobs pay the same wage w. With this assumption, the only uncertainty becomes whether a job offer arrives in the period.

We suppose that a worker chooses a probability, π, that an offer will arrive in a given period, by incurring a utility cost, $c(\pi)$, per period. We assume that the cost function $c(\pi)$ has positive and increasing marginal costs: $c(\pi) = 0$, $c'(\pi) > 0$, $c''(\pi) > 0$. If an unemployed worker decides to search this period, he or she receives unemployment compensation and incurs search costs of $c(\pi)$ this period. The worker then receives an offer with probability π at the beginning of next period or no offer with probability $(1–\pi)$. We let $\Omega(\pi)$ denote the expected present value of searching with intensity π. We can compute

$$4) \quad \Omega(\pi) = -c(\pi) + \gamma + \pi \frac{w}{r} + (1-\pi)\,\beta\Omega(\pi).$$

The right side of equation 4 expresses the benefits associated with search intensity π as the sum of four terms: 1) $-c(\pi)$, the negative value of the search cost in the current period; 2) γ, the unemployment compensation to be received in this period; 3) the present value from next period onwards of receiving a wage $w, \frac{w}{r}$, weighted by the probability, π, of receiving an offer next period; and 4) the value of restarting the search process next period, discounted one period by β, and weighted by the probability $(1-\pi)$ of not drawing an offer next period. Equation 4 can be rearranged to become

$$5) \quad \Omega(\pi) = \frac{-c(\pi) + \gamma + \pi \frac{w}{r}}{1 - \beta(1-\pi)} .$$

The optimal choice of probability, π, is the one that maximizes total benefits, $\Omega(\pi)$.

Figure 4 displays the three components of the right side of equation 5 as functions of the probability of getting a wage offer, while figure 5 displays their sum for two different levels of unemployment compensation, γ, equal to zero and greater than zero. (These graphs assume the particular cost function $c(\pi) = 50\pi^4$.) As shown in figure 4, for a given level of unemployment compensation, the expected present value of received unemployment compensation decreases as the probability of an offer increases. Moreover, the higher the level of unemployment compensation, the higher this curve in figure 4. It follows that the higher the level of unemployment compensation, the lower the probability of getting a wage offer (corresponding to a lower search intensity) that maximizes the total benefits. Figure 5 shows how the optimal setting of the probability declines as unemployment compensation increases. (We mark the optimal probability for each level of unemployment compensation with a star.)

In this setting, the average duration of unemployment is just $\frac{1}{\pi}$. By causing the probability (π) to decrease, increases in unemployment compensation cause the mean duration of unemployment to rise. Similar forces operate in the more general model when the distribution of offers is nontrivial. The main difference is that the value of a wage offer in the above equations must be replaced with a value that depends on the worker's reservation wage, which is also influenced by the level of unemployment compensation. This is the case we are interested in.

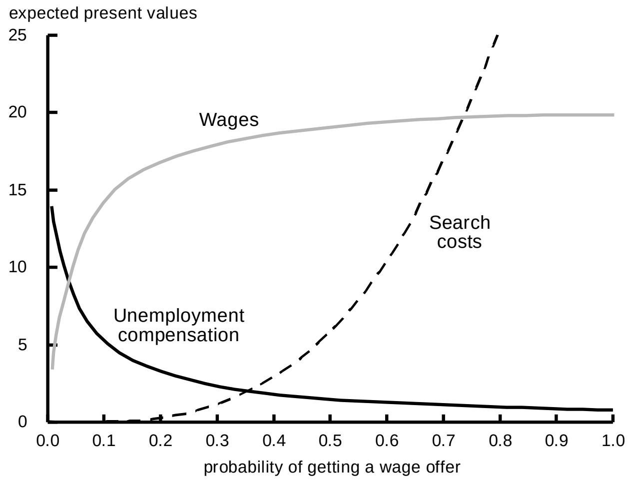
Extensions of the basic search model

To construct our theory of European unemployment, we add three features to the basic search model outlined above—job termination, human capital/skills, and earnings-dependent unemployment compensation.

Job termination—We have adjusted the option value of searching for a job to reflect

FIGURE 4

Expected present values of wages, search costs, and unemployment compensation
(as given by the three components in equation 5)



the possibility that an existing job terminates against the will of the worker. Exposing the worker to a small probability of involuntary job loss each period tends to diminish the option value of a further job search, and can diminish the reservation wage.

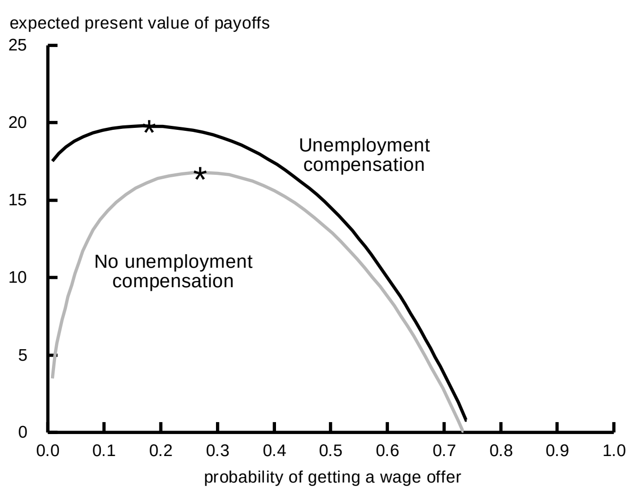
Human capital or skills—We have made earnings depend on human capital or skills. We let human capital appreciate when the worker is employed, and let it depreciate gradually during spells of unemployment. Human capital/skill levels differentiate workers from each other; unemployed workers with different human capital levels set different reservation wages and search intensities.

We specify a given number of potential levels of human capital or skills, ordered from lowest to highest. We also specify two sets of transition probabilities, describing the change in skills over time. For example, we would expect a worker's skills to improve during periods of employment and, conversely, to deteriorate during periods of unemployment.

We define a worker's total earnings as the product of a base wage, to be drawn from a given wage offer distribution, and the worker's skills. During a spell of employment, a worker who starts from a low level of skills can expect his or her earnings to grow gradually as his or her skills grow, even though the base wage is set once-and-for-all at the beginning of the current spell of employment. The worker takes into account the likely growth of earnings in formulating the reservation wage and search intensity. The worker also takes into account the way unemployment compensation depends on past earnings.

FIGURE 5

Expected total payoffs with and without unemployment compensation
(as given in equation 5)



Note: Stars indicate the optimal search intensity for each unemployment compensation regime.

Earnings-dependent unemployment compensation—The basic model has a fixed level of unemployment compensation, independent of the worker's earnings during previous employment. We modify this feature by linking unemployment compensation to earnings attained on the previous job. This means the option value of the search will depend on the worker's current skill level, the effect of prospective employment status on the worker's skills, and the level of the worker's previous earnings. The effect on this option value of unemployment compensation and the latter's dependence on past earnings form an important part of our analysis.

Representing economic turbulence

Our model contains two types of parameters that can be used to represent labor market *turbulence*, a parameter representing firing or job dissolution and parameters governing the rate at which human capital depreciates while unemployed. We will use one particular parameter from the latter set to measure turbulence, namely a parameter that sets the one-time depreciation in skill level that an employed worker experiences upon becoming unemployed. In *tranquil* times, we let the worker experience no *immediate* depreciation in human capital, but in turbulent times, we expose the worker to a one-time reduction in human capital. This is our way of roughly capturing the disparity in skills used in different jobs. In tranquil times, skills are more transferable than in turbulent times, when job descriptions change more quickly.

Consequences of additional features

The modifications of the basic model, in our view, provide a more realistic picture of the incentives unemployed workers face. Given the possibility that a job may terminate, the unemployed worker takes into account not only current unemployment compensation, which is linked to *past* earnings, but also the fact that *future* unemployment compensation will be linked to *future* earnings, which depend on the worker's base wage and human capital level. Because the human capital level deteriorates with the passage of time spent unemployed, the worker will balance the benefits of waiting for a higher base wage against the prospects of further deterioration of human capital while unemployed.

The balance will depend on the level of unemployment compensation. High unemployment compensation sets the following trap. Consider a worker who had relatively high earnings before losing a job and, therefore, qualifies for a high level of unemployment compensation. This worker's reservation base wage and search intensity each depend on his or her human capital level. Early in a spell of unemployment, the worker searches intensively, and sets a *reasonable* reservation base wage, because his or her earnings are the product of that wage and the human capital level and, even for typical wages, the associated earnings compare favorably with unemployment compensation. However, if the worker remains unemployed for a while and experiences a deterioration in human capital, the incentives change adversely. The worker's unemployment compensation remains high (tied to previous earnings), but for any given prospective draw from the base wage distribution, the earnings are lower because of diminished human capital. Because the benefits of searching have declined relative to the compensation for remaining unemployed, the worker will tend to search less intensively and to set a higher reservation base wage. This behavior, in turn, will diminish the worker's probability of leaving unemployment and increase the mean duration of unemployment.

Human capital acquisition can also represent a source of *quits* or voluntary separations. A worker with low human capital may accept a lower base wage than one who has higher human capital. Having subsequently experienced growth in human capital, the worker may find it optimal to quit the job and search for a higher base wage to capitalize on his or her higher human capital.

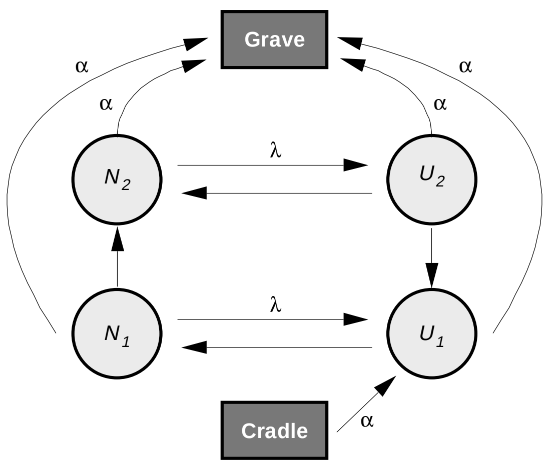
Equilibrium: Many workers

The search model captures the experiences of an individual worker as time and opportunities pass. We can use it as a building block to model the behavior of a large number of *ex ante* identical but *ex post* diverse workers composing a complete labor market. To build a model of the labor market, we reinterpret the search model's *individual* descriptive statistics—average duration of unemployment, average accepted wage, average times between incidents of quitting or being fired—as applying to the average at any point in time of a large number of statistically identical individuals.

Imagine the labor market as a set of lakes connected by inlet and outlet streams (see figure 6). The volume of water in each lake represents the number of people in a particular labor market state (for example, employed and unemployed with different levels of human capital), and the flows between lakes represent rates of hiring, firing, and quitting. The system is in equilibrium when all lake levels are constant over time, which means that inflows balance outflows for each lake. The rates of inflow and outflow are the critical determinants

FIGURE 6

An illustrative *lake* model



Notes: Employment flows and reservoirs in a model with birth/death, firing, quitting, and decisions to accept or refuse job offers. Here U_1 and U_2 denote pools of unemployed workers of low human capital and high human capital, respectively; N_1 and N_2 measure employed workers of low human capital and high human capital, respectively; α is a given birth/death rate; and λ is a given layoff rate.

of the lake levels. The individual search model lends itself to becoming a model of these inflow and outflow rates. For example, we can interpret the probability of job acceptance as determining the *rate* of flow from a state of unemployment to a state of employment.

Within such a model, government-supplied unemployment compensation gives rise to expenditures that must be financed. In particular, the size of the unemployment lake (or lakes) determines the total volume of government unemployment compensation payments. We suppose that these are financed from income taxes and that, in a state of *equilibrium*, government expenditure rates and tax rates must be set so that the government budget balances.

Numerical examples

We use numerical simulations to illustrate the equilibrium forces at work in our aggregate model of the labor market. Our results are mainly driven by two sets of parameters—the skill technology and the unemployment compensation scheme.[6]

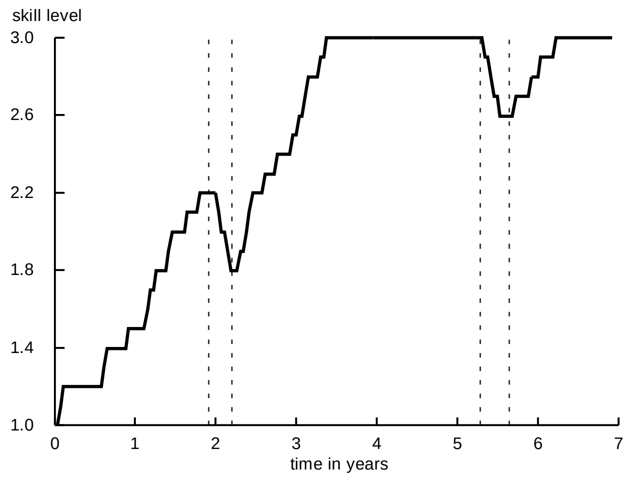
Our model includes 21 skill levels and assumes that all new entrants to the labor market start out with the lowest skill level. After each two-week period of employment that is not followed by a layoff, the worker has a one in four chance to increase skills by one level; otherwise, the skill level remains unchanged. Employed workers who have reached the highest skill level retain those skills until becoming unemployed. It will take a worker who is continuously employed, on average, about three years and one month to reach the highest skill level. We assume that the stochastic depreciation of skills during unemployment is twice as fast as the accumulation of skills. That is, after each two-week period of unemployment, there is a one in two risk that the worker's skills decrease by one level; otherwise, they remain unchanged. Once the lowest skill level is reached through depreciation, the worker remains at that level until becoming employed. Finally, in a period of being laid off, it is assumed that the worker keeps the skill level from the last period of employment. As pointed out above, our definition of tranquil economic conditions implies that skill depreciation is related only to the time spent unemployed; there is no unusual loss of skills associated with the layoff itself.

Figure 7 depicts a random realization of skills for a new entrant into the labor market. The vertical dotted lines separate periods of employment and unemployment. According to the figure, the worker's first job lasts for almost two years, during which he or she accumulates considerable skills. However, the following 3.5 month spell of unemployment is associated with skill depreciation. After finding a second job, the worker remains there for three years and attains the highest skill level. Following another short spell of unemployment, the worker finds a third job and regains the skills lost during unemployment.

Concerning the unemployment compensation scheme, we examine the outcome for two economies, one with unemployment insurance and one without. The economy with unemployment insurance is called the welfare state (WS) and has a 70 percent replacement ratio, that is, unemployment benefits cover 70 percent of lost earnings for laid off workers.[7] The economy with no unemployment insurance is called the laissez-faire (LF) economy.

FIGURE 7

Random realization of a worker's skill level under tranquil economic conditions



Note: The vertical dotted lines separate periods of employment (skill accumulation) and unemployment (skill depreciation).

Tranquil economic times

Table 2 reports on the equilibria under tranquil economic times for the WS economy and the LF economy. It might be surprising to see that the economies look very similar in terms of unemployment levels and duration. The unemployment rate is only eight-tenths of a percentage point higher in the WS economy. The average unemployment spell is 11.6 weeks in the WS economy versus 9.4 weeks in the LF economy. However, the WS economy has considerably more dispersion in the duration of unemployment spells, as indicated by the proportion of long-term unemployed at any point in time. In the WS economy, 14.0 percent of currently unemployed workers have unemployment spells to date greater than or equal to six months (and 5.1 percent greater than or equal to 12 months), compared with 4.7 percent (0.3 percent) in the LF economy. However, in absolute numbers these long-term unemployed workers constitute a very small portion of the total labor force; a 3.3 percent income tax is sufficient to finance the unemployment insurance scheme in the WS economy.

To understand why the equilibria in these two economies are virtually the same, we make a connection between the workers' behavior, as discussed earlier, and the economy's aggregate performance. Let us track a large group of workers who lost their jobs after having attained the highest skill level. Although we can not determine precisely the fate of each individual unemployed worker (since luck plays a role in what wage offers an individual obtains), we can compute average outcomes for these workers as a group. Specifically, at different unemployment durations, we can estimate the *hazard rate* of gaining employment, that is, the proportion of still unemployed workers who gain employment in the current two-week period (see figure 8).

As shown in figure 8, the hazard of gaining employment in the LF economy is first increasing and then decreasing. These dynamics are completely driven by changing reservation wages over the unemployment spell. Initially, these workers with the highest skill level have nothing more to gain in terms of skills so they find it optimal to search for a very good wage, that is, they choose high reservation wages. As time goes by, some workers are unlucky in their job search and their skills start depreciating due to unemployment. It then becomes optimal for them to choose a lower

TABLE 2

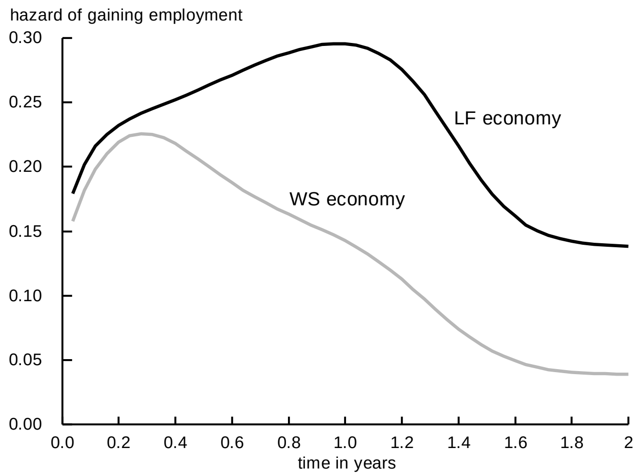
Equilibria in WS economy and LF economy in tranquil economic times

	WS	LF
Unemployment rate (percent)	7.11	6.33
Average duration of unemployment (weeks)	11.6	9.4
Percent of unemployed with spells so far ≥ 6 months	14.0	4.7
Percent of unemployed with spells so far ≥ 12 months	5.1	0.3
Tax financing unemployment benefits (percent)	3.3	n.a.

Note: n.a. indicates not applicable.

FIGURE 8

Hazard of gaining employment as a function of the length of the unemployment spell



Notes: We assume an initial skill level equal to the highest one. The curves show the fraction of still unemployed workers who gain employment in any given two-week period after the layoff, with the workers' last earnings belonging to the most common income class.

reservation wage, thereby increasing the chance of finding an acceptable job and reducing the risk of further skill deterioration. This accounts for the increasing segment of the hazard function in figure 8. However, a very small group of the unemployed workers in the LF economy will find themselves unemployed for more than a year (0.3 percent of all unemployed, as shown in table 2). These workers will once again find it optimal to choose higher reservation wages; because they have already lost most of their skills, the cost of searching for a better wage has actually gone down.

Consider a similar group of laid off workers in the WS economy. Because these workers receive unemployment benefits with a replacement ratio of 70 percent, we have to make an assumption about their lost earnings. (As mentioned earlier, their choice of reservation wages and search intensities will depend on their unemployment compensation.) Figure 8 depicts the hazard of gaining employment in the WS economy, under the assumption that lost earnings were in the most common income class. Note that the LF and WS curves in figure 8 are remarkably similar during the first four months. Despite their unemployment compensation, workers in the WS economy choose to search for and accept jobs in similar ways to those in the LF economy. They are eager to find jobs paying more than their current replacement ratio of 70 percent. But after this initial period, the hazard of gaining employment falls dramatically in the WS economy. Long-term unemployed workers in the WS economy become disillusioned when they experience skill depreciation. In other words, the passage of time makes the prospect of finding a job less attractive, compared with living on unemployment benefits. These workers hold out for a very good wage offer before giving up their generous benefits (relative to their currently low skills). Since it is rare to find such good wage offers, they reduce their investment in job search, that is, they reduce the intensity of their job search.

Under the assumed tranquil economic conditions, these incentive problems in the WS economy have only a small impact on the aggregate outcome. The average duration of unemployment in the WS economy is only 11.6 weeks, as shown in table 2. So most unemployed workers find jobs before becoming disillusioned.

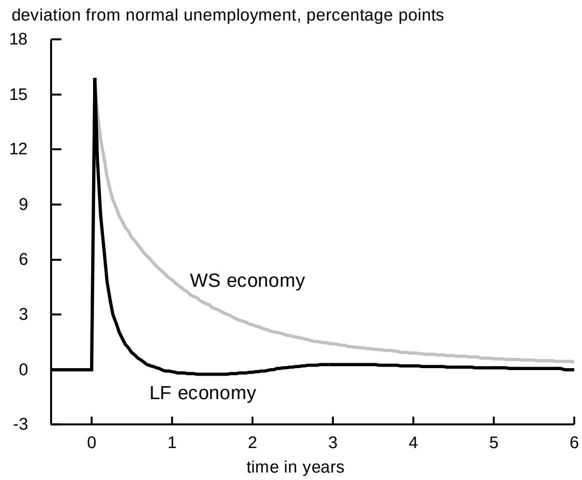
A transient economic shock

The unemployment dynamics described above make the WS economy more vulnerable to economic shocks than the LF economy. This can be demonstrated by examining the economies' behavior in response to a transient unemployment shock. We assume that the normal layoff rate increases sharply (twentyfold) in a single two-week period, and that everyone who becomes unemployed in this particular period immediately loses 75 percent of his or her skills. After this one-period shock, both economies revert to their normal layoff and skill depreciation/accumulation rates. Policy parameters, such as taxes and the unemployment compensation program, are kept constant throughout the experiment. It follows that the economies will eventually return to the equilibria in table 2.[8]

As shown in figure 9, the shock causes unemployment rates in both economies to jump initially by about 16 percentage points. However, in the LF economy, the high unemployment

FIGURE 9

Response in unemployment to a transient economic shock



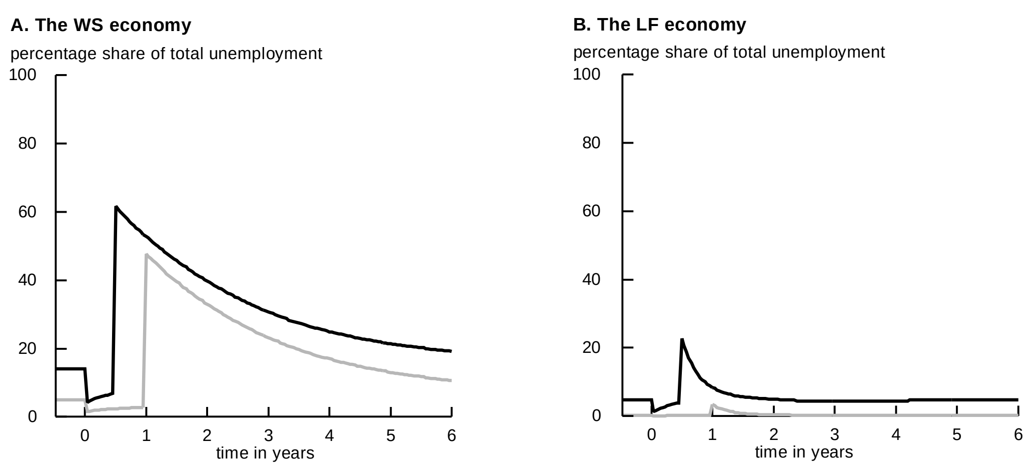
these workers also reduce search intensities to balance the small prospective gains with the utility costs of search.

Panels A and B of figure 10 show how long-term unemployment gradually emerges after the shock. At any point, the figures decompose unemployment into the fraction of unemployed workers who have been unemployed for at least one year, those who have been unemployed for between six months and one year, and those who have been unemployed for less than six months. Not surprisingly, both of the first two measures of unemployment fall at the time of the shock, when there is a flood of newly laid off workers. The two measures then rise predictably after six months and 12 months, respectively. The problem of long-term unemployment in the WS economy shows up starkly in panel A of figure 10. In contrast, the LF economy (panel B) has a much lower incidence of long-term unemployment, and there is hardly any persistence in the fractions of long-term unemployed, compared with the WS economy.

rate dies out quickly because unemployed workers search intensively for jobs paying less than their previous employment. In contrast, workers in the WS economy enter a prolonged period of unemployment because, given their depreciated skills, they have difficulty finding jobs that they prefer to their unemployment compensation (which is based on past earnings). Besides setting high reservation wages,

FIGURE 10

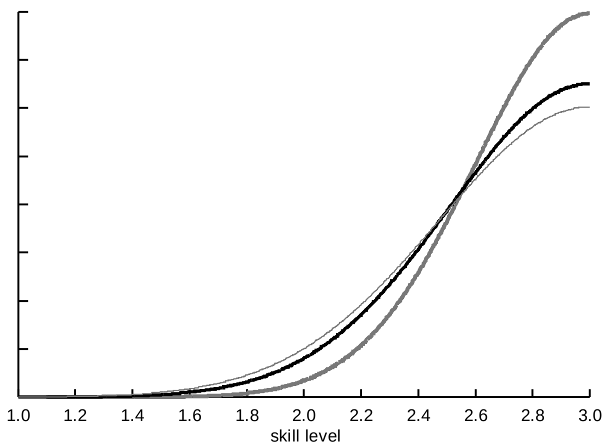
Response in the decomposition of the unemployed with respect to the length of unemployment spells so far



Notes: The percentage of unemployed workers with at least six months (12 months) of unemployment to date is below the black line (colored line). The percentage above the black line is then unemployed workers who have been unemployed for less than six months.

FIGURE 11

The probability distribution of a worker's skills immediately after a layoff



Notes: The range starts at the lowest skill level and ends at the worker's skill level before the layoff. (The current graph is drawn for a worker who had attained skill level 3 before the layoff.) The thick colored line, black line, and thin colored line refer to different degrees of economic turbulence indexed by a variance of .010, .015, and .0175, respectively.

Turbulent economic times

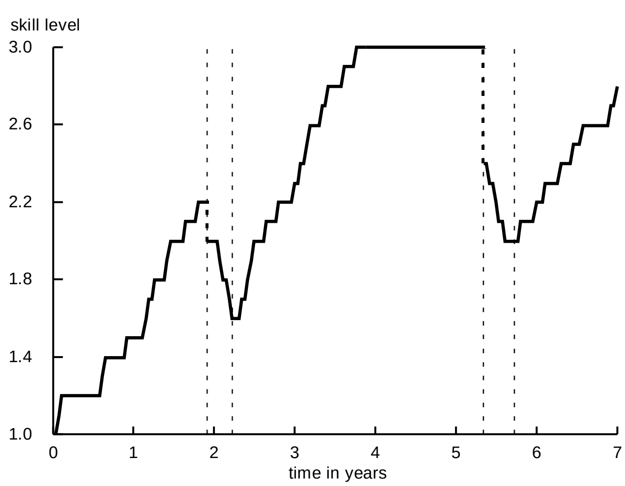
Below, we show how the poor unemployment performance of the WS economy in response to a transient economic shock will persist during times of ongoing economic turbulence. We define economic turbulence in terms of the mean and variance of skill losses associated with layoffs. At the time of a layoff, we assume that a worker draws a new skill level from one of the distributions in figure 11. The range of each distribution starts at the lowest possible skill level and ends at the worker's skill level before the layoff. In other words, the worker stands to lose some of his or her skills immediately and a few workers may even draw a significantly lower skill level in the left-hand tail of the distribution. During the unemployment spell itself and at times of continuing employment, skills depreciate and accumulate as before.

The new skill technology is illustrated in figure 12 analogously to figure 7. In fact, both figures depict exactly the same realization of the direction of skill movements during unemployment spells and at times of continuing employment. The only difference is that the new skill technology may give rise to additional skill losses exactly at the time of layoffs. As can be seen, the extra skill loss is pretty modest at the first layoff, but the second time around the skill loss is close to 30 percent of the worker's accumulated skills. The extra skill losses occasionally associated with job losses (figure 12) affect the unemployed worker's search intensity and reservation wage, as discussed in the case of a transient unemployment shock above. This means that the length of unemployment spells can vary between figures 7 and 12 because of the different incentives confronting these two unemployed workers. We want to know how these changes will affect economy-wide average rates of unemployment and long-term unemployment in the WS and LF economies.

To address this question, we compute equilibria for each degree of economic turbulence in Figure 11. We use the equilibria under tranquil economic conditions (discussed above) as a benchmark case.[9] As shown in figure 13, unemployment remains virtually

FIGURE 12

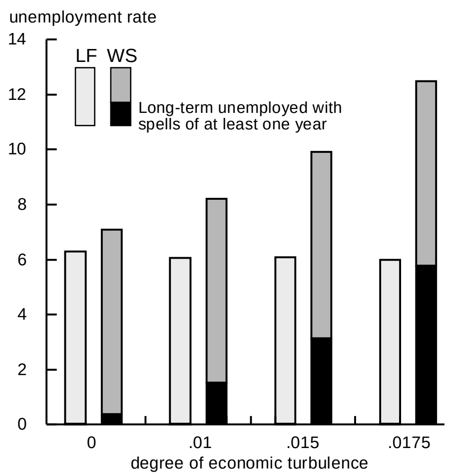
Random realization of a worker's skill level under turbulent economic times



Note: The vertical dotted lines separate periods of employment (skill accumulation) and unemployment (skill depreciation).

FIGURE 13

Unemployment rates under different degrees of economic turbulence



flat in the LF economy in response to increased economic turbulence, while both the unemployment rate and the incidence of long-term unemployment rise sharply in the WS economy (in the LF economy, long-term unemployment remains low and therefore is not visible in figure 13). The explanation of these patterns is essentially the same as that for the responses to a transient economic shock. Moreover, the pressure to finance the unemployment compensation scheme in the WS economy naturally increases with economic turbulence. Thus, the tax rate of 3.3 percent required to finance unemployment compensation under tranquil conditions (see table 2) increases to 9.1 percent under the highest degree of economic turbulence (indexed by .0175).

Conclusion

Our analysis suggests that high unemployment rates in Europe can be attributed to the adverse incentive effects of generous welfare programs in times of economic turbulence. According to this view, the smooth performance of the European welfare states up to the 1970s was due to tranquil economic times, while the current unemployment crisis has been brought about by a change in the economic environment that required increased adaptability of the workers forced to change jobs. Since generous benefits based on past earnings greatly diminish the incentives for individual workers to accept a transition to a new job, where skills once again have to be accumulated, our model predicts a high incidence of long-term unemployment in the welfare states. In fact, more than half of all those currently unemployed in Europe have been out of a job for more than a year.

Our analysis highlights the need to reform European social insurance programs. This is a real challenge, because a more turbulent economic environment has both reduced the effectiveness of existing social safety nets and increased the perceived need for social insurance. But the fact remains that it is more important than ever to incorporate incentives to work in the design of social safety nets. Failure to do so threatens to produce high and long-term unemployment and needlessly to waste human capital.

NOTES

[1]This article summarizes our research on European unemployment, and a more detailed account can be found in Ljungqvist and Sargent (1995).

[2]The notion of unemployment compensation should be interpreted broadly in our framework. The welfare states have various programs assisting individuals out of work. For example, totally disabled persons in the Netherlands in the 1980s were entitled to 70 percent (80 percent prior to 1984) of last earned gross wage until the age of 65—after which they moved into the state pension system. At the end of 1990, disability benefits were paid to 14 percent of the Dutch labor force and 80 percent of them were reported to be totally disabled. (See Organization of Economic Cooperation and Development 1992).

[3]In contrast to our labor supply explanation, earlier theories of European unemployment have focused on a shortfall in the demand for labor due to insufficient aggregate demand (Blanchard et al. 1986), trade union behavior driven by insider–outsider conflicts (Blanchard and Summers 1986; Lindbeck and Snower 1988), hiring and firing costs (Bentolila and Bertola 1990), and capital shortages (Malinvaud 1994). Our analysis will instead bear out the assertion by Layard, Nickell, and Jackman (1991, p. 62) that the "unconditional payment of benefits for an indefinite period is clearly a major cause of high European unemployment." However, our model differs sharply from their framework, which emphasizes hysteresis and nominal inertia in wage and price setting.

[4]Formally, the conditional expectation of wages exceeding a reservation wage, $\bar{w}$, is given by

$$E_{\bar{w}}(w) = \frac{\int_{\bar{w}}^{\infty} w f(w)dw}{(1 - F(\bar{w}))},$$

where $f(w)$ is the probability density function for wage offers, and $F(\bar{w}) = Prob(w \leq \bar{w}) = \int_0^{\bar{w}} f(w)\,dw$ is the cumulative density function.

[5]A troublesome feature of the basic search model is the existence of the always rejected part of the wage distribution beneath the reservation wage. The presence of such offers justifies the time the worker waits for higher ones. But if such offers are always rejected, why do firms continue to make them? This conceptual problem has been circumvented by reinterpreting the *wage* as an overall measure of worker–firm job match quality. Many features influence the quality of matches between heterogeneous collections of workers and jobs. The idea is to reinterpret the wage as a match parameter that aggregates these diverse features of a job–person match. Thus, a worker–firm pair is actually *jointly* drawing a match quality each time an unemployed worker receives a job offer. We still interpret this parameter as the wage of the worker, but regard it as compensation for a particular match quality. This interpretation leaves room for offers that are rejected by one worker to be accepted by another, because they are different matches.

[6]For a detailed discussion of all parameter values in our model, see Ljungqvist and Sargent (1995).

[7]Workers who have quit their jobs and new entrants to the labor market are not entitled to any benefits in our model. Moreover, the insured unemployed workers are disqualified from receiving benefits if they are discovered turning down job offers that would have earned them at least as much as their current unemployment compensation.

[8]We assume that the extra government expenditures on unemployment compensation in the WS economy are financed by levying lump-sum taxes, that is, nondistortionary taxes.

[9]The tranquil economic environment has a zero variance according to our definition of economic turbulence. Recall that our earlier assumption was that a newly laid off worker kept his or her skills from the last period of employment.

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