European Unemployment: From A Worker's Perspective

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Abstract:

After several decades of low unemployment rates and low mean durations of unemployment, European countries experienced high rates and average durations of unemployment during the 1980's and 1990's. We impute these outcomes to the effects of increasing economic turbulence confronting displaced workers combined with the incentive effects on labor supply of generous European unemployment compensation systems. We use a general equilibrium search model where workers accumulate skills on the job and lose skills during unemployment. To highlight the forces at work, we perform an artificial natural experiment by comparing the decisions and life-time employment experiences of two initially identical workers. Although subjected to identical shocks, they make different decisions because they confront different unemployment compensation systems.

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1. Introduction

This paper summarizes and extends our supply side explanation of two striking patterns in unemployment for Europe and the rest of the OECD (see Figure 1 and Table 1).[1] First, average unemployment performances for Europe were similar to the rest of the OECD during the nineteen sixties and seventies, but since the eighties unemployment in Europe has persistently exceeded the average unemployment rate in the OECD by around two percentage points. Several European countries have in fact seen their unemployment rates double between those periods. Second, since the eighties, the average *duration* of unemployment spells in Europe has greatly exceeded that in the rest of the OECD. We attribute these patterns to the incentive effects on labor supply of the far more generous unemployment compensation arrangements in Europe.[2]

Our explanation of the broad patterns is in terms of how shocks and institutions shape workers' incentives to supply labor: random *shocks* that end workers' jobs and diminish their human capital when jobs end, and public *institutions* that subsidize unemployed workers. We confront 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 for the rest of the OECD. We attribute the rise in unemployment in Europe after 1980 to a change in the environment that raised the value of adaptability by workers who are forced to change

[1] This paper builds on Ljungqvist and Sargent (1998), which contains a rigorous description of our model.

[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 % (80 % 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 % of the Dutch labor force and 80 % of them were reported to be totally disabled. (See OECD, 1992b.)

jobs by changing conditions. During the more tranquil times before 1980, there was a less role for adaptability, so that then a generous unemployment compensation system was consistent with similar unemployment rates that would have been observed with little or no assistance to the unemployed. However, when the required adaptability increased after 1980, that generous unemployment compensation system propelled European economies into persistently high unemployment.[3]

Long-term unemployment is the heart of the European unemployment problem. According to Table 1, workers unemployed for one year or more today constitute around half of all unemployment in the European OECD countries. This stands in sharp contrast to earlier decades that saw much lower long-term unemployment and also a lower duration of unemployment. Sinfield's (1968) study established that, except for Belgium, long term unemployment was not much of a problem in Europe in the 1960s. Defining 'long-term' as six months and over, Sinfield concluded that long-term unemployment typically affected half a percent of a country's labor force. In countries such as former West Germany and the Scandinavian countries, it was less than two tenths of a percent.

2. A Search Model of Unemployment

To study the level and duration of unemployment, we use a 'lake and streams' model (see figure 6 below for an example with several lakes). We posit enough lakes and streams, i.e.,

[3] In contrast to our labor supply explanation, early theories of European unemployment 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, page 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. Independently of our work, Bertola and Ichino (1995) pursued the same idea that increased economic turbulence might explain the outbreak of high European unemployment but once again their mechanism hinged on rigid wages and high firing costs that reduced labor demand. Since then, there have been several studies focusing on the interaction between a change in the economic environment and welfare-state institutions, and some of those have emphasized negative labor-supply effects of generous benefits, e.g., Mortensen and Pissarides' (1999) model of skill-biased technology shocks. However, these models commonly fail to produce long-term unemployment or falling hazard rates of individual unemployed workers, features that we think are crucial for understanding high European unemployment.

states, to capture what we see as important aspects of the situation confronting European workers. We begin with McCall's simple two-lake, two-streams (two state) model, then describe our extensions of it.

The McCall worker

A simple version of John McCall's (1970) search model sees workers moving between the two states of being employed and being unemployed. Each state defines a 'lake'. The flows between them define 'streams'. At the beginning of each period that he is unemployed, a worker receives one offer to work at a job with a fixed wage drawn from a time-invariant cumulative distribution function $F(w)$. He can take or leave the offer, with no opportunity to recall rejected offers. Successive draws from F are independent. At the beginning of each period that he is employed, the worker is exposed to a probability $\lambda \in (0,1)$ of being cast into unemployment that period. If the worker lives forever and sets reservation wage $\overline{w}$ for accepting wage offers, he spends a fraction

$$U = \frac{\frac{1}{1-F(\overline{w})}}{\frac{1}{\lambda} + \frac{1}{1-F(\overline{w})}}, \tag{1}$$

of his life unemployed. In this two state model, workers have average spells of employment of $\frac{1}{\lambda}$ and average spells of unemployment of $\frac{1}{1-F(\overline{w})}$. If the economy is populated by a fixed large number of *ex ante* identical such workers who make independent draws from the wage offer distribution F and the Bernoulli job-extinguishing distribution with parameter λ, then U is also the aggregate unemployment rate in every period. Thus, equation (1) justifies an analysis of the unemployment rate, like the one of Layard, Nickell, and Jackman (1991) described below, in terms of an entry rate into unemployment λ and a mean duration of unemployment $\frac{1}{1-F(\overline{w})}$. Given the wage distribution F, both the level and duration of unemployment are influenced by the reservation wage $\overline{w}$.

McCall theorized about how workers choose $\overline{w}$. McCall derived a Bellman equation for the reservation wage $\overline{w}$, above which all wage offers are accepted. For the present setting with firing probability λ, the reservation wage $\overline{w}$ satifies

$$\frac{\overline{w} + \beta\lambda Q}{1-\beta(1-\lambda)} = b + \beta Q$$

where b is the level of unemployment compensation, β is a discount factor, and Q is the optimal value of the expected discounted income of an unemployed worker who is about to draw a wage offer. The worker accepts all wage offers above $\overline{w}$ and rejects all those below it. In turning down a wage offer, the worker preserves the opportunity to look for a better job. McCall thus showed how the reservation wage is influenced by the distributions F and λ, as well as by any unemployment compensation to which the unemployed worker might be entitled.

When coupled with the above equation for U, McCall's theory of $\overline{w}$ completes what Lucas called a "prototype (at least) of a theory of unemployment". (Lucas, 1987, p. 56). Lucas praised McCall's model for the way it invites criticism: "in so criticizing McCall's model, we are ... really thinking about what it is like to be unemployed ... Questioning a McCall worker is like having a conversation with an out-of-work friend: 'Maybe you are setting your sights too high', or 'Why did you quit your old job before you had a new one lined up?' This is real social science: an attempt to model, to *understand*, human behavior by visualizing the situations people find themselves in, the options they face and the pros and cons as they themselves see them." (Lucas, 1987, p. 56)

We seek conversations with two McCall workers: one who lives under Europe's generous unemployment compensation system and another his American clone who experiences identical shocks but confronts the opportunities offered by stingy unemployment compensation arrangements. We extend McCall's model to enable us to have these conversations.

At every moment in the basic McCall model, all employed workers are alike, and all unemployed workers are alike. To explain the observations on European unemployment, Ljungqvist and Sargent (1998) extended the basic model to make employed and unemployed workers heterogeneous both with respect to their skills and with respect to the unemployment compensation to which they are entitled. We use that heterogeneity to model how Europe's generous systems of unemployment compensation influence the level and the duration of unemployment.

3. Empirical patterns to be linked

This section sketches some evidence about the structure of recent European unemployment and the relative generosity of European unemployment compensation. It then turns to evidence that we interpret as indicating that the environment confronting workers has become more turbulent in the last couple of decades, exposing them to larger probable losses of valuable skills on those occasions when their jobs terminate.

Decomposition of unemployment

As equation (1) indicated, an unemployment rate can be analyzed in terms of an inflow rate and an average duration of unemployment. As summarized by Layard, Nickell and Jackman (1991), the rise in European unemployment is mainly caused by an increase in the duration of unemployment while the inflow rate has been roughly constant. This phenomena is illustrated in Figure 2 for Britain (panel (b)), while the U.S. (panel (a)) shows a trend in neither the average duration nor the inflow rate. Layard, Nickell and Jackman continue with the observation that the average duration of unemployment does not capture the huge variation in the length of spells of unemployment. Figure 3 reproduces their data for the distribution of male unemployment experience in Britain in 1985. Panel (a) shows the proportion of a cohort of entrants into unemployment that remains unemployed as time passes, panel (b) reports the proportion of the cohort leaving unemployment in each quarter (the slope of panel (a)), and panel (c) depicts the corresponding outflow rate (panel (b) as a proportion of panel (a)). The outflow rate, or the 'hazard rate', is the proportion of survivors to each duration that leave unemployment in the subsequent quarter. The figure shows starkly how the outflow rate in Britain is much lower at the longer durations.

Generosity of unemployment benefits

It is difficult to provide a summary measure of a country's 'replacement rate', i.e., the proportion of lost income from work which is replaced by unemployment compensation and related welfare benefits. The benefits come not only from different programs such as housing benefits, but also depend on specific personal and family characteristics of the unemployed. The OECD has launched a project to gather relevant data and construct replacement rates comparable across countries. Martin (1996) reports the OECD's computations of the welfare benefits available to the average 40-year-old worker with a long period of previous employment. Depending on family status, Table 2 shows net unemployment benefit replacement rates after tax and housing benefits. The U.S. stands out in the table with hardly any benefits after the first year of unemployment while the European countries have replacement rates around 70 % even in the fifth year out of work.

Turbulence

It is a widely held notion that the economic environment has become more turbulent in the two last decades. OECD (1994, pages 29–30) 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 favourably; trade and payments systems were progressively liberalised, 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 per cent of OECD-area GDP, and each sending large relative price changes through all OECD economies. Exchange rate 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 liberalisation and product market deregulation which greatly enhanced the potential efficiency of OECD economies, and also accelerated 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 globalisation."

The sense of turbulence relevant for us must manifest itself in terms of larger volatility of workers' earnings. Gottschalk and Moffitt (1994) provide empirical evidence of such an increase. For the two periods 1970-78 and 1979-87, they summarized U.S. earnings distributions in ways that led them to conclude that both the 'permanent' and 'transitory' components of the distributions had spread out from one subperiod to the next. In particular, using data from the Michigan Panel Study on Income Dynamics (PSID), Gottschalk and Moffitt computed an individual's average earnings for each subperiod to arrive at an estimate of the individual's permanent earnings. Figure 4a shows the distribution of individuals' permanent earnings in the two subperiods. Gottschalk and Moffitt also computed the variance of an individual's income fluctuations, or transitory earnings, around his or her permanent earnings. The distribution of the standard deviations of transitory earnings in the two subperiods is depicted in Figure 4b. As can be seen, the dispersion of *both* permanent earnings and the standard deviations of transitory earnings have increased in 1979-87 compared to 1970-78. Gottschalk and Moffitt, and their discussants (see Katz (1994) and Dickens (1994)) interpreted these statistics in terms of how the increase in the dispersion of earnings observed during the 1980's in the U.S. was accompanied by an increase in the intertemporal volatility of an individual's earnings.

We want to interpret the volatility of earnings studied by Gottschalk and Moffitt partly in terms of a destruction of a worker's human capital that occurs at the time of a job termination. A study that provides evidence of that substantial human capital followed job destruction in the U.S. is by Jacobson, LaLonde, and Sullivan (1993), who found that long-tenured displaced workers experienced large and enduring earnings losses. In their Pennsylvania sample from the 1980's, a displaced worker experienced the following typical pattern: a sharp drop in earnings in the quarter a job was left, followed by a rapid recovery during next couple of years toward an eventual level of about 25 % less than earned at the pre-displacement job. Figure 5 reproduces Jacobson, LaLonde, and Sullivan's Figure 1 which dramatically displays the pattern by showing the disparate expected earnings patterns of long-tenured workers who were displaced in the first quarter of 1982 compared to workers who remained employed throughout the period.

Evidence in the style of Jacobson, LaLonde and Sullivan is especially relevant to us because we model economic turbulence in terms of the risk of losing skills at the time of a layoff. The next section describes a search model of the labor market with such a skill technology, and the assumption that unemployment benefits are determined by workers' past earnings. In Ljungqvist and Sargent (1998), we showed that our model of increased turbulence can produce outcomes for earnings processes that mimic the findings of both Gottschalk and Moffitt and Jacobson, LaLonde, and Sullivan.[4] In this paper, our approach is to take a more personal approach and to study the life histories of two workers who are identical in all respects except for the institutions governing unemployment compensation under which they live. We do that in section 5. In addition, simulations presented in section 6 show that a generous replacement rate for unemployment makes the unemployment rate, the mean duration of unemployment and the incidence of long-term unemployment very sensitive to the amount of economic turbulence.

4. A Multi-State Model of a European McCall worker

We have added three features to the basic McCall search model:[5] (1) In period $t+1$, an unemployed worker receives an offer drawn from c.d.f. F with a probability $\pi(s_t)$ that depends on the a variable search intensity s_t chosen at time t at cost $c(s_t)$; (2) The worker's earnings on a job are the product of his initial wage draw w and his level of skill h_t. Skill stochastically accumulates or depreciates at rates depending on whether the worker is employed or unemployed. In particular, we assume that work experience makes skills accumulate while unemployment makes them depreciate. (3) Unemployment compensation is based upon the unemployed worker's last earnings on a job.

To represent turbulence, we allow for the possibility that a worker instantaneously loses some skills at the time of being laid off. Such a loss reflects that some skills are job specific, and that those skills become obsolete especially quickly in times of industry restructuring. We capture economic turbulence in our analysis by changing the amount of instantaneous skill losses. A more turbulent economic environment in our model is tantamount to making

[4] See Figures 14 and 15 of Ljungqvist and Sargent (1998).

[5] Like McCall's model, ours assumes that the wage offer completely characterizes the job.

workers face larger risks of skill loss at times of layoff. Regardless of any such skill loss, laid off workers are entitled to unemployment compensation as a fraction of their lost earnings.

Details of environment

There is a continuum of workers with geometrically distributed life spans, indexed on the unit interval with births equaling deaths. An unemployed worker in period t chooses a search intensity $s_t \geq 0$ at a disutility $c(s_t)$ increasing in s_t. Search may or may not generate a wage offer in the next period. With probability $\pi(s_t)$, the unemployed worker receives one wage offer from the distribution $F(w) = \text{Prob}(w_{t+1} \leq w)$. With probability $(1 - \pi(s_t))$, the worker receives no offer in period $t+1$. We assume $\pi(s_t) \in [0, 1]$, and that it is increasing in s_t. Accepting a wage offer w_{t+1} means that the worker earns that wage (per unit of skill) for each period he is alive, not laid off, and has not quit his job. The probability of being laid off at the beginning of a period is $\lambda \in (0, 1)$. In addition, all workers are subjected to a probability of $\alpha \in (0, 1)$ of dying between periods.

Employed and unemployed workers experience stochastic accumulation or deterioration of skills. There is a finite number of skill levels with transition probabilities from skill level h to h' denoted by $\mu_u(h, h')$ and $\mu_e(h, h')$ for an unemployed and an employed worker, respectively. That is, an unemployed worker with skill level h faces a probability $\mu_u(h, h')$ that his skill level at the beginning of next period is h', contingent on not dying. Similarly, $\mu_e(h, h')$ is the probability that an employed worker with skill level h sees his skill level change to h' at the beginning of next period, contingent on not dying and not being laid off. In the event of a lay off, the transition probability is given by $\mu_l(h, h')$. After this initial period of a lay off, the stochastic skill level of the unemployed worker is again governed by the transition probability $\mu_u(h, h')$. All newborn workers begin with the lowest skill level.

A worker observes his new skill level at the beginning of a period before deciding to accept a new wage offer, choose a search intensity, or quit a job. The objective of each worker is to maximize the expected value $E_t \sum_{i=0}^{\infty} \beta^i (1-\alpha)^i y_{t+i}$, where E_t is the expectation operator conditioned on information at time t, β is the subjective discount factor, and $1-\alpha$ is the probability of surviving between two consecutive periods; y_{t+i} is the worker's after-tax income from employment and unemployment compensation at time $t+i$ net of disutility of searching.[6]

Workers who were laid off are entitled to unemployment compensation benefits that are a function of their last earnings. Let $b(I)$ be the unemployment compensation to an unemployed worker whose last earnings were I. Unemployment compensation is terminated if the worker turns down a job offer with earnings that are deemed to be 'suitable' by the government in view of the worker's past earnings. Let $I_g(I)$ be the government determined 'suitable earnings' of an unemployed worker whose last earnings were I. Newborn workers and workers who have quit their previous job are not entitled to unemployment compensation. Both income from employment and unemployment compensation are subject to a flat income tax of τ. The government policy functions $b(I)$ and $I_g(I)$ and the tax parameter τ must be set so that income taxes cover the expenditures on unemployment compensation in an equilibrium.

Let $V(w,h)$ be the value of the optimization problem for an employed worker with wage w and skill level h at the beginning of a period. The value associated with being unemployed and eligible for unemployment compensation benefits is given by $V_b(I,h)$, which is both a function of the unemployed worker's past earnings I and his current skill level h. In the case of an unemployed worker who is not entitled to unemployment compensation, the corresponding value is denoted by $V_o(h)$ and depends only on the worker's current skill level. The Bellman equations can then be written as follows.

$$V(w,h) \;=\; \max_{\text{accept,reject}} \Big\{ (1-\tau)wh \,+\, (1-\alpha)\beta \Big[(1-\lambda) \sum_{h'} \mu_e(h,h')V(w,h') \qquad (2)$$

$$+\, \lambda \sum_{h'} \mu_l(h,h')V_b(wh,h') \Big] \,,\, V_o(h) \Big\} \,,$$

$$V_b(I,h) \;=\; \max_{s} \Bigg\{ -c(s) \,+\, (1-\tau)b(I) \,+\, (1-\alpha)\beta \sum_{h'} \mu_u(h,h') \qquad (3)$$

[6] We have abstracted from the benefits of risk sharing that government policies can provide when capital markets are incomplete. Adding such considerations would modify but not change the flavor of our results.

$$
\begin{aligned}
&\Big[\big(1-\pi(s)\big)V_b(I,h') \;+\; \pi(s)\bigg(\int_{w\ge I_g(I)/h'} V(w,h')dF(w) \\
&+ \int_{w<I_g(I)/h'} \max_{\text{accept,reject}}\Big\{(1-\tau)wh' \\
&+ (1-\alpha)\beta\Big[(1-\lambda)\sum_{h''}\mu_e(h',h'')V(w,h'') \\
&+ \lambda\sum_{h''}\mu_l(h',h'')V_b(wh',h'')\Big]\;,\; V_b(I,h')\Big\}dF(w)\bigg)\Big]\Big\}\,,
\end{aligned}
$$

$$
\begin{aligned}
V_o(h) \;=\; \max_s\Big\{-c(s) \;+\; (1-\alpha)\beta\sum_{h'}\mu_u(h,h')\Big[(1-\pi(s))\,V_o(h') \\
+\; \pi(s)\int V(w,h')dF(w)\Big]\Big\}\,.
\end{aligned}
\tag{4}
$$

Associated with the solution of equations (2)–(4) are two functions, $\bar{s}_b(I,h)$ and $\bar{w}_b(I,h)$, giving an optimal search intensity and a reservation wage of an unemployed worker with last earnings I and current skill level h, who is eligible for unemployment compensation benefits; and two functions, $\bar{s}_o(h)$ and $\bar{w}_o(h)$, giving an optimal search intensity and a reservation wage of an unemployed worker with skill level h, who is not entitled to unemployment compensation. The reservation wage of an employed worker will be the same as for an unemployed worker without benefits, $\bar{w}_o(h)$, since anyone who quits his job is not eligible for unemployment compensation.

Stationary equilibria

We will study stationary equilibria, or steady states, for our economy. A steady state is defined in a standard way, as a set of government policy parameters, optimal policies $(\bar{s}_o(h), \bar{w}_o(h), \bar{s}_b(I,h), \bar{w}_b(I,h))$ and associated time invariant employment and unemployment distributions and total unemployment compensation payments that satisfy workers' optimality conditions and the government's budget constraint. We compute a steady state as a fixed point in the tax rate τ. For a fixed tax rate τ, we solve workers' optimization problem and use the implied search intensities and reservation wages to deduce stationary employment and unemployment distributions, and unemployment compensation. A balanced government budget defines a fixed point in τ, which is associated with a stationary equilibrium.[7] After having found a stationary equilibrium, we compute various quantities such as GNP per capita, average productivity of employed workers, average skill level, average duration of unemployment, and measures of long-term unemployment.

Lakes and streams

As with the basic McCall model described above, we can imagine the labor market as a set of lakes connected by inlet and outlet streams. Figure 6 depicts an example with two possible skill levels. The volume of water in each lake represents the number of people in a particular labor market state (e.g., employed, unemployed and having quit a previous job, unemployed and having been laid off from a previous job, unemployed because of having just entered the labor force), and the flows between lakes represent rates of hiring, firing, and quitting. The system is in a stationary equilibrium when all lake levels are constant over time, which means that inflows just balance outflows for each lake. The rates of inflow and outflow are evidently the critical determinants of the lake levels. The individual search model lends itself to becoming a model of these inflow and outflow rates if we simply reinterpret the probability of job acceptance as determining the *rate* of flow from a state of unemployment to a state of employment.

Skill dynamics

Two sets of parameters mainly drive our results – those giving the skill technology and the unemployment compensation scheme.[8] There are 21 skill levels in our model which evenly span the range $[1, 2]$. Newborn workers are endowed with the lowest skill level equal to one and work experience can at most result in twice that level of skills. The evolution of

[7] The iterative procedure picks the lowest possible τ consistent with a stationary equilibrium. We choose to focus on this the least distortionary tax rate and ignore any higher tax rates that might be consistent with other steady states.

[8] For a detailed discussion of all parameter values in our model, see Ljungqvist and Sargent (1998).

skills while employed is as follows. After each two-week period of employment not followed by a layoff, the worker has a one in ten 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 seven years and eight months to reach the highest skill level. We assume the stochastic depreciation of skills during unemployment to be twice as fast as the accumulation of skills. That is, after each two-week period of unemployment, there is a one in five 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.

In a period of being laid off, we assume that the worker draws a new skill level from one of the distributions in Figure 7. The range of each distribution starts at the lowest possible skill level equal to one, and ends at the worker's skill level before the layoff. In other words, the worker stands to lose some skills immediately; occasionally workers draw a significantly lower skill level, one from the left-hand tail of the distribution. The two distributions in Figure 7 refer to two different degrees of economic turbulence. The distribution indexed by variance .04 corresponds to a more turbulent economic environment since there is a higher probability for large skill losses; that is, the left-hand tail is fatter compared to the distribution indexed by variance .02.

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 both a 70 % replacement rate and a 70 % "suitable earnings" criterion. That is, laid off workers receive unemployment benefits equal to 70 % of lost earnings as long as they do not turn down jobs with earnings greater than or equal to those benefits. The economy with no unemployment insurance is called the laissez-faire (LF) economy.

5. 'Conversations' with two workers

We now follow the lives of one worker in the WS economy and another in the LF economy. The economic environment is taken to be the more turbulent one indexed by variance .04 in Figure 7. The two workers confront identical realizations of individual shocks. Thus, both workers die after 40 years in the labor market. For each two-week period during these 40 years, we draw random realizations of layoff/continuing employment, conditional on employment in the previous period; skill changes (bounded by the permissible skill range $[1, 2]$), conditional on layoff in the current period, continuing employment or unemployment in the previous period; and a search outcome with or without a wage offer, conditional on unemployment in the previous period and chosen search intensity. The two workers share these 40-year long sequences of potential shocks. That is, if both workers were employed in the previous period, they share the same layoff shock in the current period. If they are not laid off, both either retain their skills or gain one skill level depending on another common shock in the current period (the exception being a worker who has already reached the highest skill level). Similarly, if both workers were unemployed in the previous period, both either retain their skills or lose one skill level depending on a common shock in the current period (the exception being a worker who has already reached the lowest skill level). If the workers are laid off in the same period, they face the same draw from the distribution indexed by variance .04 in Figure 7 but their realized absolute skill levels depend on their particular right-hand end points (i.e., skill levels just before the layoff). Moreover, if the two workers find a job in the same period, they will be offered the same wage per unit of skill. The likelihood of generating a wage offer will naturally depend on their search intensities chosen in the previous period.

Since our two workers share the same sequences of potential shocks, they would also experience the exact same lives if they made the same decisions at all points in time. Our assumption of maximizing behavior implies that they *would* make the same decisions if they lived in the same environment, in particular, under the same tax and benefit rules. But the two workers are unlikely to make identical decisions because they live with different institutional arrangements in the WS economy and the LF economy. Figures 8a and 8b show what happens for our particular random draw of shocks. It happens that the two workers do actually make the same decisions during the first 27 and half years in the labor force. After entering the labor market, they both find and accept a job after three months of unemployment. However, their first job lasts less than a year and they experience another spell of unemployment. This time the worker in the WS economy receives unemployment compensation equal to 70 % of his lost earnings (which is not shown in Figure 8 which only depict labor earnings). The workers' second job lasts four years and they accumulate considerable skills before being laid off again and thereby losing some of these skills. Their third job has a very attractive wage per unit of skill and, in a little more than six years, the workers have attained the highest skill level and their labor income is at the top of the earnings distribution.[9]

When the two workers are laid off from their long-tenure job in their 27th year in the labor market, their fates depart dramatically in Figure 8. The worker in the WS economy never again posts any labor earnings while the worker in the LF economy returns to work after four months of unemployment, though at substantially lower earnings. The question is, what goes wrong in the welfare state regime in that unfortunate 27th year? Figure 9 reveals that the workers experience a large loss of skills at the time of the layoff. They lose about 25 percent of their skills. A year after the layoff, the worker in the LF economy starts to rebuild skills in his new job while the unemployed worker in the WS economy continues losing skills. A factor contributing to the inability of the worker in the WS economy to find an acceptable job can be found in Figure 10. The worker sets much higher "reservation earnings" for an acceptable job as compared to the worker in the LF economy. Given a replacement rate of 70 %, the worker in the WS economy is more choosy than his colleague in the LF economy.

In the next couple of years, the worker in the WS economy starts lowering his reservation earnings in Figure 10, so it might seem surprising that he continues to have trouble finding a job. But the reservation earnings is set in relation to the unemployed worker's skills which are also depreciating over time. It is therefore more informative to focus on the "reservation wage" per unit of skill in Figure 11. As can be seen, the worker in the WS economy is not becoming less choosy over time but *more*. The unemployed worker demands higher

[9] Wages per unit of skill are confined to the unit interval and the highest skill level is equal to two, which means that maximum earnings are two.

and higher reservation wages per unit of skill before being willing to surrender benefits that amount to 70 % of past earnings. In other words, the worker is looking for a better and better "match" in the labor market, or wage per unit of skill, to compensate for his depreciating skills. The generous unemployment benefits make him compare any potential job with his past high earnings. Of course, the worker in our model is well aware of the low probability of finding such high wage offers, so it becomes rational for him to invest less in job search. Figure 12 shows a falling search intensity over time for the worker in the WS economy. After about two years of unemployment and fruitless job search, the worker becomes totally disillusioned and withdraws from labor market participation by setting his search intensity equal to zero (but he continues to receive benefits in our model).

6. *Aggregate outcomes*

The simulations of two workers' lives illustrate the economic forces at work in our model. We can gain further insights by exploring the aggregate implications of alternative degrees of economic turbulence. Table 3 reports the steady states for the WS economy and the LF economy when turbulence is indexed by variance 0.02 and 0.04, respectively. The unemployment responds to increased economic turbulence in strikingly different ways in the two economies. When moving from low to high turbulence, the unemployment rate remains roughly constant in the LF economy but doubles in the WS economy. This outcome is consistent with our theory that increased economic turbulence in the 1980's contributed to high unemployment in the European welfare states, while leaving the U.S. unemployment rate unchanged as in Table 1. Moreover, a decomposition of our artificial unemployment data into inflow rates and average duration of unemployment spells produces the same pattern as in Figure 2, provided that we once again let the U.S. approximate a LF economy and Britain represent a WS economy. In our analysis, the inflow rate remains practically constant across different degrees of economic turbulence because we keep the layoff rate λ unchanged. The parameter λ is chosen so that the monthly layoff rate is just above 1.8 %. According to Table 3, the average duration of unemployment remains around two and half months in the LF economy for both degrees of economic turbulence. In contrast, the most turbulent economic environment produces an average duration of about 8 months in the WS economy, which is significantly higher than the three months in less turbulent times.

The worse employment performance of the WS economy arises from the increasing incidence of long-term unemployment. The fractions of long-term unemployed explode in the WS economy when economic turbulence increases in Table 3. The percentage of currently unemployed workers with spells to date of six months or more rises from 18.2 % to 63.1 %. Concerning the percentage of unemployed workers with spells to date of one year or more, the corresponding increase in the WS economy is from 5.8 % to 55.6 %. In the LF economy, the small numbers of long-term unemployed stay virtually unchanged in response to increased economic turbulence.

The problem of long-term unemployment in the WS economy can also be studied in terms of hazard rates. Given the highest degree of economic turbulence indexed by variance 0.04, Figure 13 depicts three graphs for the WS economy corresponding to our Figure 3, which we took from Layard, Nickell and Jackman (1991). Figure 13 from our artificial economy manages to produce the patterns documented by Layard, Nickell and Jackman. Most unemployed workers leave unemployment during the first year of a spell. Thereafter, a significantly lower outflow rate tends to produce very long unemployment spells for the remaining unemployed.

We conclude that moving from a turbulence indexed by variance 0.02 to 0.04, can account quite well for the unemployment experience of Europe (the WS economy) and the U.S. (the LF economy) in the decades before and after 1980, respectively. The question then becomes what is the empirical support for our parameterization of the degree of economic turbulence. Since there are no data on human capital losses at layoffs, we will need to rely on indirect evidence such as observations on labor earnings. As mentioned above, we have earlier shown that our parameterization does in fact produce outcomes for earnings processes that mimic studies in the U.S. of both increased turbulence between the 1970's and the 1980's, and earnings losses of displaced workers.[10] If anything, our artificial earnings data suggest that the mechanism generating high long-term unemployment in our

[10] See Ljungqvist and Sargent (1998) for details.

model operates at much lower levels of economic turbulence than those observed in the U.S.

7. Conclusions and extensions

Having been encouraged by how our model matches some of the facts about European unemployment, we are now refining the model to capture more. In particular, we want to understand: (1) how Europe's unemployment was actually *lower* than America's during the 1950s and 1960s; and (2) how it is *older* workers who are now especially drawn into long term unemployment in Europe. To understand these facts, we proceed in the spirit of Lucas's conversation with a McCall worker and add some more realistic features to the worker's enviroment. First, we add a worker's age as part of the description of his state. To control the dimension of the state, we add a small number of discrete ages, and posit an exogenous stochastic aging process.[11] Second, in the spirit of Ljungqvist and Sargent (1995), instead of being constant during the worker's tenure on a job, we posit that the wage process while employed is a stochastic process. Stochastic 'job reclassifications' confront the employed worker with the decision of staying or quitting. Third, we impose a tax on job destruction, a feature that several writers have emphasized in discussions of European unemployment.[12] These three features are overlaid upon the model described above.

The interaction of a stochastic on-the-job wage with layoffs costs is the key to explaining how unemployment was lower in Europe in the less turbulent environment of the 1950s and 1960s. The model predicts that Europe (modeled as having high unemployment compensation and a high job destruction tax) had a lower unemployment rate than a laissez faire country would have had in that period: with low turbulence, the model predicts that Europe would have lower job destruction rates and longer job tenures than would a country under laissez faire. That lower unemployment might have been purchased at an efficiency

[11] The additional dimension of age adds lakes to the counterpart of Figure 6.

[12] See Ljungqvist (2001) for a critical evaluation of how layoff costs work in several models of the labor market.

cost by making workers stay too long in jobs that had gone sour. An increase in turbulence in the extended model has broader effects than those analyzed in this paper, prompting older workers especially to choose extended periods of unemployment. Thus, we expect to gain further insights from our extended McCall model.

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Table 1: Unemployment and long-term unemployment in OECD

	Unemployment (Per cent)			**Long-term unemployment of six months and over** (Per cent of total unemployment)		
	1974–79[a]	1980–89[a]	1995[b]	1979[c]	1989[d]	1995[e]
Belgium	6.3	10.8	13.0	74.9	87.5	77.7
France	4.5	9.0	11.6	55.1	63.7	68.9
Germany[g]	3.2	5.9	9.4	39.9	66.7	65.4
Netherlands	4.9	9.7	7.1	49.3	66.1	74.4
Spain	5.2	17.5	22.9	51.6	72.7	72.2
Sweden	1.9	2.5	7.7	19.6	18.4	35.2
United Kingdom	5.0	10.0	8.2	39.7	57.2	60.7
United States	6.7	7.2	5.6	8.8	9.9	17.3
OECD Europe	4.7	9.2	10.3	...	...	...
Total OECD	4.9	7.3	7.6	...	...	...

a) Unemployment in 1974–79 and 1980–89 is from OECD, Employment Outlook (1991), Table 2.7.

b) Unemployment in 1995 is from OECD, Employment Outlook (1996), Table 1.3.

c) Long-term unemployment in 1979 is from OECD, Employment Outlook (1984b), Table H.; except for the OECD aggregate figures that are averages for 1979 and 1980 from OECD, Employment Outlook (1991), Table 2.7.

Table 1 (continued)

	Long-term unemployment of one year and over (Per cent of total unemployment)			
	1970[f]	1979[c]	1989[d]	1995[e]
Belgium	...	58.0	76.3	62.4
France	22.0	30.3	43.9	45.6
Germany	8.8	19.9	49.0	48.3
Netherlands	12.2	27.1	49.9	43.2
Spain	...	27.5	58.5	56.5
Sweden	...	6.8	6.5	15.7
United Kingdom	17.6	24.5	40.8	43.5
United States	...	4.2	5.7	9.7
OECD Europe	...	31.5	52.8	...
Total OECD	...	26.6	33.7	...

d) Long-term unemployment in 1989 is from OECD, Employment Outlook (1992a), Table N.; except for the OECD aggregate figures that are from OECD, Employment Outlook (1991), Table 2.7.

e) Long-term unemployment in 1995 is from OECD, Employment Outlook (1996), Table Q.

f) Long-term unemployment in 1970 is from OECD, Employment Outlook (1983), Table 24.

g) Except for year 1995, data refer to former West Germany only.

Table 2: Net unemployment benefit replacement rates[a] in 1994 for single-earner households by duration categories and family circumstances

	Single			**With dependent spouse**		
	First year	Second & third year	Fourth & fifth year	First year	Second & third year	Fourth & fifth year
Belgium	79	55	55	70	64	64
France	79	63	61	80	62	60
Germany	66	63	63	74	72	72
Netherlands	79	78	73	90	88	85
Spain	69	54	32	70	55	39
Sweden[b]	81	76	75	81	100	101
United Kingdom[b]	64	64	64	75	74	74
United States	34	9	9	38	14	14

a) Benefit entitlement on a net-of-tax and housing benefit basis as a percentage of net-of-tax earnings.

b) Data for Sweden and the United Kingdom refer to 1995.

Source: Martin (1996), Table 2.

Table 3: Equilibrium outcomes for the WS economy and the LF economy with different degrees of economic turbulence.

	Degree of economic turbulence			
	.02		**.04**	
	WS	LF	WS	LF
Tax rate (%)	3.88	n.a.	11.69	n.a.
Unemployment rate (%)	7.13	5.81	14.87	5.73
Average duration of unemployment (weeks)	13.7	10.6	31.8	10.7
Percentage of unemployed at a point in time with spells so far $\geq$ 6 months	18.2	8.2	63.1	8.5
Percentage of unemployed at a point in time with spells so far $\geq$ 12 months	5.8	0.6	55.6	0.6

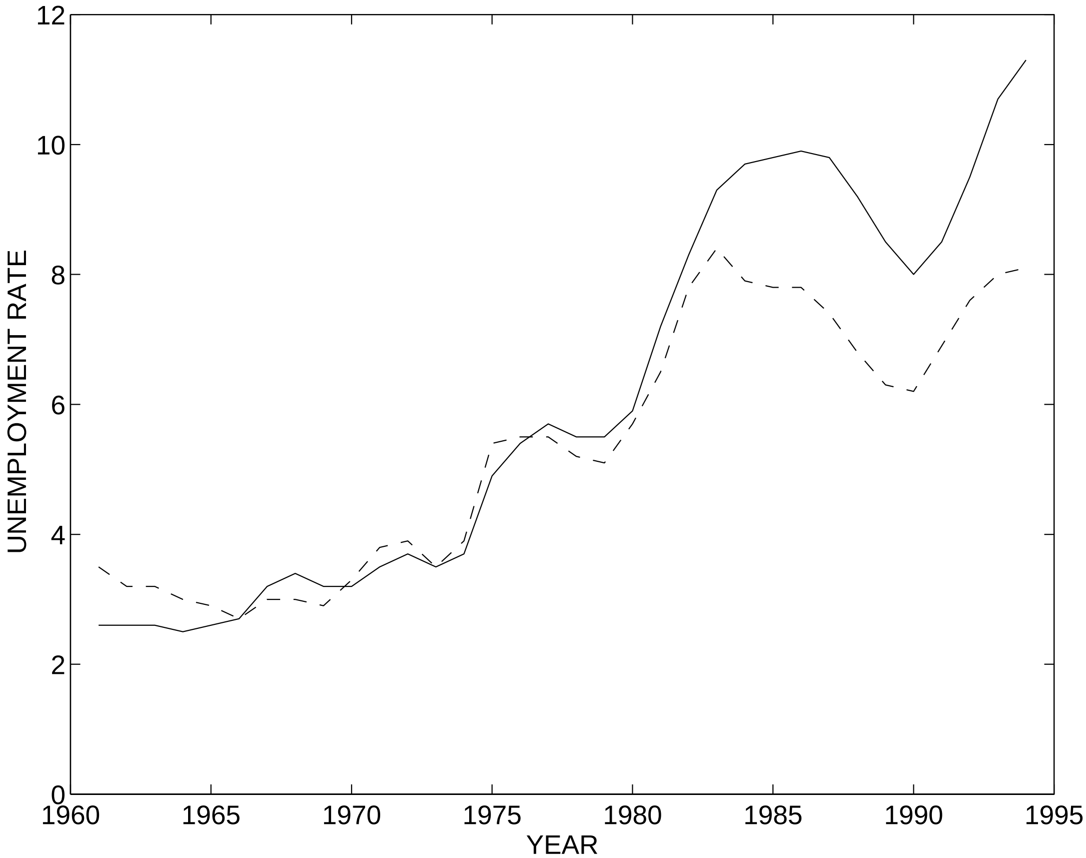

Figure 1. Unemployment rate in OECD as a per cent of the labor force. The solid line is unemployment in the European OECD countries and the dashed line is unemployment in the total OECD. *Source:* Data for 1961–1977 are from OECD (1984a), and data for 1978–1994 are from OECD (1995).

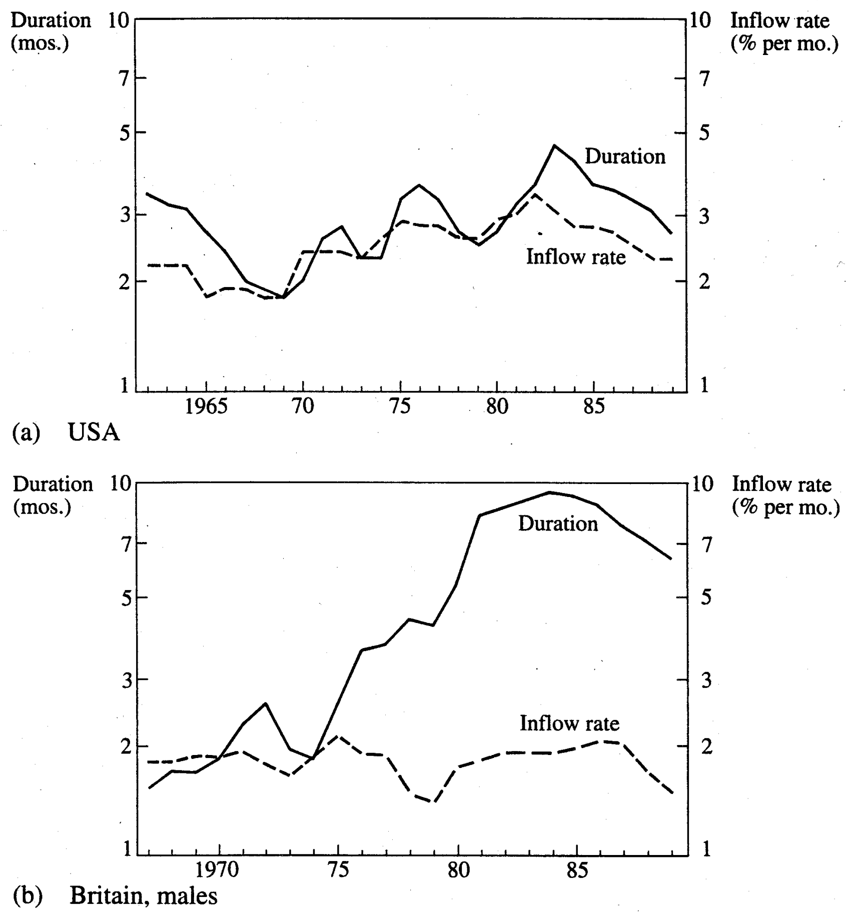

Figure 2. Inflow rates and duration of unemployment: USA and Britain, 1962–1989. Reproduction of Layard, Nickell and Jackman's figure 3 (1991, p. 225).

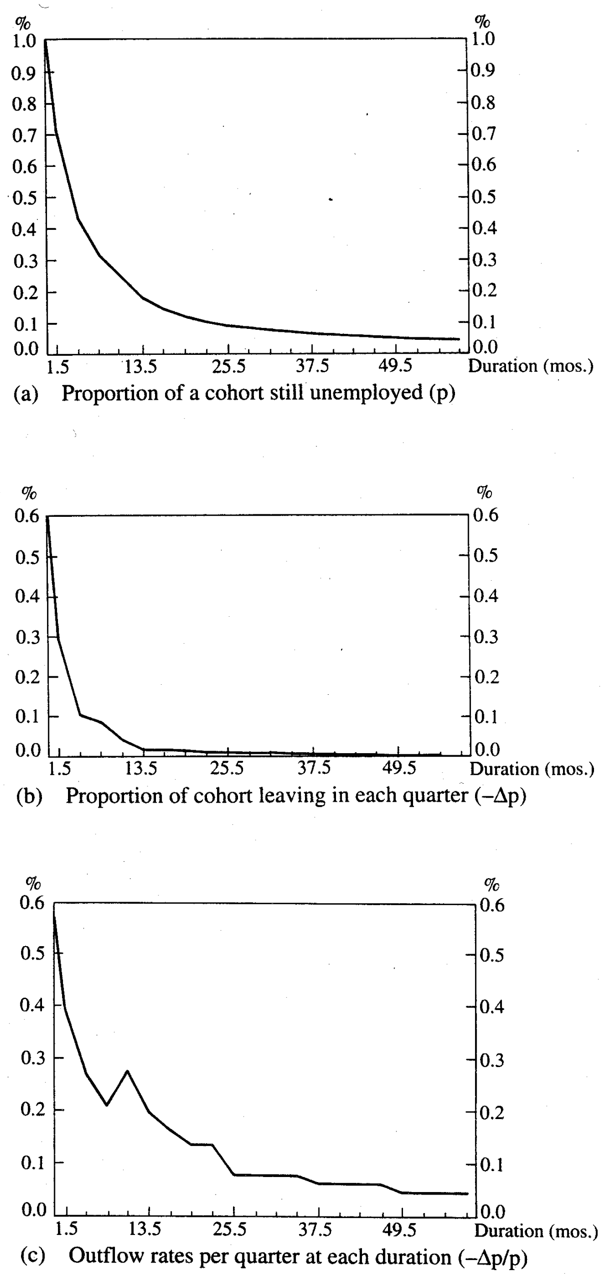

Figure 3. Outflow rates for different durations of unemployment: Britain, males, 1985. Reproduction of Layard, Nickell and Jackman's figure 4, panel c (1991, p. 226).

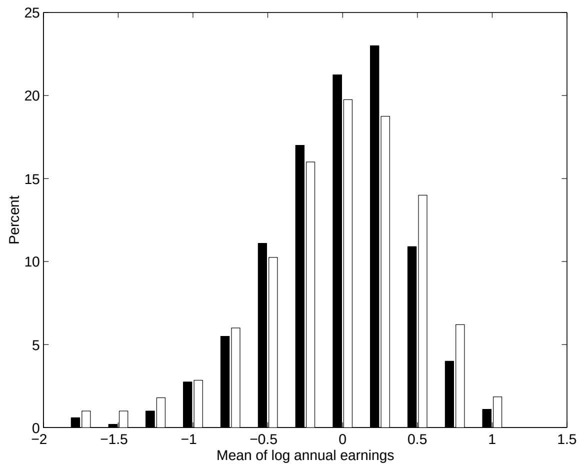

Figure 4a. Distribution of permanent earnings, 1970-78 and 1979-87. Reproduction of Gottschalk and Moffitt's (1994) Figure 2. The black bars correspond to 1970-78, the white bars to 1979-87.

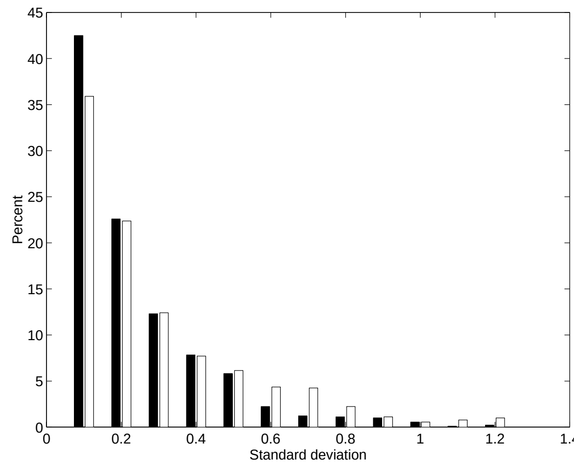

Figure 4b. Distribution of standard deviations of individuals' transitory earnings, 1970-78 and 1979-87. Reproduction of Gottschalk and Moffitt's (1994) Figure 4. The black bars correspond to 1970-78, the white bars to 1979-87.

Figure 5. Quarterly earnings of high-attachment workers separating in the first quarter of 1982 and workers staying through 1986. The solid line refers to stayers, the dashed line separators. Reproduction of Jacobson, LaLonde, and Sullivan's (1993) Figure 1. We have omitted Jacobson, LaLonde, and Sullivan's last observation becauese it is based on too small a sample.

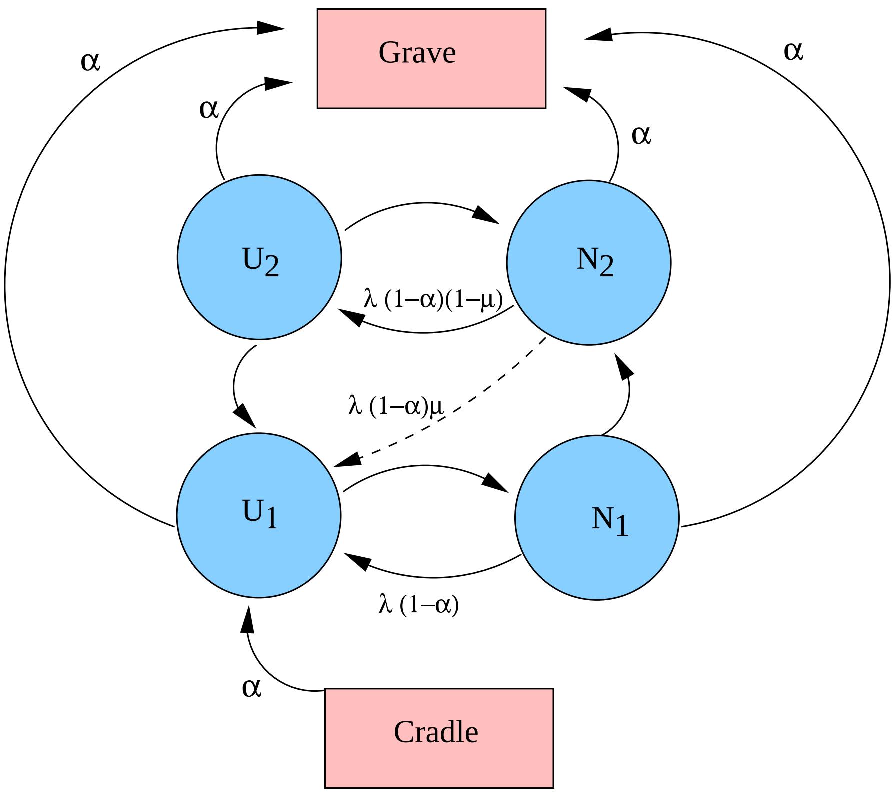

Figure 6. Employment flows and reservoirs in a model with birth/death probability α, layoff probability λ, quitting, and decisions to accept or refuse offers. Here U_1 and U_2 denote pools of unemployed workers of low and high human capital, respectively; N_1 and N_2 measure employed workers of low and high human capital, respectively. The dotted line flowing from the high skill pool of employed people N_2 to the low skill pool of unemployed people U_1 depicts the stochastic depreciation of skills that we use to represent turbulence; conditional on being laid off, the skilled worker's skill level drops from high to low with probability μ. A flow of quitters has been omitted from the graph. Employed workers who gain human capital may choose to quit to seek better-paying jobs.

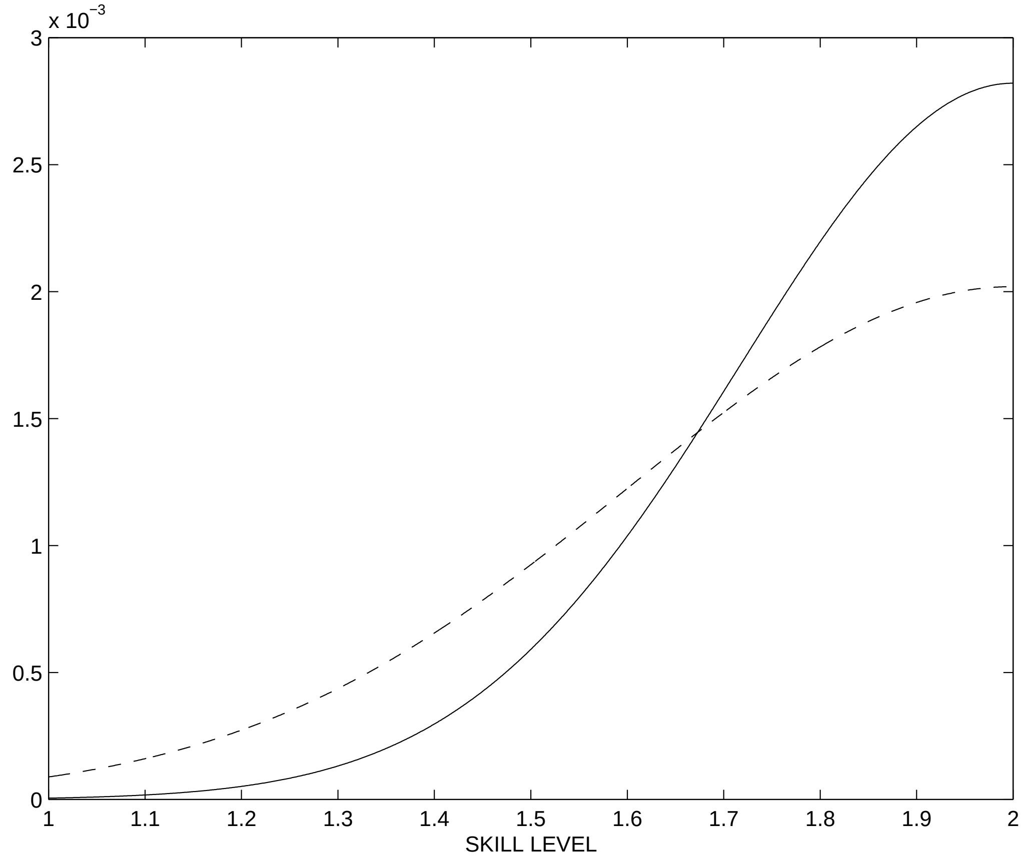

Figure 7. The probability distribution of a worker's skills immediately after a lay off. The range starts at the lowest skill level of 1 and ends at the worker's skill level before the lay off. The graph is drawn for a worker who had attained the highest skill level of 2 before the lay off. The solid line and dashed line refer to different degrees of economic turbulence indexed by variance .02 and .04, respectively.

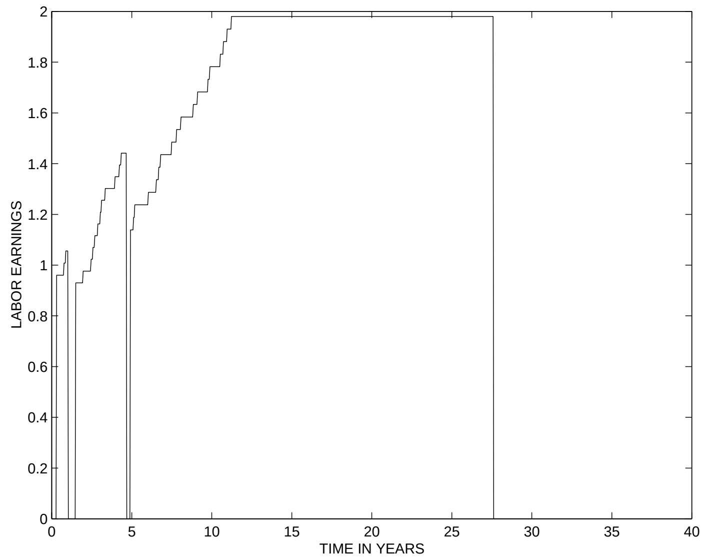

Figure 8a. Simulated labor earnings of a worker in the WS economy.

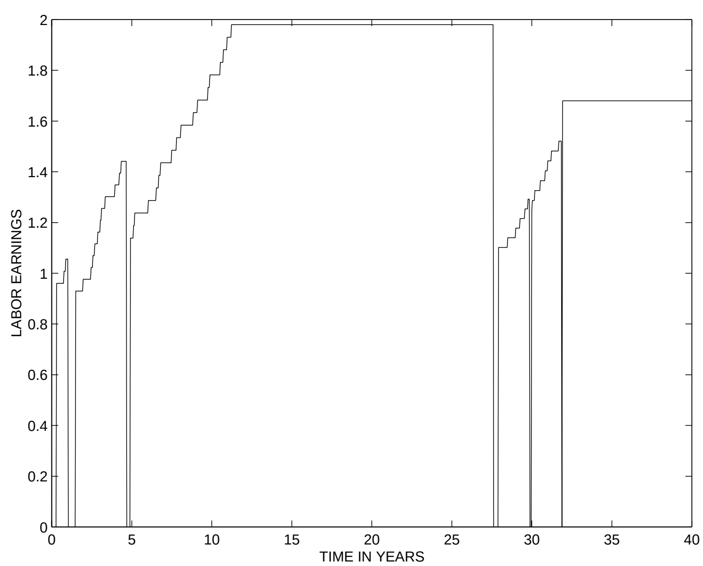

Figure 8b. Simulated labor earnings of a worker in the LF economy.

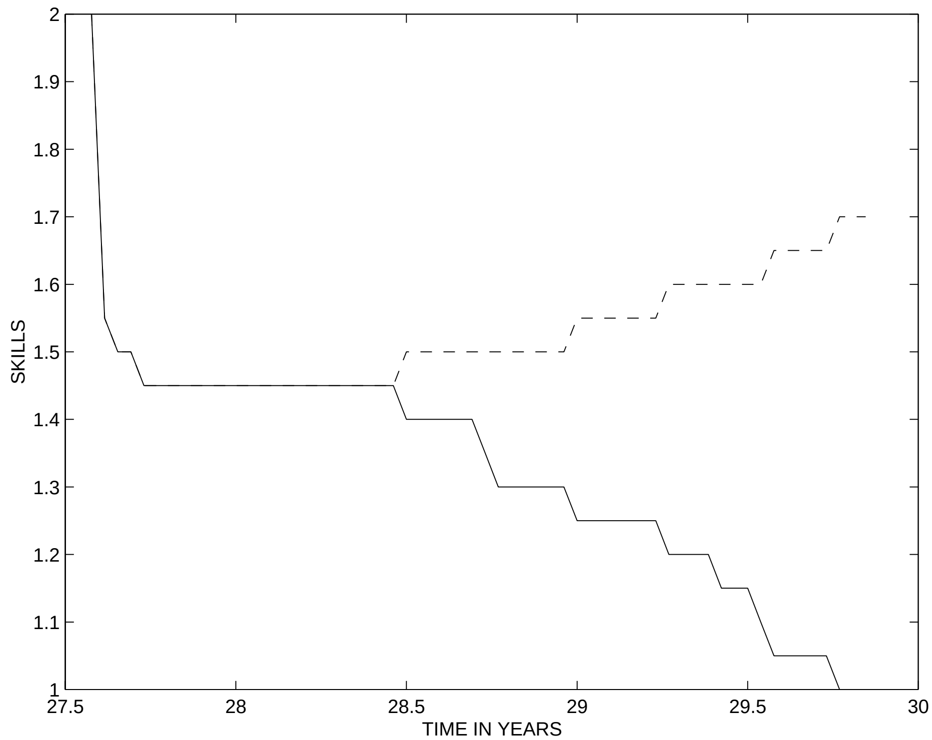

Figure 9. Simulated skills of a worker in the WS economy, solid line; and of a worker in the LF economy, dashed line.

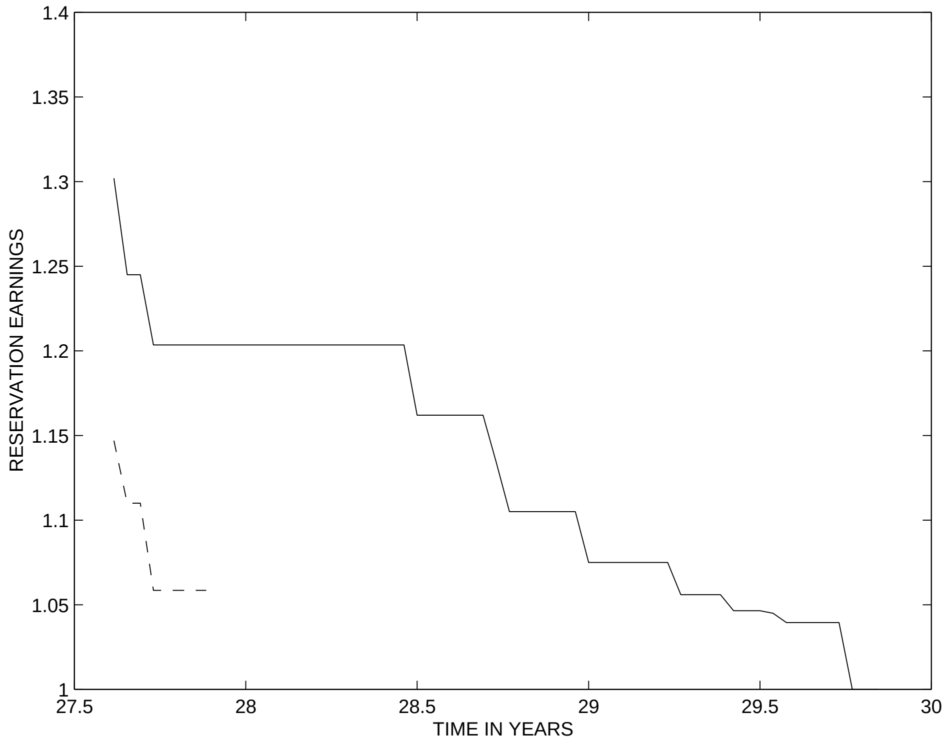

Figure 10. Simulated reservation earnings of a worker in the WS economy, solid line; and of a worker in the LF economy, dashed line.

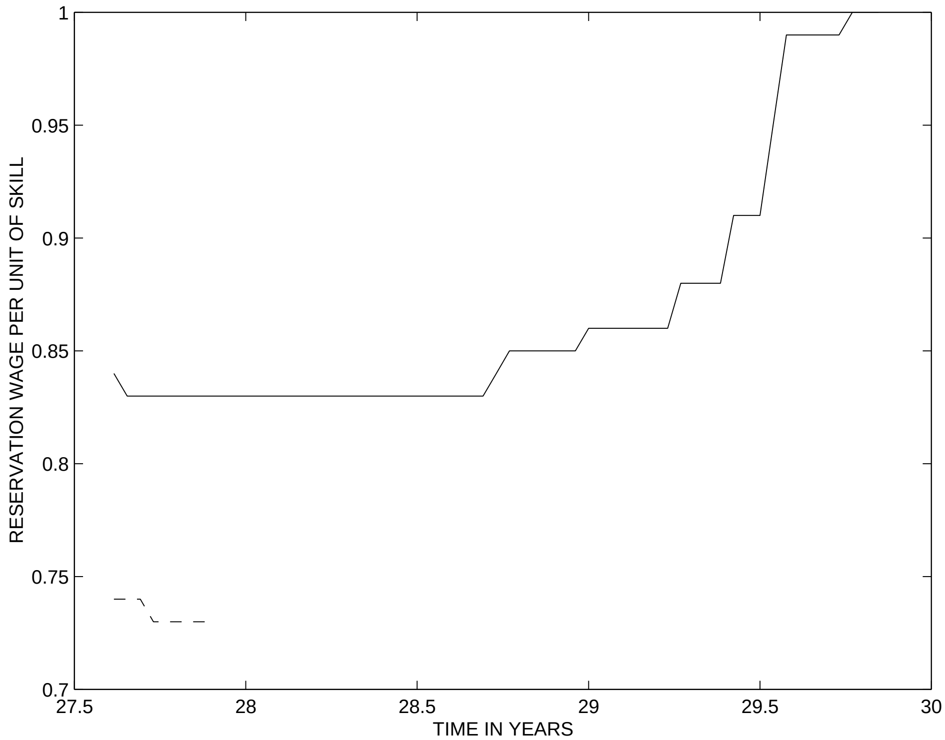

Figure 11. Simulated reservation wage per unit of skill of a worker in the WS economy, solid line; and of a worker in the LF economy, dashed line.

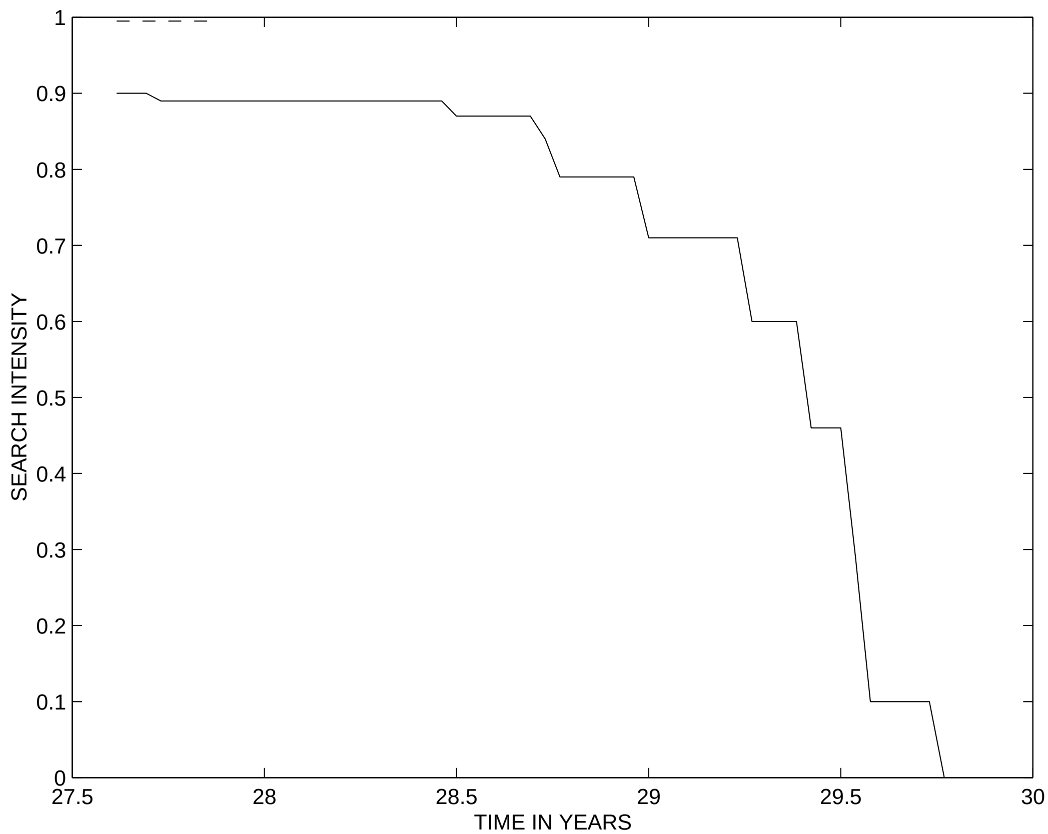

Figure 12. Simulated search intensity of a worker in the WS economy, solid line; and of a worker in the LF economy, dashed line.

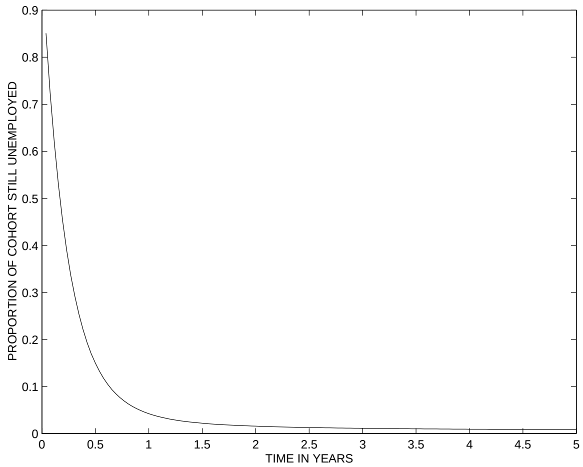

Figure 13a. Proportion of a cohort still unemployed in the WS economy with economic turbulence indexed by variance of .04.

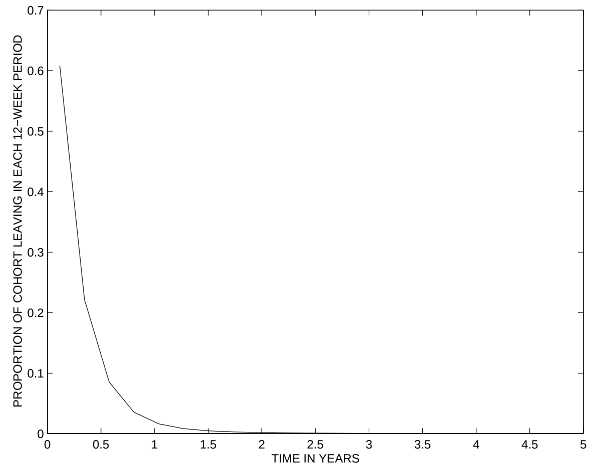

Figure 13b. Proportion of cohort leaving unemployment in each 12-week period in the WS economy with economic turbulence indexed by variance of .04.

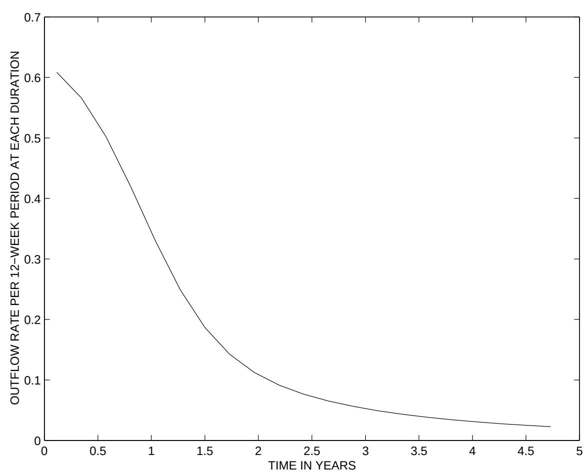

Figure 13c. Outflow rates from unemployment per 12-week period at each duration in the WS economy with economic turbulence indexed by variance of .04.