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THE DURATION OF YOUTH UNEMPLOYMENT IN WEST GERMANY: SOME THEORETICAL CONSIDERATIONS

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ABSTRACT

This paper presents a theoretical model dealing with the duration of youth unemployment in West Germany. Duration can be expressed in terms of the underlying hazard function. After a brief discussion of a reasonable shape of the hazard function a distinction is made with respect to the probabilities of receiving a job offer and accepting it. Determinants of the latter decision are developed using a unified model of consumption, leisure, and job search. Uncertainty and some restrictions such as standard work time and entitlement to unemployment compensation are taken into account. The probability of receiving a job offer depends, among other factors, on the screening process undertaken by the firms.

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> These are the unhappy persons who, in the great lottery of life, have drawn a blank.
>
> Thomas Robert Malthus (1798)

I. Introduction and caveats

The duration of unemployment is one of the most important factors of unemployment experience besides the risk of becoming unemployed and the number of spells of unemployment. A study of youth unemployment in Germany, therefore, has to carefully examine the determinants of the duration of youth joblessness. Previous work has shown [W. Franz(1979)] that the average duration of youth unemployment is considerably shorter than that of adult unemployment. The probability of becoming unemployed, however, is much higher for the youths than for adults. This is not to say that youths do not suffer much from unemployment due to the short duration. At least the number of spells in a given time period, say one year, has to be taken into account in order to compare adequately.

Given that whether to be unemployed or not may be(still) a lottery as Thomas R. Malthus has pointed out, are there biases in the sampling scheme with respect to specific individual characteristics - say education, work experience, age, or sex, for example?

The present paper which is a part of a larger study on youth unemployment tries to outline a theoretical basis for the empirical investigation of the causes of youth unemployment. The empirical part will use German micro data of unemployed persons leaving the unemployment register within a given sample week(September,1976). Although the theory discussed in this paper exceeds the framework of the empirical approach, it does not take into account several important aspects of the duration of youth unemployment due to the limitations of the data. Most important, the general level of aggregate demand for labor is given and only differences of this level with respect to regions, industries etc. can be taken into account partly. It might, therefore, be helpful to label this study by: warning - aggregate demand is given.

II. Theory

In this section a theoretical framework explaining the duration of youth unemployment is developed. A theory of unemployment has to take into account both supply and demand factors.[1] One possible recent approach is to discuss the individual's time allocation decision on the basis of a unified model of consumption, labor supply, and job search such as the sophisticated model of J.J. Seater (1979, 1977), for example, which partly contains most of the earlier micro foundation models as special cases.

One disadvantage of the Seater model, however, is the ignorance of any demand factor since it is assumed that the individual can make a work-no work decision each time period regardless of whether there is a job offer or not. Besides this, there is no uncertainty and no unemployment insurance introduced in this model and the sense of job search during the last job of working life is not quite obvious. Assets are introduced but the individual does not derive utility from asset holding. With respect to youth unemployment there is some doubt if youths apply such a general life-time utility maximization approach. The elegance of that approach may be at the expense of describing reality.

In what follows we try to discuss the duration of youth unemployment considering demand factors, unemployment insurance, and uncertainty more explicitly. To begin with, the duration can be expressed in terms of the hazard function.[2] It is defined as the proportion of items failing in a time period (x, x + dx) among those items which have survived up to the time x.

In our study the hazard function is the proportion of unemployed who left unemployment status in the sample week among all unemployed registered.

More precisely, the hazard function h(x) is defined as

(1) $$h(x) = \frac{d\, F(x)/dx}{1 - F(x)}$$

where F(x) denotes the cumulative distribution function and where 1 - F(x) can be interpreted as the sum of unemployed who "survived" in the unemployment register until x. The function 1 - F(x) is the "reliability" of unemployment and is characterized by the hazard function. Eq. (1) can be written as

(2) $$h(x)\, dx = d\, [\, - \ln(1-F(x)\,)\,].$$

Integrating (2) from a truncation point x_o to a time x gives

(3) $$\int_{x_o}^{x} h(x)dx = - \ln(1-F(x)\,) \Big|_{x_o}^{x}$$

and if we define $F(x_o) = 0$ we obtain

(4) $$\int_{x_o}^{x} h(x)dx = - \ln(1-F(x)\,).$$

Solving (4) for F(x) gives

(5) $$F(x) = 1-\exp \{-\int_{x_o}^{x} h(x)dx\}.$$

A distinguishing characteristic of each life-length model is the underlying hazard function. If we know the hazard function of the unemployed we can calculate the respective duration of unemployment. Hence F(x) describes the distribution of the duration of unemployment. Several hypotheses concerning that distribution may be formulated depending on whether the hazard function is constant or varying with duration.[3] In order to allow flexibility assume that h(x) is of the form

(6) $$h_w(x) = \lambda\, x^{\lambda-1} \sigma^{-\lambda}$$

from which the following two parameter Weibull- distribution results if the truncation point x_o is zero.[4]

(7) $$F_w(x;\sigma,\lambda) = \int_{x_o = o}^{x} f_w\, (x;\sigma,\lambda)\, dx$$
$$= 1-\exp\{\, -(\tfrac{x}{\sigma})\lambda\}$$ [5].

The flexibility of the Weibull- distribution can be shown by reducing the Weibull-variable X by the transformation $Z = X/\sigma$. Hence

(8) $h_w(z;x) = \lambda z^{\lambda-1}$

and h_w decreases (increases) with increasing z when $\lambda<1(\lambda>1)$ and remains constant for $\lambda=1$ (exponential model[6]). Employing eq.(6) we can specify the hazard function by

(9) $\ln h_w(x;\lambda) = \beta Z_{ij}(x)+(\lambda-1)\ln x+\alpha_i$

where $Z_{ij}(x)$ is a vector of explanatory variables of the i-th individual in the j-th spell of unemployment and x is the duration of that spell. The α_i represent individual differences not captured by the Z-variables. If we assume that the explanatory variables do not vary within one spell and simplify notation, eq. (9) reduces to

(10) $\ln h(x)=\beta Z_{ij} + (\lambda-1)\ln x + \alpha_i$.

Although the Weibull-distribution seems to be rather flexible at a first glance, a major disadvantage of an approach using this distribution is the sharp contrast between a rising and a falling hazard function corresponding to the value of λ. Suppose, for example, that an unemployed person does not suffer so much in the first days of unemployment as later. Or suppose the labor office needs some days to complete the unemployed person's records and to propose a job, and another few days pass until the unemployed person starts working. Both examples imply that the hazard function may rise to a peak in the first days and then decrease with time. Opposite to pure reliability application where it is difficult to rationalize such a shape[7], it should not be excluded a priori in the present study. A promising specification, therefore, may rely on the log-normal distribution. The probability distribution function and the cumulative distribution function of a log-normal random variable are given by[8]

(10a) $f_{ln}(x;\mu,\sigma) = \frac{1}{x\sigma\sqrt{2\pi}} \exp\left\{-\frac{1}{2}\left(\frac{\ln x-\mu}{\sigma}\right)^2\right\}$

(10b) $F_{ln}(x;\mu,\sigma) = \frac{1}{\sigma\sqrt{2\pi}} \int_0^x \frac{1}{x} \exp\left\{-\frac{1}{2}\left(\frac{\ln x-\mu}{\sigma}\right)^2\right\} dx$

where $x,\sigma>0$ and ln stands for log-normal. Inserting equations (10a) and (10b) into equation (1) gives the hazard function of this distribution. It can be shown that the hazard function increases to a maximum and then decreases to zero as $x \to \infty$.[9] Employing this type of a hazard function seems to be more appealing than excluding a maximum value of the hazard function a priori.

One should be careful, however, in deciding whether the individual hazard function is constant or not. As has been shown,for example, by S. Salant(1977) and T. Lancaster(1979) an observed falling hazard function may be due to the effect of unrecognized heterogeneity of the individuals in question. They may have in fact a constant hazard function but individuals with high escape rates will tend to be "sorted" out sooner and those individuals with a poor performance will remain. Thus the average hazard function may decline due to heterogeneity although the individual hazard function may be constant over time.

After this brief discussion concerning the distribution of the duration of unemployment the next step is to analyse the explanatory variables of the hazard function. The probability of leaving the unemployment register and being employed in a given time period can be viewed as the joint probability of receiving at least one job offer (=A) and of accepting one job offer(=B). Hence this joint probability is [10]

(11) $p(AB) = p(BA) \cdot p(A)$

The probability of receiving a job offer p(A) has to take into account both general business conditions and individual specific characteristics of the unemployed person seen by the employer. The conditional probability of accepting a job offer represents the choice of the individual whether to work or not, which depends onthe individual's preferences and his budget constraint.

Factors determining the decision whether a job offer is accepted by the unemployed person or not are considered first. Although the above considerations concerning the hazard function suggest a multiperiod framework of the decision process, we restrict ourselves to a two time period model (period t and t + 1) in order to evaluate the effects more clearly. The follo wing considerations, however, may be extended to the life-time model without substantial change to the results.

Consider an unemployed youth at the beginning of period t and suppose he has got a job offer for t but he does not know if he will get one for t + 1. The youth derives utility from consumption (C), measured in goods, and leisure (F), measured in hours, whereas labor (L) and job search (S), both measured in hours, cause disutility. Let $\bar{T}$ be the fixed time at the individual's disposal,[11] which he may spend in L,S, and F with the restriction that

(12) $\bar{T} = L_\tau + S_\tau + F_\tau \quad \tau = t,\ t+1$

The utility function is assumed to be constant over the two periods and specified as

(13) $U[(\tau),\ F(\tau)] = U[C(\tau),\ L(\tau) + S(\tau)] \quad \tau=t,\ t+1$ with $U_C>0$, $U_{C,C}<0$, $U_{L+S}<0$,

$U_{L+S,L+S}<0$. We assume that the utility function satisfies the usual properties.[12] The individual's two period budget constraint includes labor income and unemployment compensation. For the sake of simplicity and taking into account that the individual is a youth we neglect wealth considerations, i.e. the initial and final value of assets equals zero. The youth may, however, make a deficit or a surplus in the first period. With respect to a deficit there may be credit restrictions for an unemployed youth which are neglected here.

The individual faces several requirements concerning the work time and the entitlement to unemployment compensation. These restrictions may be described by the following assumptions.

Assumption A: Consumption must be positive in both periods in order to allow for a minimum consumption. Since the youth is assumed to have no wealth he must work in at least one time period. We can, therefore, distinguish three cases.[13]

Case I: $L_t>0,\ L_{t+1}=0$
Case II: $L_t>0,\ L_{t+1}>0$
Case III: $L_t=0,\ L_{t+1}>0$

Assumption B: All job offers require that the individual must work at least some standard number of hours $\bar{L}$. The individual is allowed to work any amount over $\bar{L}$ within the time restriction given by $\bar{T}$ (eq.12).

Assumption C: The individual receives unemployment compensation only if he has worked before. Assume he is not or no longer entitled to unemployment compensation in the first period, hence he gets unemployment compensation only if $L_t>0$ or, recalling assumption B, if $L_t \geq \bar{L}$. The amount of the unemployment compensation depends on the previous income $w_t L_t$ and the unemployment benefit ratio for the second period ϱ_{t+1}. Besides this, unemployment compensation is of course not available for $L_{t+1}>0$. Hence, the individual may receive unemployment compensation only in case $I(L_t \geq \bar{L}, L_{t+1}=0)$.

Case I: $L_t \geq \bar{L}$, $L_{t+1}=0$, $\varrho_{t+1}>0$

Case II: $L_t \geq \bar{L}$, $L_{t+1} \geq \bar{L}$, $\varrho_{t+1}=0$

Case III: $L_t=0$, $L_{t+1} \geq \bar{L}$, $\varrho_{t+1}=0$

Assumption D: Job search S makes sense only if the individual plans to work in the second period. Clearly, this follows from our limitation to a two period model. In a life-time model job search would also not make sense if the last job of working life is held.

Hence, we obtain finally:

Case I: $L_t \geq \bar{L}$, $L_{t+1}=0$, $\varrho_{t+1}>0$, $S_t=0$

Case II: $L_t \geq \bar{L}$, $L_{t+1} \geq \bar{L}$, $\varrho_{t+1}=0$, $S_t \geq 0$

Case III: $L_t=0$, $L_{t+1} \geq \bar{L}$, $\varrho_{t+1}=0$, $S_t \geq 0$

There may be, however, some doubt if case III is a true choice for the individual since there is no guarantee for a job offer in period t + 1. In order not to be accused of letting the youth starve if he chooses $L_t=0$ but unexpectedly does not get a job offer, we redefine C as consumption exceeding the minimum consumption and assume that the youth really does want to consume more in both periods and therefore must plan to work in at least one period. Hence $\lim_{C \to \bar{C}} U_C = +\infty$ now with $\bar{C}$ the minimum consumption paid by the parents in both periods in any of cases I to III. Alternatively we can assume that the youth will be on a very poor welfare program for period t + 1 if he fails to get a job.

The budget constraint is then given by

(14) $$(1+r_t)(\omega_t^* L_t - p_t C_t) + \omega_{t+1}^* L_{t+1} + q_{t+1}^* \omega_t^* L_t - p_{t+1} C_{t+1} = 0$$

$$\omega_\tau^* = \begin{cases} \omega_\tau & \text{if } L_\tau \geq \bar{L} \\ 0 & \text{otherwise} \end{cases} \qquad \tau = t, t+1$$

$$q_{t+1}^* = \begin{cases} q_{t+1} & \text{if } L_t \geq \bar{L} \text{ and } L_{t+1} = 0 \\ 0 & \text{otherwise} \end{cases}$$

where r is the market interest rate by which the individual may borrow or lend and which is assumed to be constant ($r_t = r$). ω_t is the highest wage offer the individual has received until the beginning of period t. Its determinants are discussed later. ω_{t+1}^* is the wage rate the individual expects to receive in the future. It differs from his current wage ω_t in several ways. As mentioned earlier, the unemployed person may be uncertain if he will get a job offer at the beginning of the second period and how much of the current wage he can achieve. Let u_{t+1} be an additive stochastic disturbance term with $N(0,\sigma^2)$ to formalize this uncertainty. It includes a zero wage offer if $u_{t+1}<0$ is small enough to compensate all other factors determining the future wage rate. Such other factors are expected business conditions B^*_{t+1}, abilities A, and the search duration in period t. The search duration is not assumed to be a necessary condition to get a job offer but is expected to have a positive effect on both the probability of receiving a job offer and the wage rate offered. There may be a negative effect if the search is carried out while unemployed. The employer may view an unemployed searcher as an applicant with less satisfactory potential performance. The unemployed searcher himself may have a weaker position compared with an employed searcher due to a higher readiness to make concessions. In order to take into account this negative effect let D3 be a dummy being 1 for case III (unemployed in period t) and zero otherwise. This dummy variable also takes into account the possibility that in case II the job held in t may be the same which is held in t+1. Hence we expect a higher probability to get a job offer in t+1 if D3 equals zero (case I and II).

(15) $$w_{t+1} = \alpha_1 w_t + g(D3, B^*_{t+1} A, S_t) + u_{t+1}$$

$$D3 = \begin{cases} 1 \text{ if } L_t = 0 \\ 0 \text{ otherwise} \end{cases}$$

The restriction concerning the minimum work time is met by introducing a slack variable $H \geq 0$ with

(16) $$L_\tau - H_\tau = \bar{L} \text{ or } L_\tau = L + H_\tau \quad \tau = t, t+1$$

The question is does the individual choose not to work in one period and to become unemployed, and if he does so which period is the unemployment period. We are especially interested in whether or not the individual, who is assumed to be unemployed before period t, remains unemployed in t. The objective of the individual is to maximize the expected value of utility subject to the constraints.

In general the problem is given by

(17) $$\max_{C_t, H_t, H_{t+1}, S_t} \mathcal{L} = E\{ U[C_t, C_{t+1}, (L+S)_t, L_{t+1}] \}$$

subject to $$C_{t+1} = \left(\frac{1+r}{P_{t+1}}\right)\left(w^*_t L_t - P_t C_t\right) + \frac{w^*_{t+1}}{P_{t+1}} L_{t+1} + \frac{q^*_{t+1}}{P_{t+1}} w^*_t L_t$$

$$w^*_\tau = \begin{cases} w_\tau \text{ if } L_\tau \geq \bar{L} \\ 0 \text{ otherwise} \end{cases} \quad \tau = t, t+1$$

$$w_{t+1} = \alpha_1 w_t + g(D3, B^*_{t+1}, A, S_t) + u_{t+1}$$

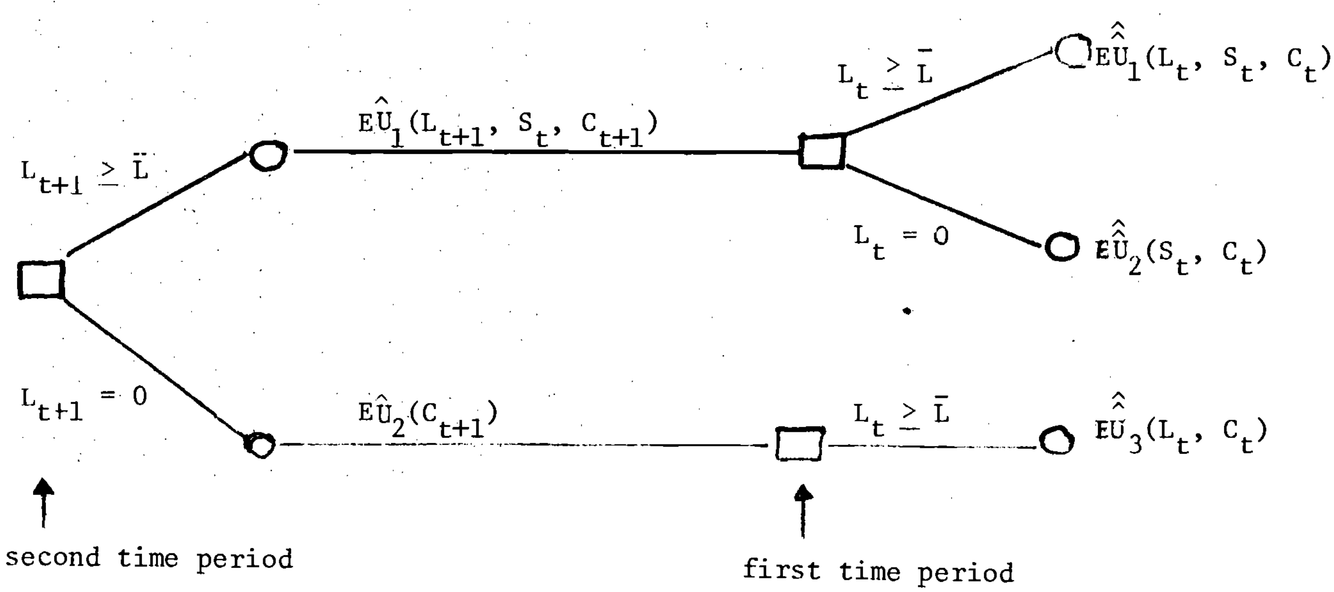
$$L_\tau = \begin{cases} \bar{L} + H_\tau \text{ where } H \geq 0, \bar{L} > 0 \\ 0 \text{ otherwise} \end{cases} \quad \tau = t, t+1$$

$$q^*_{t+1} = \begin{cases} q_{t+1} \text{ if } L_t > 0 \text{ and } L_{t+1} = 0 \\ 0 \text{ otherwise} \end{cases}$$

$$D3 = \begin{cases} 1 \text{ if } L_t = 0 \\ 0 \text{ otherwise} \end{cases}$$

How does the individual make his decision? Note that he cannot maximize expected utility of present consumption, labor, and job search unless he knows the expected utility of the second period. The reason is that he cannot be sure to get a job offer in the second period. Hence the decision of the optimal values of the variables in the present period is conditioned by whether he gets a job offer for the second period or not. Remember, for example, that in order to receive a job offer some search time is useful (see equation 15). The maximal utility of the second period is determined by the amount of C_{t+1}, L_{t+1}, and w_{t+1} and therefore also of S_t because of the relationship between w_{t+1} and S_t. Hence the decision for the first time period requires some information concerning the decision of the second time period. If the individual would reverse the decision process it might happen that he would decide not to search (or only a little bit). But that might imply no job offer which conversely implies work in the first period. Hence the individual must solve his maximization problem in two steps where the first step is to maximize expected utility of the second period.

The procedure can be illustrated by employing a decision flow diagram ("decision tree").[14]



The starting point is the decision whether to work in the second period or not. This decision implies an expected utility of $\hat{U}_1$ and $\hat{U}_2$, respectively. Then the decision for the first time period is made taking into account the results for the second period. The resulting expected utilities of the second step are $E\hat{\hat{U}}_i$, i=1,2,3. The total expected utilities of all three possibilities are

$$EU^{I} = E\hat{U}_2 + E\hat{\hat{U}}_3$$

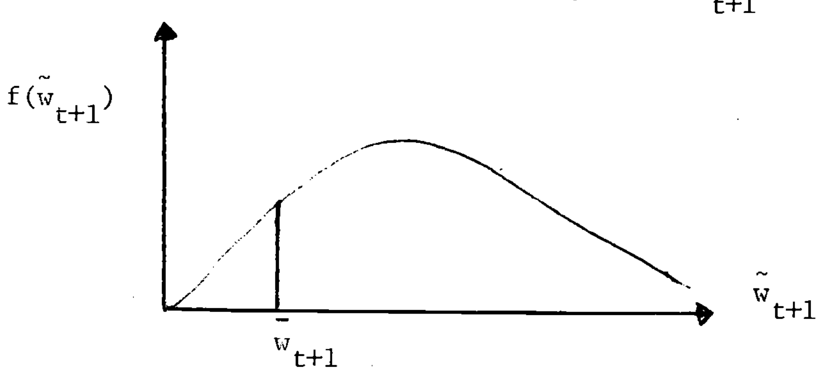
$$EU^{II} = E\hat{U}_1 + E\hat{\hat{U}}_1$$

$$EU^{III} = E\hat{U}_1 + E\hat{\hat{U}}_2$$

The numbers I, II, III correspond to the three cases mentioned earlier.

To avoid possible confusion it should be mentioned again that one ^ means the first step in the decision process which concerns the second time period. The expected utility from working in the second period $E\hat{U}_1$ is discussed first. Recalling equation 15, w_{t+1} depends on several variables including skills, business conditions, job search duration, and whether the job searcher is unemployed or not. Let X be a vector including these determinants and let $\tilde{w}_{t+1}$ be the resulting wage rate which differs from w_{t+1} because of uncertainty.

Suppose that the distribution of $\tilde{w}_{t+1}$ can be approximated by a continuous density function $f\,[\tilde{w}_{t+1}\,(X)]$ **and assume** further that all wages below a given level, say, $\bar{w}_{t+1}$ are non-admissable job offers since the employer must at least pay the negotiated wage rate $\bar{w}_{t+1}$.



Define $f[\tilde{w}_{t+1}(X)] \geq 0$ and

$$\int_0^\infty f[\tilde{w}_{t+1}(X)]d\tilde{w}_{t+1}=1.$$

The probability that the individual receives a job offer is then given by

$$(18) \quad \int_{\bar{w}_{t+1}}^\infty f[\tilde{w}_{t+1}(X)]d\tilde{w}_{t+1}$$

Both the negotiated wage rate $\bar{w}_{t+1}$ and the distribution are assumed to be known to the individual. The uncertainty mentioned above is captured by an additive disturbance term $u_{t+1} \sim N(0, \sigma_u^2)$. Hence

$$(19) \quad w_{t+1} = \tilde{w}_{t+1}(X) + u_{t+1}$$

and the joint density function is given by

$$(20) \quad g[\tilde{w}_{t+1}(X), u_{t+1}] \geq 0, \text{ where}$$

$$(21) \quad \int_0^\infty \int_{-\infty}^\infty g[\tilde{w}_{t+1}(X), u_{t+1}]d\tilde{w}_{t+1}\, du_{t+1}=1$$

If we assume a bivariate normal distribution for $\tilde{w}_{t+1}$ and u_{t+1} with variances σ_w^2 and σ_u^2 and covariance $\rho\sigma_w\sigma_u$ it follows that the joint density function is given by

$$(22) \quad e^{-C}/2\pi\sigma_w\sigma_u\sqrt{1-\rho^2}$$

where

$$C = \frac{1}{2(1-\rho^2)}\left[\frac{(\tilde{w}_{t+1} - \tilde{\tilde{w}}_{t+1})^2}{\sigma_w^2} + \frac{u^2}{\sigma_u^2} - \frac{2\rho u(\tilde{w}_{t+1} - \tilde{\tilde{w}}_{t+1})}{\sigma_w\sigma_u}\right]$$

and where $\tilde{\tilde{w}}_{t+1}$ denotes the mean of $\tilde{w}_{t+1}$. Using expression (22) we are able to calculate the probability that the individual receives a job offer (i.e. $w_{t+1} \geq \bar{w}_{t+1}$). This implies, however, that the individual is willing to accept $\tilde{w}_{t+1} < \bar{w}_{t+1}$ if the probability of a positive error provides that $w_{t+1} \geq \bar{w}_{t+1}$. That means, for example, that he may reduce his job search duration to an amount which -- ceteris paribus -- would imply no job offer ($\tilde{w}_{t+1} < \bar{w}_{t+1}$). But since he views the influences captured by a positive u_{t+1} as certain and strong enough, he nevertheless expects to get a job offer, (i.e. a wage rate $w_{t+1} \geq \bar{w}_{t+1}$). In the latter case, then there would be no need to work in the first period. This, however, would suggest more the behavior of a risk attraction. In the case of more risk aversion we may employ the following approach. Assume a zero covariance, for the sake of simplicity, and rewrite (22) as

$$(23) \quad \int_0^{\infty} g_1[\tilde{\omega}_{t+1}(X)]\, d\tilde{\omega}_{t+1} \cdot \int_{-\infty}^{\infty} g_2(u_{t+1})\, du_{t+1} = 1$$

If the individual is more risk averse the probability of receiving a job offer β may be sufficient to the individual if

$$(24) \quad \beta = \int_{\bar{\omega}_{t+1}}^{\infty} g_1[\tilde{\omega}_{t+1}(X)]\, d\tilde{\omega}_{t+1} \cdot \int_0^{\infty} g_2(u_{t+1})\, du_{t+1}$$

$$= \int_{\bar{\omega}_{t+1}}^{\infty} g_1[\tilde{\omega}_{t+1}(X)]\, d\tilde{\omega}_{t+1} \cdot \int_0^{\infty} \frac{1}{\sigma_u \sqrt{2\pi}} \cdot \exp\left\{ - \frac{u^2}{2\sigma_u^2} \right\} du$$

$$= 0.5 \int_{\bar{\omega}_{t+1}}^{\infty} g_1[\tilde{\omega}_{t+1}(X)]\, d\tilde{\omega}_{t+1} \,.$$

In this case both $\tilde{w}_{t+1}$ and u_{t+1} must have passed threshold value until the individual has a non-zero expectation of a job offer. Since the individual must work in the second time period unless he works in the first period, there is some reason to believe that he may act as a risk averter in the sense mentioned above.[15]

Hence the expected value of the future wage rate is derived in the following manner:

(25)

$$E\left(w_{t+1} \mid \bar{w}_{t+1} \leq w_{t+1}\right) = E\left(\tilde{w}_{t+1} + u_{t+1} \mid \bar{w}_{t+1} \leq \tilde{w}_{t+1} \text{ and } u_{t+1} \geq 0\right)$$

$$= \left\{ \int_{\bar{w}_{t+1}}^{\infty} \tilde{w}_{t+1}\, g_1[\tilde{w}_{t+1}(X)]\, d\tilde{w}_{t+1} + \int_0^{\infty} u_{t+1}\, g_2(u_{t+1})\, du_{t+1} \right\} \Big/ \left\{ 0.5 \int_{\bar{w}_{t+1}}^{\infty} g_1[\tilde{w}_{t+1}(X)]\, d\tilde{w}_{t+1} \right\}$$

$$= 2 \left\{ \int_{\bar{w}_{t+1}}^{\infty} \tilde{w}_{t+1}\, g_1[\tilde{w}_{t+1}(X)]\, d\tilde{w}_{t+1} + \frac{\sigma_u}{2\sqrt{2/\pi}} \right\} \Big/ \int_{\bar{w}_{t+1}}^{\infty} g_1[\tilde{w}_{t+1}(X)]\, d\tilde{w}_{t+1}.$$

Although rather restrictive assumptions have been employed, the description of the decision problem of the youth turns out to be rather complicated. We did not take into account other important features. To give an example, the individual does not correct his estimate of w_{t+1} during the first period. Once he has made his decision he does not revise it. Including this would require an introduction of optimal stopping rules. Besides the increase in mathematical complication of the system there is some justification for not revising the decision if the periods are not too long (a month, for example),[16] and roughly coordinate with the employer's interval of hiring (say the 1st of each month). Therefore we do not proceed in analyzing the stochastic nature of the future wage rate, but continue to derive the expected utilities according to the decision flow diagram.

The utility from working in the second time period $E\hat{U}_1$ is given by

$$(26)\quad E\hat{U}_1 = E\left\{\left[\frac{\partial U(\cdot)}{\partial C_t}/p_t + \frac{\partial U(\cdot)}{\partial C_{t+1}}/p_{t+1}\right]\cdot\left(w_{t+1} \mid \bar{w}_{t+1} \leq w_{t+1}\right) L_{t+1}\right\} + E\left\{\frac{\partial U(\cdot)}{\partial L_{t+1}} L_{t+1}\right\}$$

The first expression is the benefit from working in the second period and the second expression denotes the cost in terms of the (negative) marginal disutility of labor. It can be seen that this expected utility is greater the higher the marginal utilities of consumption and the lower the disutilities of labor and job search. The duration of job search plays an ambiguous role. It raises both the wage in t+1 and the disutility in t. The other explanatory factors and u_{t+1} have an unambiguous effect on $E\hat{U}_1$. The better the business conditions, the more highly skilled the individual is, and the higher the variance of u_{t+1} the more likely is a higher value of $E\hat{U}_1$ provided that the individual gets a job offer. However, the more risk averse the individual is, the smaller will he perceive the probability of a job offer; so there may be no realistic choice whether to work in period t+1 or not. He then may return to the starting point and follow the decision flow diagram for $L_{t+1} = 0$ and $L_t \geq \bar{L}$. On the other hand, if the probability of getting a job offer is certain enough, the individual in a second step makes a choice whether to work in the first time period or not. In each of these cases the expected utility is calculated by adding the (negative) expected disutility of labor to the (positive) expected utility of consumption. Hence

$$(27)\quad E\hat{\hat{u}}_1 = E\left\{\left[\frac{\partial u(\cdot)}{\partial c_t}/p_t + \frac{\partial u(\cdot)}{\partial c_{t+1}}/p_{t+1}\right]\cdot \omega_t L_t\right\} + E\left\{\frac{\partial u(\cdot)}{\partial L_t} L_t\right\} + E\left\{\frac{\partial u(\cdot)}{\partial s_t} s_t\right\}$$

$$(28)\quad E\hat{\hat{u}}_2 = E\left\{\frac{\partial u(\cdot)}{\partial s_t}\cdot s_t\right\}$$

$$(29)\quad E\hat{\hat{u}}_3 = E\left\{\left[\frac{\partial u(\cdot)}{\partial c_t}/p_t + \frac{\partial u(\cdot)}{\partial c_{t+1}}/p_{t+1}\right]\cdot \omega_t L_t\right\} + E\left\{\frac{\partial u(\cdot)}{\partial L_t} L_t\right\}$$

Note that in the case $E\,\hat{\hat{U}}_2$ the individual does not derive utility from consumption financed by work in the first period. As indicated by the flow diagram, however, he may partly shift consumption financed by work in the second period into the first period. The respective utility is included in $E\,\hat{U}_1$.

We must now consider unemployment compensation to which the individual is entitled if he has worked in period t but does not work in t+1. The expected utility resulting from unemployment compensation is therefore included in $\hat{EU}_2$:

$$(30) \quad E\hat{u}_2 = E\left\{\left[\frac{\partial u(\cdot)}{\partial C_t}/p_t + \frac{\partial u(\cdot)}{\partial C_{t+1}}/p_{t+1}\right]\omega_t q_{t+1} L_t\right.$$

By deciding how much to work in the first period the individual therefore has to take into account the benefit resulting from receiving unemployment compensation.

The values for EU^I, EU^{II}, and EU^{III} can be calculated, however, only if the expected optimal values of labor, job search and consumption are known. These values can be obtained by differentiating the Lagrange-function (17) with respect to the decision variables subject to the budget constraint.

$$(31) \quad \mathcal{L}_{C_t}: \quad E\left\{\frac{\partial u(\cdot)}{\partial C_t} - (1+r)\frac{p_t}{p_{t+1}}\frac{\partial u(\cdot)}{\partial C_{t+1}}\right\} = 0$$

This condition holds for all three cases and simply states the well-known result that the ratio of expected future and present marginal utilities of consumption equals the market discount factor provided that the interest rate is known with certainty and the price level is constant.

$$(32) \quad \mathcal{L}_{H_t}: \quad E\left\{\frac{\partial u(\cdot)}{\partial C_{t+1}}\left[\frac{\omega_t}{p_{t+1}}(1+r+q_{t+1})\right] + \frac{\partial u(\cdot)}{\partial H_t}\right\} \leq 0$$

This condition is valid for cases I and II with employment in the first period. It is an inequality because of the constraint $L_t \geq \bar{L}$ and indicates that the individual may not be able to realize the utility maximum of the unconstrained case. The difference between cases I and II is the value of q_{t+1}. It is zero for case II since $L_{t+1} \geq \bar{L}$. In general this condition states the relationship between the expected marginal disutility of present labor and the expected marginal utility of future consumption. A higher current real wage rate and/or a higher unemployment compensation imply higher future consumption and/or a smaller current labor supply.

$$\text{(33)}\quad \mathcal{L}_{S_t}: \; E\left\{ \frac{\partial u(\cdot)}{\partial C_{t+1}} \left[\frac{\partial w_{t+1}}{\partial S_t}/P_{t+1}\right] L_{t+1} + \frac{\partial u(\cdot)}{\partial S_t} \right\} = 0$$

This condition holds with no difference for cases II and III since job search makes sense only if the unemployed plans to work in the second period (assumption D). The higher the amount of planned labor supply (below $\bar{L}$) in t+1 and the more profitable job search (i.e. the greater $\partial w_{t+1}/\partial S_t$), the higher the duration of job search in period t.

$$\text{(34)}\quad \mathcal{L}_{H_{t+1} | w_{t+1} \geq \bar{w}_{t+1}}: \; E\left\{ \frac{\partial u(\cdot)}{\partial C_{t+1}} \cdot \frac{1}{P_{t+1}} \cdot (w_{t+1} | \bar{w}_{t+1} \leq w_{t+1}) + \frac{\partial u(\cdot)}{\partial H_{t+1}} \right\} \leq 0 \; .$$

This inequality holds for cases II and III since in case I labor supply is zero for period t+1. The derivation of $(w_{t+1}|\bar{w}_{t+1})$ has been described above. Note that D3 (whether the job searcher is unemployed or not) is zero for case II and one for case III. The higher $\partial w_{t+1}/\partial D3$ is, the less successful is job search with respect to a higher wage rate the individual expects to receive. Ceteris paribus, however, a higher duration of job search in t means a higher wage rate in t+1, thus enabling the individual to consume more and/or work less as condition (34) indicates. On the other hand, the greater the uncertainty with respect to the likelihood of receiving a job offer, the smaller is the amount of these convenient effects. If the uncertainty is great enough, the individual must switch from cases II and III to case I.

The effects of changes of exogenous variables depend on the values of the parameters of the entire system. To give an illustration, consider case II with labor supply in both periods and assume an increase in the present wage rate. To begin with, condition (32) states that this may lead to a lower current labor supply and/or to a higher future consumption with the amount of both effects depending on the expected marginal (dis-)utilities. Condition (31) states that present consumption will increase, too. In order to satisfy condition (33) the decrease in $\partial U(\cdot)/\partial C_{t+1}$ may cause an increase in the duration of job search since the individual may have free time available from his diminished current employment. The latter effect, however, depends on the planned future labor supply. A higher duration of job search implies a higher future wage rate, ceteris paribus, which has a contrary effect to the decrease in the utility in future consumption due to higher future consumption induced by the increase in the wage rate in the current period. The net effect determines the sign and the amount of the change of future labor supply, which again simultaneously influences the duration of job search according to condition (33).

Although evaluating these effects may be instructive, we are more interested in the question of whether or not the individual switches from one case to another since we want to investigate the determinants whether an unemployed person leaves the unemployment register or not. More precisely, when does the individual switch from remaining unemployed and working in the second period (case III) to the cases of accepting the job offer and working being either employed or unemployed in the second period? Given the values of the exogenous variables, the individual calculates the expected utility for all three cases inserting the optimal values of the endogenous variables into the utility function. Assume that the individual has chosen case III. He will switch to, say, case I if EU^{I} becomes greater that EU^{III}, i.e.

(35)

$$E\left\{\left[\frac{\partial u(\cdot)}{\partial C_t}/p_t + \frac{\partial u(\cdot)}{\partial C_{t+1}}/p_{t+1}\right]\omega_t q_{t+1} L_t\right\} + E\left\{\left[\frac{\partial u(\cdot)}{\partial C_t}/p_t + \frac{\partial u(\cdot)}{\partial C_{t+1}}/p_{t+1}\right]\omega_t L_t\right\} + E\left\{\frac{\partial u(\cdot)}{\partial L_t} L_t\right\}$$

$$> E\left\{\left[\frac{\partial u(\cdot)}{\partial C_t}/p_t + \frac{\partial u(\cdot)}{\partial C_{t+1}}/p_{t+1}\right]\left(\omega_{t+1} \mid \bar{\omega}_{t+1} \leq \omega_{t+1}\right) L_{t+1}\right\} + E\left\{\frac{\partial u(\cdot)}{\partial L_{t+1}} L_{t+1}\right\} + E\left\{\frac{\partial u}{\partial S_t} \cdots\right.$$

The major effects can be seen already without explicitly solving the inequality. A switch to case I is the more likely, ceteris paribus

(i) The higher the unemployment benefit ratio. At a first glance this result may be contrary to the theoretical and empirical discussion of this topic.[17] Note, however, that the individual in this model is not (or no longer) entitled to unemployment compensation which does not seem to be completely unrealistic in the case of youth unemployment. In order to be entitled to "enjoy" the high unemployment compensation the individual must have worked previously.[18] Therefore, this result is not necessarily contrary to the mentioned studies. Whatever the relationship between unemployment and unemployment compensation, what these theories have in mind is the work behavior of the second period of this model.

(ii) The higher the present wage rate compared with the expected future wage rate. Taking into account the determinants of the expected future wage rate, the individual will be more likely to switch to work in the first period the worse the expected business conditions, the weaker the position of an unemployed searcher (compared with an employed searcher), and the greater the uncertainty of getting a job offer at all.

(iii) The higher the disutility of job search (i.e., the higher $|\partial U(\cdot)/\partial S|$) and the less the improvement of the future wage rate due to job search.

(iv) The lower the abilities of the individual. Higher abilities measured by school education, vocational training, and work experience may lead the individual to the assumption that he will get a higher wage rate in the future. That is to say, in terms of search models the reservation wage increases with the level of abilities. This implies a higher duration of unemployment ceteris paribus which may be a rather curious result and contradicting actual experience, at a first glance. Note, however, that demand conditions which also rely upon the individual's abilities have not been taken into account yet.

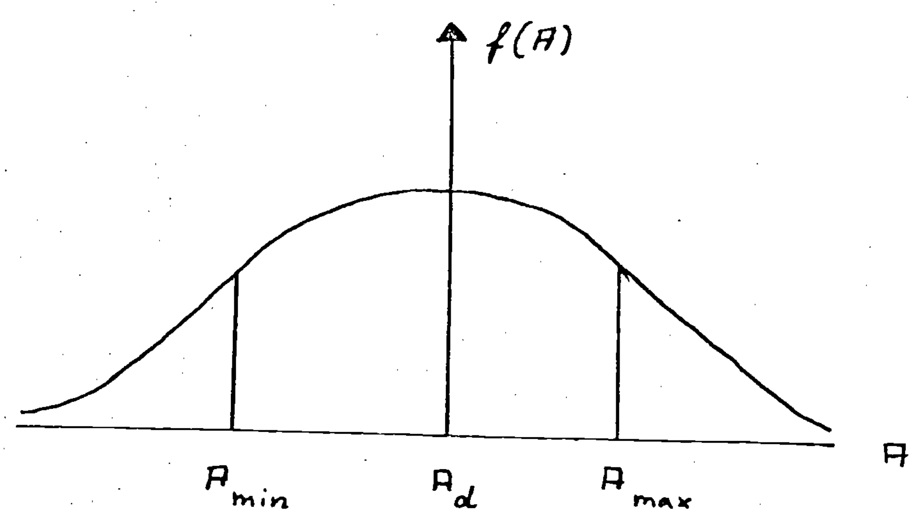
(v) The less the individual suffers from working now than later. That means the greater the disutility of labor in the second period compared with the first period (i.e., the greater the difference $|\partial U(\cdot)/\partial L_{t+1}|-|\partial U(\cdot)/\partial L_t|$) the more likely is a switch to working in the first period.

We want to stress, however, that there are interactions between these effects and that these arguments are valid ceteris paribus only. Some of the variables of the system are not observable, of course. But they may be influenced by individual characteristics reported in the records of the unemployed. The crucial step is to link the unobservable components of the theory with observed characteristics of the individual (i.e., in the present context to determine mainly how the (dis-) utilities of the model may be influenced by observable individual characteristics such as health conditions, marital status, etc.). The following examples may illustrate. A high number of proposals for jobs made by the labor office and rejected by the applicant may indicate a present weak work ethic, i.e. a high disutility of labor in the first period in our model. The number of unemployment spells (relative to the individual's age) may serve as a similar proxy. Temporary poor health conditions may increase the present disutility of labor, too. Marital status may affect the marginal utility of consumption since the same level of consumption may have a higher marginal utility for a married individual who is the bread-winner of the family. For a married individual the model suggests a higher consumption implying a higher total labor supply and thus a higher probability that the individual wants to work in both periods. It is unnecessary to say that one must be careful in making general statements. In order to illustrate for the latter example: the probability that a married woman, who is not the main bread-winner of the family, accepts a job offer may be lower than that of a single woman. The former may have a low regional mobility due to the employment conditions of her husband.

Recalling eq(11), the question whether an individual leaves the unemployment register depends on both the probability that the individual receives at least one job offer and that he accepts one.[19] It remains to discuss the first probability. Assume that there are vacancies with different requirements concerning the qualifications of the job.[20] Assume for a moment that the job searcher or the firm contacted each other, which is the more likely the more intensive and longer the duration of search of both parties has been in the previous period. When will the searcher get a job offer (including a wage offer)?

In order to make a decision the firm must determine the applicant's productivity. A screening process is undertaken, therefore, which assigns each applicant with a score: failing or passing. The decision if an applicant fails or passes depends on whether he satisfies a given minimum requirement of ability. If no applicant passes the test the firm continues to search.[21] Applicants who fail do not get job offers. But on the other hand, not all applicants who pass will get job offers. The first reason is that the firm does not hire overqualified workers for a job with given skill requirements even if the applicant agrees upon a rather low wage rate compared with his ability. At a first glance, this may violate the standard assumption of a profit maximizing firm which states that the firm hires those persons whose marginal product is higher or equal their real wage rate. Note, however, that the marginal product of an applicant with much more ability that required may be lower than that of an applicant who meets the requirements. This may be due to the dissatisfaction of his situation, for example, which may even negatively influence the morale of the other employees.

Suppose the ability - which is defined more precisely later - can be measured by an index. Let f(A) be the distribution of ability of all applicants known to the firm, A_d the firm's desired level of ability[22], A_{min} the minimum level to be fulfilled in order to get a job offer, and A_{max} the maximum level beyond which the applicant is viewed to be overqualified.



The probability of being considered to get a job offer is then given by

$$P_H = \int_{A_{min}}^{A_{max}} f(x)dx \tag{36}$$

Young workers may be allowed to have a greater variance of abilities since (vocational) schooling is often the only information available to the employer.

The sequence in which each of the applicants will get a job offer (combined with a wage offer) depends on the value of $A-A_d$ with $A_{min} \leq A, A_d \leq A_{max}$. The applicant with the highest (positive) value will receive a job offer first. Since his abilities are higher than the requirements for this job, the firm may offer him a higher wage rate compared with the wage rate of the applicant with abilities A_d. This depends on how much the firm believes in an increase of productivity due to these higher abilities. This leads to the general question to what extent measured abilities are able to predict the productivity of the applicant.

There are different views on how much education determines productivity.[23] Productivity may depend only on the type of the job and not on education (pure signalling model) or may be determined by education (pure human capital model).

Assume that the level of abilities can be measured by an index including school education, vocational training, and the result of an interview. The fact that certain characteristics ("signals") attached to the individual do not always tell the whole story about the individual's productivity makes the hiring decision an investment decision under uncertainty.[24] "On the basis of previous experience in the market, the employer will have conditional probability assessments over productive capacity given various combinations of signals and indices."[25]

The expected marginal product for an individual with given observable attributes then results in a wage offer (if $A_{min} \leq A \leq A_{max}$). The firm may increase the wage offer if the applicant does not accept it. The maximal amount of this revision is reached when future marginal costs due to a non-hiring of this applicant (search costs of the firm) equal the marginal cost of the additional wage payment, ceteris paribus.[26] It is this final wage offer of the firm which was introduced in the individual's unified model of consumption, leisure, and job search, and which has been denoted by w_t earlier. Hence, this wage offer depends on the expected productivity of the applicant π^* and is conditional on the educational level E (neglecting search duration for this moment).

$$(37) \qquad w_t = w(\pi_t^* | E_t).$$

The less the individual's abilities differ from the firm's desired level of ability (A_d), the greater is the probability of getting a job offer, ceteris paribus. As has been pointed out, a certain minimum level of abilities is very important depending on the kind of job which is in question.[27] The crucial step, however, is to fit these considerations in a manageable framework taking into account the limitations of the data. Suppose therefore, that we can distinguish between n categories of jobs with given requirements concerning skills. Assume that each individual can be placed in one (and only one) of these categories according to his personal abilities measured by school education. Each category of jobs requires a minimum level of skills measured by the extemt of vocational training (including higher vocational training schools) and work experience.[28] Let DA be a variable which indicates to what extent the individual meets the minimum requirements.[29] The greater DA is, the higher the probability that the individual receives a job offer.

We want, however, to stress the simplicity of this procedure which takes into account only a part of the theoretical considerations. The upper limit of skills the firm allows for a certain job is disregarded because data on vacancies distinguished by the level of requirements are not available.[30] We do know the number of the labor office's proposals to the unemployed for presenting himself before firms that have announced vacancies in jobs that the labor office judges to be roughly appropriate to the unemployed person. Due to several deficiencies of this variable[31] it can serve only as a rough proxy for the individual's probability of receiving a job offer.

Hence, the probability that the individual receives a job offer at the beginning of period t is the higher

- the longer and more intensive the search has been in previous time periods,
- the more the individual meets the minimum requirements of skills of the job category he is belonging to, and
- the higher the number of the labor office's proposals to the unemployed persons described above.

III. Conclusion

The outcome of the theory may be summarized as follows.

(i) A distinguishing characteristic of the duration is the underlying hazard function from the shape of which the length of a stay in the unemployment register can be calculated. A log-normal distribution seems to be an appropriate specification.

(ii) Heterogeneity of the individuals can be taken into account by analyzing both the probability of receiving at least one job offer and the probability of accepting one job offer for each individual.

(iii) The decision of the individual whether to accept a job offer or not can be analyzed in a unified model of consumption, labor supply, and job search. Several restrictions concerning some minimum work time, a minimum wage, and the entitlement to unemployment must be considered. Besides this uncertainty with respect to future job offers plays an important role. The greater uncertainty the more likely is an acceptation of a job offer now. Search plays an ambiguous role since it raises disutility and the probability of receiving a better job offer. The effect of the amount of unemployment compensation is ambiguous, too, and depends on whether the individual is entitled to it or not in the present time period. Higher abilities of the individual may result in a higher reservation wage such implying a longer duration of job search ceteris paribus.

(iv) The probability of receiving a job offer depends on the screening process undertaken by the firm, on the abilities of the individual, and on the search duration of both parties. The wage offer is determined by the expected productivity of the applicant and is conditional on his educational level. Higher abilites may lead to an overqualification of the individual with respect to the requirements of the job in question.

(v) The crucial step is to link several (unobserved) variables of the model to usually observed variables. Although some attempts are described no claim is made that available data are a satisfactory substitute for the variables in question.

Footnotes

[1]For possible causes of youth unemployment (in the U.S.) see R. FREEMAN (1979) and (in the Federal Republic of Germany) W. FRANZ (1979).

[2]For more details see K. V. BURY (1975) and D.R. COX (1962), for example.

[3]See G. CHAMBERLAIN (1979), D. R. COX (1962).

[4]See K. V. BURY (1975, p. 489).

[5]$f_W(x;\sigma,\lambda) = \frac{\lambda}{\sigma}(\frac{x}{\sigma})^{\lambda-1} \cdot \exp\{-(\frac{x}{\sigma})^{\lambda}\}$

[6]$\lambda=1$ implies $f_W(x,\sigma,\lambda=1) = \frac{1}{\sigma}\exp\{-\frac{x}{\sigma}\}$ $f_{EX}(x;\sigma)$ and $F_{EX}(x,\sigma) = 1 - \exp\{-\frac{x}{\sigma}\}$. In the case $\lambda=1$ the WEIBULL-model coincides with the gamma-model. The main difference between the WEIBULL- and the gamma-model is that the WEIBULL hazard function approaches zero as $x \to \alpha$ if $\lambda<1$ whereas the gamma hazard function approaches an asymptote value > 0. See G. CHAMBERLAIN (1979, p.33).

[7]K. V. BURY (1975, p.500).

[8]For an extensive discussion of the log-normal distribution see J. AITCHISON and J. A. C. BROWN (1957).

[9]See G. S. WATSON and W. T. WELLS (1961). The higher the value of σ the earlier the maximum of the hazard function with respect to time.

[10]This is similar to the procedure of L. S. LEIGHTON and J. MINCER (1979, p.35) who consider the probability of finding a job offer and the probability of finding an acceptable job conditional on finding a vacancy.

[11]In the model of J. J. SEATER (1979, 1977) where a week is the underlying time period $\overline{T}$ equals 168 hours. A discussion about how much recreation time an individual needs at the minimum is beyond the scope of this paper and is left to the reader.

[22] A_d may or may not coincide with the first moment of the distribution.

[23] See M. SPENCE (1976).

[24] See M. SPENCE (1973). "Signals" are subject to manipulation by the individual, whereas "indices" are attributes generally thought not to be alterable (sex, for example). The uncertainty may be reduced by a time of probation with a very short period of notice.

[25] See M. SPENCE (1973, p.352).

[26] The expected return from screening one more applicant is the probability of being qualified multiplied by the difference between the marginal product of a worker correctly predicted to be qualified and his wage. In equilibrium this return must equal the marginal cost of screening.
See G. J. BORJAS and M. S. GOLDBERG (1978, p.919).

[27] These minimum abilities may, of course, change over time. There is some evidence that employers had raised this minimum level for some jobs during the last recession.

[28] The details are reported in the empirical part. In order to give an impression now what we have in mind suppose n=2. Let category 1 include all jobs which require abilities measured by a level of school education below high school education (i.e., below "Mittlere Reife" or "Fachschule"). The minimum level is assumed to be vocational training or at least some training on the job and work experience for this category. With respect to category 2, minimum requirements are difficult to explore. Lack of data prohibits us from taking more into account than work experience.

[29] In the empirical section it turns out that DA is a dummy with DA=1 if the minimum requirements are met and DA=0 otherwise.

[12] They include separable, complete, reflective, transitive, continuous and strongly monotonic preferences and that $\lim_{C \to 0} U_C = +\infty$, $\lim_{C \to \infty} U_C = 0$,

$$\lim_{L+S \to 0} U_{L+S} = 0, \quad \lim_{L+S=\overline{T}} \_ = -\infty, \quad U_{C,L+S} = U_{L+S,C} = 0$$

[13] We neglect the case $L_t = L_{t+1} = 0$ for a youth satisfactorily supported by his parents since it gives no substantial additional information.

[14] See e.g. M. H. DE GROOT (1970), and H. RAIFFA (1970). □ denotes a decision fork and **O** a chance fork. See H. RAIFFA (1970), p.11.

[15] We assume that his economic situation will be very bad if he fails to get a job and did not work in the first period. He may be on a very poor welfare program or receive some money from his parents, for example.

[16] Too short a time period, however, may be in conflict with the requirement that the individual must have worked in the present time period in order to be entitled to unemployment compensation.

[17] See e.g. H. G. GRUBEL and D. MAKI (1976), H. KÖNIG and W. FRANZ (1978), and D. T. MORTENSEN (1970).

[18] For a similar result see D. T. MORTENSEN (1977).

[19] For simplicity assume that $\overline{L}$ is high enough to make it impossible for the individual to hold two different jobs.

[20] Remember the caveat in the introductory chapter. We do not discuss hiring in general. This may be due to replacement demand or additional demand because of a higher (expected) level of demand for the firm's products.

[21] Another possibility in this case would be that the firm lowers the level of these minimum requirements. Note, however, that the firm may run into difficulties, then. First, the job requirements may be statutory (example: medical service). Second, other persons holding a similar job within the firm may object to the lowering standards because it might later reflect on their own qualifications.

[30]Neither a minimum nor a maximum nor a desired level of required skills is reported. If only one of these were available, one might assume a variance of skills allowed by the firm and calculate an approximate range of skills for each category of vacancies and the percentage of unemployed persons falling into this range. This percentage would be a better proxy for the probability to get a job offer.

[31]Not all vacancies are announced to the labor office, and experience indicates that the appropriateness of the unemployed the labor office presents to the firms may be seriously questioned in some cases.

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