

VU Research Portal

Barriers to employment

Gorter, C.; Nijkamp, P.; Rietveld, P.

1991

document version

Publisher's PDF, also known as Version of record

[Link to publication in VU Research Portal](#)

citation for published version (APA)

Gorter, C., Nijkamp, P., & Rietveld, P. (1991). *Barriers to employment*. (Serie Research Memoranda; No. 1991-80). Faculty of Economics and Business Administration, Vrije Universiteit Amsterdam.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

E-mail address:

vuresearchportal.ub@vu.nl

1991-80

ET

Faculteit der Economische Wetenschappen en Econometrie

05348

Serie Research Memoranda

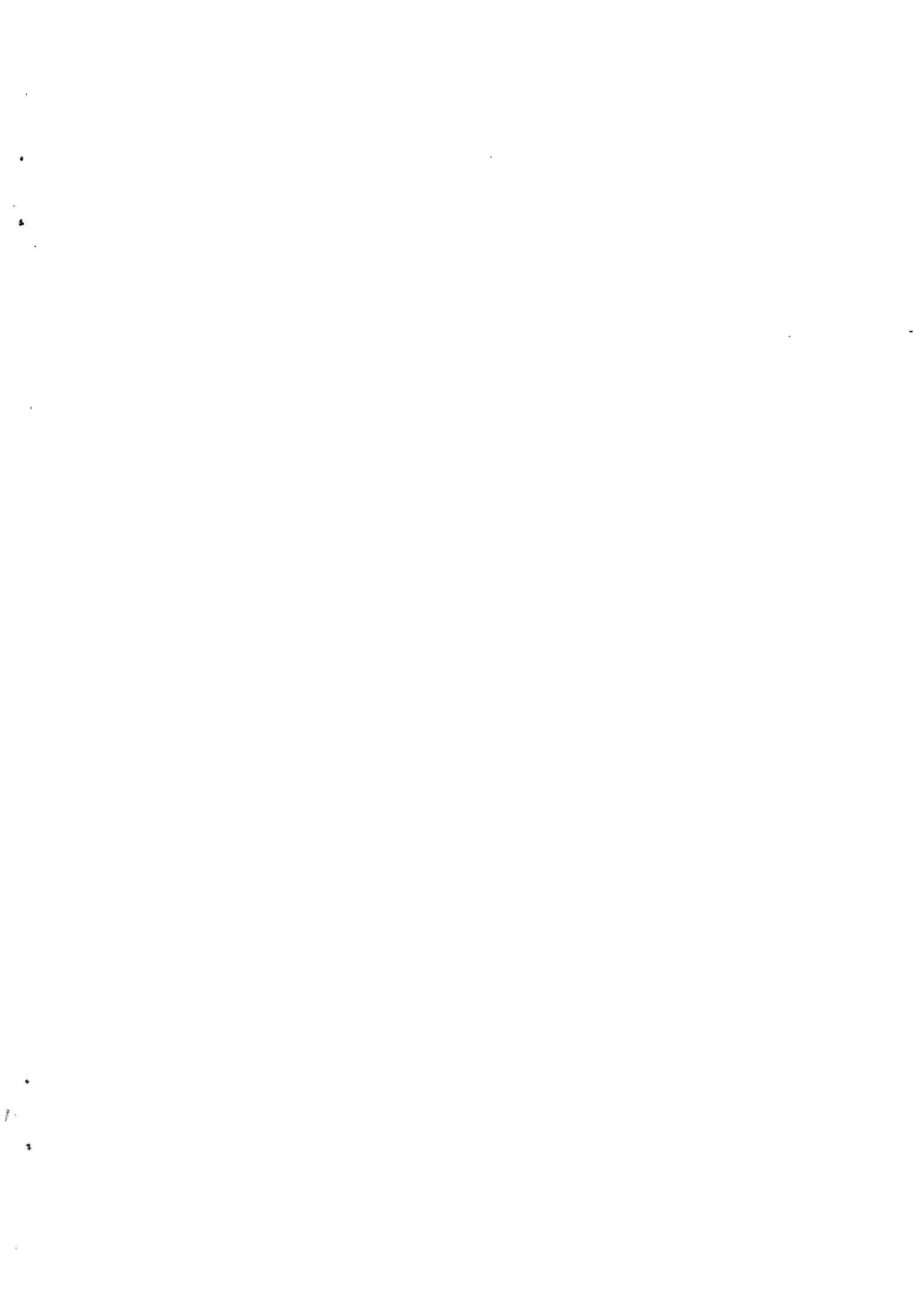
BARRIERS TO EMPLOYMENT;

Entry and Re-entry Possibilities
of Unemployed Job Seekers in the Netherlands

C. Gorter
P. Nijkamp
P. Rietveld

Research Memorandum 1991-80
December 1991





BARRIERS TO EMPLOYMENT;
ENTRY AND RE-ENTRY POSSIBILITIES OF UNEMPLOYED JOB SEEKERS IN THE NETHERLANDS

C. GORTER
P. NIJKAMP
P. RIETVELD



Department of Economics
Free University Amsterdam
Boelelaan 1105
1081 HV Amsterdam
The Netherlands

November 1991
Revised version



ABSTRACT

In this paper, the barriers to re-employment for unemployed job seekers are studied by means of duration models. The determinants included in the duration models are derived from an economic model of the different stages in the job search process. The empirical analysis of unemployment duration is based on both a reduced form and a structural approach.

The reduced form model used is a proportional hazard model with a flexible base-line hazard. In the estimation procedure, special attention is paid to the problems of unobserved heterogeneity and attrition bias. The estimation results show that age and non-labour income have a significant negative impact on the re-employment probability of unemployed job seekers. In addition, the hazard rate appears to be negative duration dependent.

In the structural model, the rate at which unemployed job seekers find a job is decomposed into the application rate and the probability of receiving an actual job offer if an application is made. We find that the low probability of becoming (re-)employed is mainly caused by the low probability to receive an actual offer. Furthermore, differences in the application intensity of unemployed job seekers can be explained by various personal characteristics, regional labour market conditions, elapsed duration of unemployment and search methods, whereas the outcome of the selection process is mainly influenced by the qualifications of unemployed job seekers.

1. INTRODUCTION

In many countries, including the Netherlands, the unemployment rate has been remarkably high during the eighties. The consequences of this persistently high level of unemployment are far-reaching for the Dutch economy in terms of productivity and welfare loss. On the individual level, unemployment influences the well-being not only as a result of reduced income, but also due to a loss of social contacts and of social status.

The persistent nature of unemployment has become even more visible when the Dutch economy recovered from the recession in the second half of the eighties and employment started to grow steadily (with about 70.000 jobs per year). Many unemployed people, who are willing to work but were unable to benefit from the newly available jobs, find themselves excluded from this economic recovery. This exclusion might be tackled by effective labour market policies, provided it were known which causes prevent unemployed people from becoming re-employed. In other words, it is essential to identify the barriers to re-employment for unemployed job seekers in order to be able to improve the labour market prospects of these people.

In this paper, barriers to re-employment for unemployed job seekers will be studied by means of duration models. We will use hazard models of unemployment duration in which the intensity at which unemployed people are leaving the state of unemployment (the hazard rate) is explained by relevant personal and labour market characteristics (for an overview of duration models with hazard functions, see Klefer, 1988). Moreover, the models will allow the hazard rate to vary over time in order to estimate the size and direction of duration dependence¹. In general, two different methods can be followed to model unemployment duration, namely a "reduced form" and a structural approach. Both approaches will be used in this paper, whereas the specification of the models will be derived from job search theory. The structural model used in this paper does explicitly distinguish between the application behaviour of unemployed job seekers and the selection behaviour of employers in the allocation process on the labour market. Hence, the model differs from the structural model used up to now in empirical studies of unemployment duration (see Yoon, 1981, Lancaster and Chesher, 1983, Lynch, 1985, Narendranathan and Nickell, 1985, Ridder and Gorter, 1986, Wolpin, 1987 and Van den Berg, 1990).

Furthermore, we will pay special attention to the spatial context of the job search process by incorporating the pressure of the local labour demand for different homogeneous groups (with respect to occupational group, age and gender) in the model.

Finally, it is obvious that the policy implications are directly linked to the identification of the barriers for unemployed job seekers: removing such bottlenecks (or changing the (dis)-incentives) will lead to an improvement of the labour market prospects of unemployed job seekers.

The structure of this paper is as follows. In section 2, we will derive the determinants of unemployment duration from a theoretical model of the different stages in the job search process. The data and variables used in the analysis will be considered in the next section. The reduced form and the structural model will be presented in sections 4 and 5, respectively. Finally, we will draw some conclusions on the basis of our empirical results in section 6.

2. ECONOMIC MODELS OF UNEMPLOYMENT DURATION

In job search theory, the probability of getting a job for an unemployed job seeker is usually modelled as the product of the probability of getting a job offer and the probability of accepting this offer (for a survey of job search theory, see Mortensen, 1986). The spell of unemployment is considered to be an investment in achieving a higher wage in the future. Optimal search behaviour implies that the unemployed job seeker is trading off the cost of further search (including the "opportunity" cost of not accepting a job offer) against the discounted gain of possible future job offers with a higher wage level. The equality of marginal costs and benefits of job search gives rise to an unique solution for the so-called reservation wage, i.e., the minimum wage level for which an unemployed individual will accept the job offer. In this context, the escape (or hazard) rate of unemployment can be written as

¹ The presence of duration dependence of unemployment (hysteresis) can also be examined on the macro level (see for example, Graafland, 1988).

$$\lambda = \mu \cdot [1-F(w^*)] \quad (1)$$

with

- λ = hazard rate
- μ = job offer arrival rate
- $F(w)$ = wage offer distribution
- w = reservation wage

In a *tight labour market*, the level of the reservation wage is the crucial factor for the duration of unemployment. Under the assumption of optimal search, it can be derived that the reservation wage is correlated positively with the mean and variance of the distribution of expected wages and the level of unemployment benefits, and negatively with the discount factor and the direct search cost (Mortensen, 1986).

In a *depressed labour market*, however, unemployment duration is expected to be mainly determined by demand side factors, i.e., the probability of getting a job offer. In job search theory, the arrival of job offers is usually seen as an exogenous process (usually following a Poisson distribution), which cannot be influenced by the behaviour of both job seekers and employers. One could - in this view - say that the probability of receiving a job offer is the "chance" component of the probability of leaving the state of unemployment, whereas the probability of accepting a job offer is the "choice" component (see for example, Mortensen and Neumann, 1984). However, Narendranathan and Nickell (1985) already pointed out that the intensity of receiving job offers is the product of the rate at which potential jobs are discovered and the probability that a potential job is actually offered to the job seeker, given a job application. From this decomposition, it becomes clear that for an individual the arrival of job offers may be hampered by

- (I) the inability to discover potential jobs due to
 - a) a lack of information about the potential jobs
 - b) a shortage of available vacancies
- (II) an insufficient level of labour productivity (as expected by the employer²) related to
 - a) the qualifications required for the jobs
 - b) the qualifications of other applicants

The decomposition of Narendranathan and Nickell can be extended even further by distinguishing explicitly between the decision to apply (made by the job seeker) and the probability of receiving an actual job offer.

Formally, one could rewrite the hazard rate of unemployment as

$$\lambda = \mu_d \cdot P_a \cdot P_r \cdot [1-F(w^*)] \quad (2)$$

with

- μ_d = intensity at which potential jobs are discovered
- P_a = probability of applying for a potential job (given that it is discovered)
- P_r = probability of receiving a job offer (given that one applied for it)

Summarizing, we can distinguish four structural barriers to re-employment for unemployed job-seekers³:

- (1) potential jobs cannot be found (μ_d)
- (2) no applications are made for discovered jobs (P_a)
- (3) the expected productivity is insufficient according to the employer (P_r)
- (4) the actual job offer is not attractive according to the applicant ($1-F(w)$)

² It might also be the case that unemployed job searchers do not apply for a job, because they don't consider themselves to be of sufficient quality ("negative self-selectivity").

³ We note that this decomposition of the path to re-employment cannot be applied if jobs are offered directly to the job seeker. In our model, it is assumed that the unemployed job seeker is searching sequentially for jobs until a suitable one is found and that the different stages in the job search procedure take place without any delay.

Now, the question arises as to how the effects of the structural barriers on the leaving rate of unemployment can be measured. One can choose between two different approaches:

- (a) estimating a structural model of unemployment duration in which the effect of each stage in the job search process (discovering a potential job, applying for a job, receiving a job offer and accepting an offer) can be identified, and
- (b) estimating a "reduced form" model of unemployment duration without disentangling the effects of the structural components. The structural elements in the several stages can, however, be used to select the appropriate determinants of finding a job in the "reduced form" model.

Most of the empirical applications of unemployment duration models are based on the latter approach (see for studies in the Netherlands, for example Kooreman and Ridder, 1983, Van Opstai and Theeuwes, 1986, Meesters and Van de Pol, 1989, Theeuwes et al., 1990 and Gorter et al., 1991), because there is usually no (or not reliable) data available which gives information about the various stages in the job search process. In order to estimate structural models, it is almost inevitable to differentiate between fewer stages. Until now (as far as we know), structural models of unemployment duration are formulated in which only two stages are distinguished, namely the arrival process of job offers and the acceptance probability of the job-seeker (i.e., formulation (1)). For the Netherlands, structural models - on the basis of optimal search behaviour - have been estimated by Ridder and Gorter (1986) and Van den Berg (1990).

However, one can expect that in depressed (regional) labour markets the acceptance probability of an actual job offer is close to 1⁴, so that the length of unemployment duration is mainly determined by the barriers in the job offer arrival process⁵. Therefore, we will here develop another decomposition of the hazard rate, which will be based on the application behaviour of the job seeker and the selection behaviour of the employer. The hazard rate is then written as

$$\lambda = \mu_a \cdot P_r \quad (3)$$

with $\mu_a = \mu_d \cdot P_a \cdot [1-F(w^*)]$

and

μ_a = the application rate of unemployed job seekers

P_r = probability of receiving an actual job offer (given that one applied for it)

This alternative specification of the structural model includes the employers' selectivity towards the applicant in contrast with the usual specification of the structural model. Furthermore, the "choice" component of the job seeker has been shifted from the last stage (i.e., accepting an actual offer) to the first stage (i.e., applying for a job). In fact, it is assumed that one knows the wage rate associated with a vacancy before one responds to that vacancy, i.e. before the job is actually offered. Consequently, the decision whether to apply for a vacancy or not is also determined by the wage corresponding to that vacancy. The probability of applying for a job then becomes

$$P_a^* = P_a \cdot [1-F(w^*)] \quad (4)$$

with

$1-F(w^*)$ = probability of application based on the wage level of a job

P_a = probability of application based on other characteristics of a job.

The alternative specification of the structural model (see equation (3)) has the advantage that the effect of the selective choice behaviour of both job seekers and employers can be identified. It must be realized, however, that this specification still is a restrictive version of the full (four-stage) model⁶.

⁴ This expectation is confirmed by the results of Van den Berg (1990), who concluded that almost every job offer is acceptable for unemployed job searchers.

⁵ In this respect, another direction of relevant research is the acceptance and hiring strategy of employers trying to fill their vacancies (see for example, Van Ours, (1989, 1990)).

⁶ Notice that this is also true for the "usual" specification of the structural model.

Therefore, we will first proceed along the lines of the "reduced form" approach in which the path to re-employment is not specified and will return to the structural approach in the second part of this paper. The choice of the explanatory variables in the reduced form model can be obtained from the structural elements in each stage in the job search process (according to (2)).

Stage 1: acquiring information on potential jobs.

The ability of the unemployed individual to find the available vacancies will depend on his search behaviour with respect to the kind of search channels (and the intensity at which they are used), the tightness of the relevant segment on the local/regional labour market (according to occupation, sector, age-group, educational level, etc.) and other personal characteristics (like for example the social environment).

Stage 2: applying for a job.

The probability that an unemployed worker will apply for a job will depend on the expected gain in income, the duration of unemployment (for example, negatively due to a "discouragement" effect and/or positively due to a "learning" effect) and other personal characteristics.

Stage 3: receiving an actual job offer.

The probability that the unemployed individual is actually chosen to fill the vacant job will depend on personal characteristics (such as age, nationality, education, gender, etc.) and the labour market history of the individual (occupation in a previous job, number of spells of (un)employment, the length of the current spell of unemployment, etc.). In addition, the degree of competition for the type of job (i.e. the tightness of the market) will also play an important role. The degree of competition will depend (among others) on the kind of job applied for, the number of potential applicants and the way information - about which jobs are vacant - is gathered by the job seeker.

Stage 4: accepting an actual job offer.

The acceptance probability of the unemployed person will depend on the expected gain in (family) income, personal characteristics (like age, education, gender, household position, etc.) and the duration of unemployment. The latter is - according to search theory - expected to be (negatively) correlated with the level of the reservation wage.

In conclusion, we arrive at the following scheme of the determinants of unemployment duration that play a role in the four stages of the job search process (see Figure 1).

| STAGES - DETERMINANTS ↓ | (1) DISCOVERING A VACANCY | (2) APPLYING FOR A JOB | (3) RECEIVING AN OFFER | (4) ACCEPTING AN OFFER |
|----------------------------|---------------------------------|------------------------------|------------------------------|------------------------------|
| SEARCH STRATEGY | * | - | * | - |
| LABOUR DEMAND | * | - | * | - |
| INCOME | - | * | * | * |
| CURRENT DURATION | - | * | * | * |
| OTHER ATTRIBUTES | * | * | * | * |

Figure 1. The determinants of unemployment duration in the four stages of the job search process (an asterisk indicates an influence in the relevant stage).

In the rest of this paper, we will estimate models of unemployment duration by incorporating (sets of)

variables reflecting the impact of the determinants in the model⁷. This enables us to determine whether the transition from unemployment to employment is prevented by the use of inefficient search activities, bad labour market conditions, insufficient financial incentives, the high length of the elapsed duration of unemployment or unfavourable personal and labour market characteristics.

3. DESCRIPTION OF THE DATA

The data used in our analysis originates from the labour market surveys conducted by the Dutch organisation for strategic labour market research, OSA ("Organisatie voor Strategisch Arbeidsmarktonderzoek"). The OSA labour market surveys are held in order to provide actual labour market information and do also offer the opportunity to analyze the behaviour of labour supply in more detail. The first stage took place in April 1985, when almost 3,000 individuals were interviewed about their current labour market position, their labour market history and numerous personal characteristics. In addition, people who reported to be searching for a job were asked about their search behaviour. In the second stage of the labour market survey (held in November 1986), an attempt was made to re-interview the same people. From the original number of people in the first wave, roughly 35% was - for several reasons - not questioned again (see Allaart et al., 1989).

For our analysis, we have selected the individuals who were reported to be unemployed and were searching for a job in the first stage of the survey and who were also re-interviewed in the second stage and hence were able to provide information on the labour market events between the two stages. In this way, we were able to identify whether the unemployed job seeker has succeeded to leave the state of unemployment or not. Furthermore, we have also information on the residual duration for the leavers of the unemployment state.

The duration of unemployment of individuals at the first stage is measured by means of two variables, namely the duration of registration at the labour exchange and the answer to the question "how long have you been looking for work". The latter will be used in this paper, because the moment of registration at the labour exchange office does not necessarily coincide with the start of the period of unemployment⁸.

The OSA labour market surveys were extended with data on unemployment rates in geographical occupational labour market segments. The geographical areas in the Netherlands were selected by extending each so-called Corop region with the adjacent Corop regions. For each of these areas unemployment rates have been calculated for 46 homogeneous occupational groups, 5 age groups and for males and females separately (see for more details, Mekkelholt et al., 1989). These unemployment rates (cross-classified according to occupation, age and gender) can be used to reflect the condition of the regional labour market for each individual in the sample.

Furthermore, we have supplemented this data set by adding information on the expected wage level. In the survey, the following question has been asked. "If you compare yourself with other colleagues or with friends with a similar education as you have, what do you expect to earn in a full time job?". The answer to this question has been used to evaluate the expected wage level. For unemployed people who did not answer this question, we have assessed the expected wage level on the basis of a set of personal characteristics (like, age, education, gender, etc.). For this purpose, we have used the results of a regression of the expected wage level of unemployed job seekers on personal characteristics estimated on the basis of an extended dataset by Groot and Jehoel-Gijsbers, (1990)⁹. The level of unemployment benefits is determined by taking together the revenues directly related to the state of unemployment of an individual. Other sources of income (such as labour market income of the partner, rent, interest, income from activities in the "black market", etc.) are added up in the variable additional income.

⁷ The choice of these variables will be discussed in section 3.

⁸ In addition, there are unemployed people looking for a job who are not registered at the labour exchange office.

⁹ Note that the implementation of the estimated values of the expected wage level might introduce a selection bias if the group who answered the question about the expected wage level is different from the group who did not.

The information on personal characteristics, search behaviour and labour market history collected on the first stage have been used to choose the explanatory variables corresponding to each determinant of unemployment duration. With respect to the labour market history, two variables will be used in this paper. First, it is known how many years a person has been employed until now (with exclusion of possible unemployment spells) and this figure is used as an indicator of work experience. Secondly, the individuals are asked about the changes in labour market position in the previous five years. This information is used to identify the number of transitions between unemployment and employment in this period (this variable will sometimes be abbreviated as "the number of U-E transitions"). Another important variable (especially in the structural model) included in our analysis is the number of rejected applications made in the six months previous to the first stage of the survey.

After eliminating observations with missing information, a sample of 162 individuals remained. In the appendix, we have given an overview of the independent variables and their sample means.

4. A PROPORTIONAL HAZARD MODEL WITH A FLEXIBLE BASE-LINE HAZARD

4.1. The likelihood function

In order to estimate the reduced form of equation (2), we must specify the hazard rate as a function of the explanatory variables and the current spell of unemployment duration. In this paper, we will use a flexible functional form for the base-line hazard in order to allow the hazard rate to vary over time and test whether there is any unobserved heterogeneity left in the model. Consequently, we will assume the following stepwise functional form for the hazard rate over time:

$$\lambda(t) = \lambda_j, t_{j-1} < t \leq t_j, j=1, \dots, n \quad (5)$$

so that the corresponding density function is given by

$$f(t) = \lambda_j \cdot e^{-\lambda_j(t-t_{j-1}) - \sum_{i=1}^{j-1} \lambda_i(t_i-t_{i-1})} \quad (6)$$

We assume that the hazard rate is given by

$$\lambda_j = e^{a_j + X\beta} \quad (7)$$

where X is the matrix of independent explanatory variables and a_j and β are vectors of unknown parameters.

As stated in section 3, the estimation will be carried out on the basis of a two-stage labour market survey. This implies that we have information on three types of unemployment duration spells:

- (1) **Incomplete** spells of unemployment duration for individuals who are unemployed both at the time of the first and the second survey;
- (2) a. **Completed** spells of unemployment duration with full information for individuals who are unemployed at the first inquiry and get a job (at a known date) between the first and the second stage; and
 - b. **Completed** spells of unemployment duration without full information for individuals who are unemployed at the first stage and get a job (at an unknown date) between the first and the second stage.

Suppose that the elapsed duration of unemployment at the first stage is t_1 (incomplete duration). Let the time between the first stage and the end of the unemployment spell be equal to t_2 (residual duration) and let the time between the two stages of the survey be equal to t_3 (see Figure 2).

In our likelihood function, we will use both incomplete and residual duration with the joint probability function (see Ridder, 1984):

$$g(t_1, t_2) = \frac{f(t_1 + t_2)}{E_f(t)} \quad (8)$$

Consequently, the likelihoodfunction becomes

$$\prod_{\text{spells of type 1}} \frac{[1 - F(t_1 + t_3)]}{E_f(t)} \cdot \prod_{\text{spells of type 2a}} \frac{f(t_1 + t_2)}{E_f(t)} \cdot \prod_{\text{spells of type 2b}} \frac{[F(t_1 + t_3) - F(t_1)]}{E_f(t)} \quad (9)$$

Now, the parameters of the model can be estimated by maximizing the likelihoodfunction. In the next section, we will discuss the estimation results.

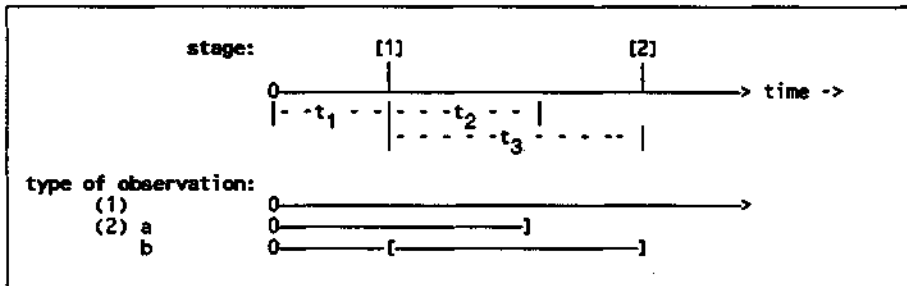


Figure 2. Information on unemployment duration in the surveys.

4.2. The estimation results

First of all, we will present in Table 1 the results for the (sets of) determinants of unemployment duration in the proportional hazard model (with the reference group of dummy variables in parentheses).

It is noticeable that the relevant segment condition of the labour market with respect to the occupational and age group - as reflected by the unemployment rate - has a positive influence on the length of unemployment duration¹⁰. Apparently, local labour market conditions are responsible for differences in unemployment duration, providing support for the hypothesis that individuals search for a job in a limited geographical area.

The small - insignificant - positive effect of unemployment benefits levels on the hazard rate suggests that there is no "push"-effect on unemployment duration. This result is in line with the other empirical studies in the Netherlands (for example, see Van Opstal and Theeuwes, 1986, Lindeboom and Theeuwes, 1989, Gorter and Hoogteijling (1990), Groot and Jehoel-Gijsbers, 1990). The presence of additional income - mainly stemming from the labour-income of the partner - substantially increases the expected length of unemployment duration. It is possible that an individual who is independent (or less dependent) on labour income is more selective with respect to the type of job. The expected wage level turns out to have a small impact on the unemployed job seeker in obtaining a job more rapidly. A much stronger "pull" effect of the expected wage (i.e., the elasticity of expected duration becomes 0.7) is found by Groot and Jehoel-Gijsbers when they extend the OSA dataset with other data sources related to the years 1985-1986.

¹⁰ We notice here that the differences in unemployment rates (cross-classified according to occupation, age, and gender) between adjacent areas are quite high in the Netherlands (up to 40-50%), which leads to differences in expected duration of about 25-30% (ceteris paribus).

| <u>variables:</u> | <u>coefficient</u> | <u>t-value</u> |
|---|--------------------|----------------|
| * SEARCH STRATEGY | | |
| - main search activity (informal contacts) | | |
| . looking at advertisements | -0.004 | -0.02 |
| . writing at advertisements | 0.032 | 0.18 |
| . labour exchange office | -0.058 | -0.26 |
| * LABOUR MARKET CONDITIONS | | |
| - regional unemployment rate [in %] | -0.006 | -1.12 |
| * INCOME INCENTIVES* | | |
| - log[unemployment benefits] | 0.009 | 0.57 |
| - log[additional income] | -0.036 | -2.21 |
| - log[expected wage level] | 0.045 | 0.22 |
| * DURATION OF UNEMPLOYMENT** | | |
| - less than six months | -2.091 | -1.38 |
| - between six and twelve months | -2.235 | -1.49 |
| - more than one year | -2.582 | -1.73 |
| * OTHER CHARACTERISTICS | | |
| - age [in years] | -0.032 | -2.88 |
| - educational level [1 = primary;...; 5 = high] | 0.022 | 0.36 |
| - preference for full-time job (part-time) | 0.049 | 0.24 |
| - willing to move (unwilling) | -0.097 | -0.71 |
| - household position (single male) | | |
| . single woman | 0.160 | 0.71 |
| . man with partner | 0.257 | 1.20 |
| . woman with partner | 0.412 | 1.58 |
| - experience [in years] | 0.012 | 0.99 |
| - number of U-E transitions | 0.084 | 0.87 |
| - number of applications | 0.001 | 0.17 |
| <u>minus log-likelihood</u> | 920.04 | |
| <u>number of observations</u> | 162 | |

Table 1. Estimation results of the proportional hazard model
 (*: measured in guilders per month, **: flexible baseline hazard).

From the estimates of the step function for the base-line hazard, we conclude that the duration of unemployment is negative duration dependent, which means that the probability of getting a job decreases over time. The reduction of the hazard rate does already occur in the first year of unemployment and is stable afterwards¹¹.

The variables measuring differences in personal and labour market characteristics demonstrate that only age has a significant effect on the probability of finding a job. Each additional year is responsible for an increase of 3.2% in the expected duration of unemployment. Similar results have been found by Gorter and Hoogteijling (1990) who used data of unemployed job searchers originating from the Dutch Socio-Economic Panel for the years 1985-1987. Furthermore, Kerckhoffs et al. (1990) also estimated that each additional year for unemployed males (registered at the labour exchange office in April 1987) gives rise to an increase of about 2.5% on expected unemployment duration.

¹¹ It appeared that the variation in the base-line hazard after the first year of unemployment was negligible (see also Appendix B).

Surprisingly, people with higher education have only slightly better chances of getting a job than lowly educated people. Studies of unemployment duration usually show a significant positive effect of the educational level on the hazard rate (see for example, Groot and Jehoel-Gijbers (1990), Kerckhoffs et al. (1990), Gorter et al. (1990) and Van Opstal and Theeuwes (1986)). In our model, education is measured in a uni-dimensional way, which might be too rigid to identify the expected advantage of a higher educational level.

In summary, we conclude from our estimates that the major determinants of unemployment duration appear to be age, additional income and elapsed duration. This is nicely corresponding with the results of Vissers and Groot (1988), who have analyzed differences in unemployment duration by means of probit models on the basis of the same data source. Moreover, the significant negative effect of age on the hazard rate is universally found in Dutch studies of search duration using similar data on (registered) unemployed job seekers (see Table 2). We can also observe from Table 2 that the duration of unemployment usually has a significant negative effect on the hazard rate. Unfortunately, it is impossible to compare our results of an substantial effect of additional income on unemployment duration because this variable is usually not included in other Dutch studies.

| Study | Data | Effect of Age | Effect of Duration |
|----------------------------------|---|-----------------------------|--|
| Gorter and Hoogteljling (1990) | Unemployed 1985-1987 | sign. negative | not included (partial likelihood estimates) |
| Gorter et al. (1990) | Registered Unemployed Males, Nov. 1988 | sign. negative | sign. negative (due to unobserved heterogeneity) |
| Groot and Jehoel-Gijsbers (1990) | Unemployed 1985-1986 | sign. negative | sign. negative (due to elapsed duration) |
| Kerckhoffs et al. (1990) | Registered Unemployed Males, April 1987 | sign. negative | sign. pos. (first 200 days) sign. neg. (afterwards) |
| Lindeboom and Theeuwes (1991) | Unemployed with Unemployment Benefits 1982-1984 | sign. negative | sign. negative ¹² |
| Theeuwes et al. (1990) | Unemployed 1980-1985 - Males - Females | sign. negative not sign. | not sign. not sign. |

Table 2. The effect of age and duration on the hazard rate: An overview of Dutch studies

Finally, we have checked whether our estimates were biased due to the effect of attrition and unobserved heterogeneity. The specification tests showed that these effects are not significantly present in our model (see, for more details, Appendix B).

5. A STRUCTURAL MODEL OF UNEMPLOYMENT DURATION

In this section, we will estimate a structural model in which the hazard rate is decomposed into the application rate and the probability of receiving an actual job offer (see also equation (3) in section 2)¹³. This model can be estimated by using information on unemployment duration and the number

¹² It should, however, be noted that there is a significant positive effect found for the residual duration of entitlement to (higher levels of) unemployment benefits.

¹³ An analogous approach for a structural model of vacancy duration is used by Van Ours (1990a). In this model the hazard rate is split up into the product of the rate at which applicants arrive and the probability a random applicant is accepted by the employer.

of rejected applications during the elapsed period of unemployment. We will assume that the number of rejected applications follows a Poisson process with parameter μ_a . In our data set, we only have information on the number of rejected applications made in the six months previous to the first stage of the survey. In that case, the conditional probability density function for the number of applications ($h(k|t_1)$) becomes:

$$h(k|t_1) = \frac{\left(\int_{\max(0, t_1-6)}^{t_1} \mu_a(s) \cdot (1-P_r(s)) ds \right)^k}{k!} \times e^{-\int_{\max(0, t_1-6)}^{t_1} \mu_a(s) \cdot (1-P_r(s)) ds} \quad (10)$$

with k the number of rejected applications made in the six months previous to the first stage of the survey¹⁴.

The information on unemployment duration will again be used in the joint probability density function of residual and incomplete duration (see equation (8) in section 4.1), but now we have:

$$f(t_1, t_2) = \mu_a(t_1+t_2) P_r(t_1+t_2) \cdot e^{-\int_0^{t_1+t_2} \mu_a(s) P_r(s) ds} \quad (11)$$

In order to derive the joint probability density function of unemployment duration (t_1, t_2) and the number of applications k during the first phase of unemployment, we will use the following assumption:

$$h(k|t_1) = h_1(k|t_1, t_2) \quad (12)$$

which means that the number of applications (conditional on t_1) is independent of the residual duration of unemployment. The joint probability density function of (t_1, t_2) and k can now be factorized as:

$$h^*(t_1, t_2, k) = h(k|t_1) \cdot g(t_1, t_2) \quad (13)$$

which will be used in our likelihood function.

For the choice of the determinants of the application rate (μ_a) and the probability of receiving an actual job offer (P_r), we will use the structure from Figure 1. Combining the first two stages from Figure 1 implies that each determinant should be included in the specification of the application rate and the probability of receiving an actual job offer.

Hence, we will specify:

$$\begin{aligned} \mu_a(t) &= e^{\alpha_j^1(t) + Z_1 \gamma_1} \\ P_r(t) &= \frac{e^{\alpha_j^2(t) + Z_2 \gamma_2}}{1 + e^{\alpha_j^2(t) + Z_2 \gamma_2}} \end{aligned} \quad (14)$$

with Z_1 and Z_2 matrices of the relevant independent explanatory variables, γ_1 and γ_2 vectors of unknown parameters and $\alpha_j^1(t)$ and $\alpha_j^2(t)$ vectors of the unknown interval dummies; j =interval: 0-6 months, 6-12 months, over 12 months.

The maximum likelihood estimates of the parameters are presented in Table 3.

¹⁴ In this model, it is assumed that unemployed job searchers know the wage rate associated with a vacancy before they respond to that vacancy and that they will only respond if the wage rate is higher than the reservation wage.

| variables: | application rate | | job offer probability | |
|--|--------------------|----------------|-----------------------|----------------|
| | <u>coefficient</u> | <u>t-value</u> | <u>coefficient</u> | <u>t-value</u> |
| * SEARCH STRATEGY | | | | |
| - main search activity (informal contacts) | | | | |
| . looking at advertisements | -0.338 | -3.61 | 0.388 | 1.76 |
| . writing at advertisements | 0.168 | 2.09 | -0.145 | -0.72 |
| . labour exchange office | -1.223 | -9.15 | 1.281 | 4.82 |
| * LABOUR MARKET CONDITIONS | | | | |
| - unemployment rate [in %] | -0.007 | -2.67 | -0.001 | -0.18 |
| * INCOME INCENTIVES | | | | |
| - log[unemployment benefits] | 0.006 | 1.19 | -0.003 | -0.25 |
| - log[additional income] | -0.002 | -0.43 | -0.019 | -1.45 |
| - log[expected wage level] | 0.262 | 2.58 | -0.203 | -0.86 |
| * DURATION OF UNEMPLOYMENT | | | | |
| - less than six months | -1.081 | -1.55 | -1.038 | -0.61 |
| - between six and twelve months | -1.493 | -2.09 | -0.597 | -0.34 |
| - more than one year | -1.629 | -2.31 | -0.911 | -0.53 |
| * OTHER CHARACTERISTICS | | | | |
| - age [in years] | -0.025 | -4.59 | -0.012 | -0.95 |
| - educ. level [1 = primary;..., 5 = high] | -0.083 | -3.21 | 0.113 | 1.67 |
| - willing to move (unwilling) | 0.031 | 0.48 | -0.141 | -0.92 |
| - preference for full-time job (part-time) | 0.841 | 7.09 | -0.749 | -3.09 |
| household position (single male) | | | | |
| . single woman | 0.485 | 4.52 | -0.314 | -1.28 |
| . man with partner | 0.601 | 6.28 | -0.539 | -2.27 |
| . woman with partner | 0.433 | 3.41 | -0.189 | -0.65 |
| - experience [in years] | 0.006 | 1.20 | 0.013 | 0.92 |
| - number of U-E transitions | 0.134 | 3.25 | -0.040 | -0.40 |
| <u>minus log-likelihood</u> | | 1872.6 | | |
| <u>number of observations</u> | | 162 | | |

Table 3. Estimation results for the structural model.

It can be observed that the application rate is positively influenced by the expected wage level (pull-effect), the number of labour market transitions in the past, "active" search behaviour (i.e., mainly writing on advertisements) and the preference for a full time job. On the other hand, there are unfavourable effects on the application rate from "passive" search behaviour (mainly using the labour exchange office or - to some less extent - mainly looking at advertisements), the local unemployment rate (cross-classified according to occupation, age and gender), the age, and the level of education of the unemployed job seeker. Furthermore, it becomes clear that female job seekers apply more frequently than single males, but less than males with a partner. The application rate appears to be negative duration dependent.

The probability of receiving an actual job offer as a result of an application is remarkably lower for people who prefer full-time jobs. Males with a partner appear to have a significantly lower probability than single males of obtaining a job when applying. Furthermore, we find a negative effect of additional income on the offer probability. Our results also show that employers are selecting applicants on the basis of the level of education and (to a lower extent) age and experience. Surprisingly, the offer probability is relatively low in the first period of unemployment, rising in the second half year and decreasing again after one year.

Next, we will present an interpretation of the most important results of the structural model, concerning the behaviour of both parties in the job search process.

First, "passive" unemployed job seekers (i.e. people who report that their main search activity involves the assistance of the labour exchange office) apply significantly less than "active" job seekers (i.e. people who report that their main search activity is writing on advertisements). The probability to receive a job offer (if an application is made) is, however, remarkably higher for the passive group than for the active group of unemployed job seekers. Unfortunately, we do not have information about the search medium through which an application is made (using an advertisement, an informal contact or the labour exchange office), but it can be assumed that this medium will be the main search channel of the unemployed job seeker¹⁵. In that case, the parameter estimates of the search channels at the probability of receiving an offer imply that applications for vacancies counselled by the labour exchange office are relatively more successful than applications made by means of using advertisements. This finding might be a result of differences in the degree of competition. Advertisements usually attract a large pool of applications, whereas the labour exchange office tries to match an individual job seeker with a particular vacant job. Next, suppose we assume that people who report that they mainly search by means of advertisements (looking or writing) are also making application through this channel. In that case, it can be concluded that those who report mainly looking at advertisements have a higher probability of obtaining a job if they apply than those who report mainly writing. This result indicates that unemployed people who report to be mainly writing try to escape from unemployment by applying to almost every relevant vacancy that they discover, whereas those who are mainly looking apply only for a job if they believe that there is a "real" chance of obtaining that job.

Secondly, local labour market conditions (unemployment rate, expected wage level) have a significant influence on the intensity at which unemployed people apply, but have no impact on the probability that a job is offered if an application is made. Apparently, the (local) availability of (attractive) jobs is a more critical determinant of the re-employment probability of unemployed job seekers than the degree of competition for vacant jobs. Surprisingly, additional income has a negative effect on the offer probability and hardly influences the application rate. This might be due to the fact that people who are less dependent on labour income apply more selectively with respect to the characteristics of the job (but apply as frequent as other people). Thirdly, people with a higher level of education appear to apply less (i.e., in a more selective sense) than lower educated individuals, but their chances to obtain a job once they apply are significantly higher (note that in the proportional hazard model there was no effect of education on the hazard rate). Fourthly, unemployed job seekers - who prefer full time jobs - apply more frequently, probably because working full time is providing a higher labour income. On the other hand, the probability of obtaining a job for unemployed job seekers who prefer full-time jobs (in stead of part-time jobs) is relatively small. If unemployed job seekers apply according to their preferences, the lower probability to obtain a full-time job may originate from the higher supply of applicants. The higher degree of competition offers the employer an opportunity to be more selective and consequently it is harder to be chosen to fill a full time job than a part time job¹⁶. Fifthly, males with a partner apply more often than single males, but if an application is made they have a relatively small probability to be chosen by the employer to fill the vacant job.

Finally, we consider the outcome with respect to the time dependence of the application rate and the offer probability - for a standard individual¹⁷ - simultaneously (see also Figure 3).

¹⁵ Of course, applications can also be made by means of search channels other than the main one. Nevertheless, it is expected that there is a positive correlation between the main search channel and the medium through which the successful application is actually made.

¹⁶ In fact, it is unknown whether the job applied for is a full-time or part-time job. Only if people apply strictly according to their preferences, it is possible to relate the lower probability for people who prefer full-time jobs to receive a job offer (if an application is made) to the higher competition for full-time jobs.

¹⁷ The hazard of a standard individual is computed by evaluating all explanatory variables in their sample means.

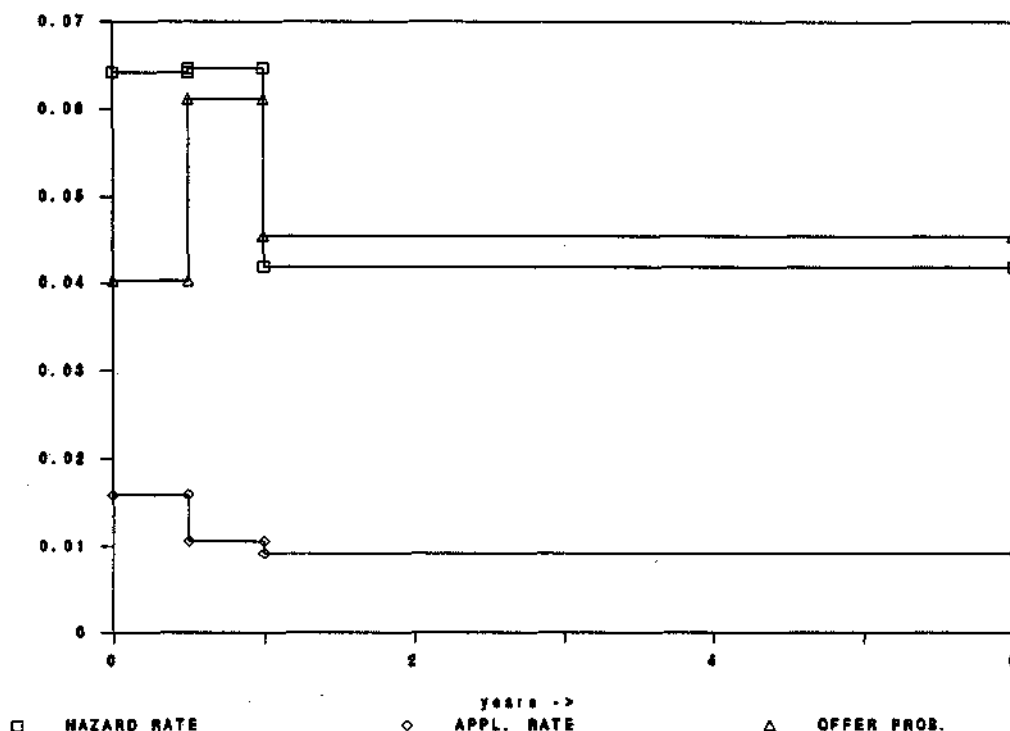


Figure 3. Decomposition of the hazard rate for a standard individual into the application rate ($\times 10^{-2}$) and the offer probability.

It can be seen from the decomposition that the low level of the hazard rate is a result of the low probability to receive an actual job offer. During the first period of unemployment (less than six months unemployed), job seekers apply more frequently than after this period but the probability to obtain an actual offer is low. A plausible explanation for this phenomenon is the following. The unemployed, although actively seeking, do not yet know which type of job is suitable for them or for which job they have a "real" chance and therefore they are often rejected by the employer. After the first period of unemployment, people may have learned from their experiences and adopt a more selective application strategy for the next period. This may then result in a higher probability of obtaining a job in the second period of unemployment. In the remaining period of unemployment (over one year¹⁸), the application rate does not decrease much further but the offer probability falls back again. The latter phenomenon could be due to an increasing selectivity for unemployed people with a longer duration.

To summarize, the alternative decomposition of the hazard rate - emphasizing the importance of different stages in the job offer arrival process - has provided a number of interesting conclusions. It has been possible to shed light on the determinants of the application behaviour of the unemployed job seeker as well as the selection behaviour of the employer¹⁹. Nevertheless, we wish to repeat our remark made in section 2. This type of model is a restrictive version of the full (four-stage) model. We believe that it could be a promising direction for further empirical research to extend our model with the identification of the "reservation wage" strategy of the unemployed job seeker.

¹⁸ It is hard to obtain reliable statistical results for the time dependence of the application rate after one year, because the number of observations in the different time periods becomes too low.

¹⁹ However, it should be realized that the model is estimated on the basis of a limited number of observations.

Finally, we will compare the estimation results of the structural and the reduced form model by looking at the derivatives of the logarithm of the hazard rate with respect to the independent variables. In the case of the reduced form model, this derivative is simply equal to the estimated coefficient (β) of the relevant variable, whereas for the structural model it can be derived that

$$\frac{\partial \log \lambda}{\partial Z_i} = \gamma_{1i} + \gamma_{2i} - P_r \gamma_{2i} \quad (15)$$

In the latter case, we need to choose certain values of the explanatory variables to calculate the probability of receiving an offer (P_r)²⁰. Here, the value of P_r is computed by evaluating the explanatory variables in their sample means. The results of the derivatives for both models are presented in Table 4.

| | reduced form model | structural model |
|--|--------------------|------------------|
| * SEARCH STRATEGY | | |
| - main search activity (Informal contacts) | | |
| . looking at advertisements | -0.004 | 0.035 |
| . writing at advertisements | 0.032 | 0.029 |
| . labour exchange office | -0.058 | 0.008 |
| * LABOUR MARKET CONDITIONS | | |
| - unemployment rate [in %] | -0.006 | -0.008 |
| * INCOME INCENTIVES | | |
| - log[unemployment benefits] | 0.009 | 0.003 |
| - log[additional income] | -0.036 | -0.020 |
| - log[expected wage level] | 0.045 | 0.067 |
| * OTHER CHARACTERISTICS | | |
| - age [in years] | -0.032 | -0.036 |
| - educational level [1 = primary; ...; 5 = high] | 0.022 | 0.026 |
| - willing to move (unwilling) | -0.097 | -0.104 |
| - preference for full-time job (part-time) | 0.049 | 0.121 |
| household position (single male) | | |
| . single woman | 0.160 | 0.183 |
| . man with partner | 0.257 | 0.082 |
| . woman with partner | 0.412 | 0.251 |
| - experience [in years] | 0.012 | 0.018 |
| - number of U-E transitions | 0.084 | 0.096 |

Table 4. Derivatives of the logarithm of the hazard rate with respect to the explanatory variables for the reduced form and structural model.

In general, we can observe that the outcomes for the structural model are in line with the findings of the reduced form model. If we compare the derivatives of the (logarithm of) the hazard with respect to the most significant variables in the reduced form model (age, additional income, household position and local unemployment rate, respectively), it can be seen that the impact of age and the local unemployment rate are roughly the same, whereas larger differences are found for the effect of additional income and the household position of the individual. More specifically, the elasticity of the hazard with respect to additional income is substantially smaller in the structural model and the positive effect of having a partner is less pronounced in the structural model.

In short, a comparison of both models shows that - at most variables - the total effects on the hazard rate for the structural model roughly correspond to the effects resulting from the reduced form model.

²⁰ A sensitivity analysis is needed to find out to which extent the derivatives depend on the values of the explanatory variables chosen.

6. SUMMARY AND CONCLUSIONS

In this paper, we have tried to identify the barriers to re-employment for unemployed job seekers by estimating duration models. The determinants included in the duration models are derived from a theoretical model of the different stages in the job search process. Two types of models have been used in the paper.

First, we have estimated a proportional hazard model - with a flexible baseline hazard - in which the path to re-employment is not specified. This implies that it is not possible to distinguish between the underlying causes originating from the relevant stages of the process. The estimation results of the proportional hazard model show that it is relatively difficult to escape from unemployment for people who are older and/or already unemployed for a long time. Unemployed individuals who are not (or less) dependent on labour income also leave the state of unemployment less frequently. Furthermore, bad local labour market conditions on specific segments of the market are also responsible for a substantial increase in the expected duration of unemployment. It appears that in the proportional hazard model the level of unemployment benefits does not influence unemployment duration positively, which supports the conclusion of Groot and Jehoel-Gijsbers that there is no empirical evidence of a "push" effect of unemployment benefits on the duration of unemployment in the Netherlands (within the current system of social security).

Secondly, we have introduced a structural model of unemployment duration in which the hazard rate is decomposed into the application rate and the probability of receiving an actual job offer. The latter component reflects the "selection mechanism" controlled by the employer, whereas the former component is assumed to capture the choice behaviour of unemployed job seekers. From the estimation results, it becomes clear that the low level of the hazard rate is mainly caused by the low probability of receiving an actual job offer. The application intensity is significantly higher for younger people, people with a lower education, individuals who report to be searching mainly by means of advertisements and those who have experienced several transitions between unemployment and employment in the past. Higher expected wages and lower (segment-specific) unemployment rates also give rise to a higher application rate. Moreover, it appears that the short-term unemployed apply more frequently than the long-term unemployed.

Nevertheless, more applications for a job do not guarantee that a job is obtained, which is due to the selective choice behaviour of the employer. The expected level of labour productivity of the unemployed applicant appears to be insufficiently related to the qualifications required for the job or the qualifications of other applicants (competition). Our estimates demonstrate that employers prefer younger, higher educated and more experienced individuals. In addition, chances for unemployed job seekers who prefer full-time jobs and male unemployed job seekers with a partner are significantly lower.

The policy implications of the results of our structural model are the following. The intensity with which unemployed job seekers apply for a job may be improved for particular groups of unemployed (especially long-term unemployed people, single males, older people and seekers who report to be mainly searching with the assistance of the labour exchange office). Moreover, policies may also aim to enlarge the number of the potential job opportunities in regions which are characterized by high unemployment rates.

On the other hand, it is important to give sufficient attention to increasing the probability of obtaining a job if an application is made in order to improve the labour market prospects of unemployed job seekers. In particular, the qualifications of unemployed job seekers (notably education and work experience) should be tuned to the job requirements imposed by employers. This tuning process could be coordinated by local Labour Exchange Offices (for example, by means of the so-called method of Individual Traject Counseling ("Individuele Trajectbegeleiding")).

Finally, we conclude that the results of the structural model used in this paper are promising, because they show that it is possible to get more insight into the arrival process of job offers. The model might be improved by explicitly including the "reservation wage" strategy of unemployed job seekers and the process of information gathering about vacant jobs. Such extensions would be a fruitful direction of further research.

Acknowledgement.

The authors wish to thank Jan van Ours for his valuable comments on an earlier version of this paper.

REFERENCES

- Allaart, P.C., R. Kunnen and H.A. van Stiphout (1989), "Tendrapport Arbeidsmarkt 1989", "Organisatie voor Strategisch Arbeidsmarktonderzoek" (OSA), The Hague
- Berg, G.J. van den (1990), Search behaviour, transitions to non-participation and the duration of unemployment, Economic Journal, 402, 100, 842-865
- Gorter, C., P. Nijkamp and P. Rietveld (1991), The Duration of Unemployment in the Netherlands: A Proportional Hazard Model, Regional Science and Urban Economics, forthcoming
- Gorter, D. and E.M.J. Hoogteijling (1990), Duur van het zoeken naar werk, Report, Centraal Bureau voor de Statistiek, Voorburg
- Graafland, J.J. (1988), Hysteresis in Unemployment in the Netherlands, De Economist, 136, 508-523
- Groot, W. and G. Jehoel-Gijsbers (1990) "De invloed van de uitkeringshoogte op de werkloosheidsduur", Economische Statistische Berichten, 177-181
- Kerckhoffs, C., C de Neubourg and F. Palm (1990), The Determinants of Individual Unemployment Duration in the Netherlands, Report, University of Limburg
- Kiefer, N.M. (1988), Economic Duration Data and Hazard Functions, Journal of Economic Literature, June, 646-679
- Kooreman, P. and G. Ridder (1983), The effects of age and unemployment percentage on the duration of unemployment, European Economic Review, 20, 41-57
- Lancaster, T. and A.D. Chesher (1983), An econometric analysis of reservation wages, Econometrica, 51, 1661-1676
- Lancaster, T. (1985), Generalised Residuals and Heterogeneous Duration Models, Journal of Econometrics, 155-169
- Lindeboom, M. and J. Theeuwes (1989), The intensity of search and the duration of unemployment, Research Memorandum 89.06, University of Leyden, Leyden
- Lindeboom, M. and J. Theeuwes (1990), Job duration in the Netherlands: The simultaneous occurrence of high and low turnover, Research Memorandum 90.03, University of Leyden, Leyden
- Lindeboom, M. and J. Theeuwes (1991), Search, benefits and entitlement, Paper presented at the EALE conference, Madrid
- Lynch, L.M. (1985), State Dependency in Youth Unemployment, Journal of Econometrics, 71-84
- Meesters, M. and F.J.R. van de Pol (1989), Once unemployed, always unemployed? An analysis of the duration of unemployment and the stability of jobs of Dutch schoolleavers in the eighties, In: B.F.M. Bakker, J. Dronkers and G.W. Meijnen (eds.), Educational Opportunities in the Welfare State, OOMO 7, ITS, Nijmegen
- Mekkelholt, E., W. Praat and E. Brouwer (1989), "Werkloosheidspercentages in geografische beroepsdeelmarkten", Research Memorandum 8927, University of Amsterdam, Amsterdam
- Mortensen, D.T. (1986), Job Search and Labor Market Analysis in: O. Ashenfelter and R. Layard (eds.), Handbook of Labor Economics, North-Holland, Amsterdam

- Mortensen, D.T. and G.R. Neumann (1984), Choice or Chance? A structural Interpretation of Individual Labor Market Histories in: G.R. Neumann and N.C. Westergård-Nielsen (eds.), Studies in Labor Market Dynamics, Berlin, Springer Verlag, 98-131
- Narendranathan, W and S. Nickell (1985), Modelling the proces of job search, Journal of Econometrics, 28, 29-49
- Opstal, R. van and J. Theeuwes (1986), Duration of Unemployment in the Dutch Youth Labour Market, De Economist, 134, 351-367
- Ours, J.C. van (1989), Durations of Dutch Job Vacancies, De Economist, 137, 309-327
- Ours, J.C. van (1990), An Empirical Analysis of Employers' Search, in: J. Hartog, G. Ridder and J. Theeuwes (eds.), Panel Data and Labor Market Studies, North-Holland, Amsterdam, 191-213
- Ridder, G. (1984), The Distribution of Single-Spell Duration Data in: G.R. Neumann and N.C. Westergård-Nielsen (eds.), Studies in Labor Market Dynamics, Berlin, Springer Verlag, 45-73
- Ridder G. and C. Gorter (1986), Unemployment benefits and search behaviour, an empirical investigation, Mimeo, University of Amsterdam, Amsterdam
- Ridder, G. (1990), Attrition in Multi-Wave Panel Data in: J. Hartog, G. Ridder and J. Theeuwes (eds.), Panel Data and Labor Market Studies, North-Holland, Amsterdam, 45-67
- Theeuwes J., M. Kerkhofs and M. Lindeboom (1990), Transitions Intensities in the Dutch Labour Market 1980-1985, Applied Economics, 22, 1043-1061
- Vissers, A.M.C and W.N.J. Groot (1988), "Arbeidsmobiliteit, beloning and loopbaan, OSA Report ("Voorstudie"), no. V25, The Hague
- Wolpin, K.I. (1987), Estimating a structural job search model: the transition from school to work, Econometrica, 55, 801-818
- Yoon, B.J. (1981), A model of unemployment duration with variable search intensity, Review of Economics and Statistics, 63, 599-609

APPENDIX A

In this Appendix, we present the sample means of the variables used in the analysis and the distribution of the dependent variable (unemployment duration) over the different types of duration spells.

Means of variables used in the analysis (measured at the first stage of the labour market survey).

SEARCH STRATEGY

| | |
|-----------------------------|-----|
| - main search activity | |
| . informal contacts | 21% |
| . looking at advertisements | 27% |
| . writing at advertisements | 35% |
| . labour exchange office | 17% |

REGIONAL LABOUR MARKET CONDITIONS

| | |
|--|-------|
| - unemployment rate (age-occupation-gender specific) | 18.6% |
|--|-------|

INCOME INCENTIVES

| | |
|-------------------------|-------------------------|
| - unemployment benefits | 712 guilders per month |
| - additional income | 1034 guilders per month |
| - expected wage level | 1810 guilders per month |

OTHER INDIVIDUAL CHARACTERISTICS

| | |
|---|------------|
| - age | 36.0 years |
| - educational level (1 = primary; 2 = low vocational; 3 = secondary; 4 = extended vocational; 5 = university/high vocational) | 3.3 |
| - willing to move (unwilling) | 48% (52%) |
| - preference for full-time job (part-time) | 72% (28%) |
| - household position | |
| . single male | 18% |
| . single woman | 19% |
| . man with partner | 35% |
| . woman with partner | 28% |
| - experience | 11.8 years |
| - number of transitions between unemployment and employed in previous five years | 0.20 |

UNEMPLOYMENT DURATION

| | |
|------------------------------------|-------------|
| - elapsed duration of unemployment | 20.3 months |
|------------------------------------|-------------|

Distribution of unemployment duration
over the different types of duration spells.

| | |
|--|-----|
| - number of incompletd spells | 87 |
| - number of completed spells (precise information) | 61 |
| - number of completed spells (imprecise information) | 14 |
| - total sample | 162 |

APPENDIX B

In this Appendix, we will first investigate the possible effect of attrition in our data set and secondly we will test for misspecification of the proportional hazard model (see section 4) due to unobserved heterogeneity.

The proportional hazard model is estimated on the basis of data from two waves of a panel survey in 1985 and 1986. As mentioned in section 3, approximately 35% of the original 1985 sample was lost in the second wave. The use of panel data might lead to biased parameter estimates if attrition is based on the endogenous variable of the model (unemployment duration) or if it depends on omitted variables correlated with the endogenous variable (see for example, Ridder 1990). We will check for the possible effect of attrition in our model by means of the following simple tests.

First, it is noted that the attrition loss for people in labour market states other than unemployment (employment or non-participation) is about the same as for unemployed people (see also Lindeboom and Theeuwes, 1990).

Secondly, we consider the sample statistics (mean and standard error) of elapsed duration of unemployment - in the first wave - for people who are reinterviewed and for those who don't appear for the second interview. The differences between both groups are negligible (see Table 2).

All this leads us to the conclusion that there are no indications of an attrition bias in our model.

| | unemployment duration (in months) | |
|-------------|-----------------------------------|----------------|
| | mean | standard error |
| "stayers" | 20.3 | 18.3 |
| "drop-outs" | 19.4 | 18.8 |

Table B1. Sample statistics of unemployment duration for "stayers" and "drop-outs" in the panel survey.

In our model, the variation of the hazard rate over time is captured by the flexible base-line hazard. In the final specification of the model, the base-line hazard is constant after the first year, because allowing the hazard rate to vary over more time periods did not improve the fit of the model, whereas the additional duration parameters hardly differed from each other after the first year. In addition, the number of observations appeared to be too small to improve the "fit" of the model by allowing the hazard rate to change each month during the first year²¹.

Next, we will test whether the parameter estimates are biased due to the effect of unobserved (inter-individual) heterogeneity. In duration models, uncontrolled heterogeneity might bias the parameter estimates of the explanatory variables. In addition, the hazard may be biased towards negative duration dependence (see for example, Lancaster and Nickell, 1980). However, it is argued by Ridder (1987b) that the bias in the maximum likelihood estimates of the parameters in the proportional hazard model is negligible if one has a sufficiently flexible baseline hazard.

In order to test whether our results are biased by the effect of uncontrolled heterogeneity, we will use a score test (following the approach of Lancaster, 1985). It is assumed that the unobserved heterogeneity is represented by a multiplicative error term v with mean 1 and variance σ^2 .

The hazard rate can then be written as

$$\hat{\lambda}(t|v) = \lambda(t) \cdot v \quad (B1)$$

Next, the unconditional survivor function is expanded about the mean of v to second order, so that a score test of $\sigma^2=0$ can be evaluated without assuming a specific distribution function for v (see for more details Lancaster, 1985). The score test statistic is distributed asymptotically as a chi-squared variate with one degree of freedom and can be computed by using second derivatives of the likelihood function.

Our proportional hazard model produces a chi-square statistic of 2.242 (the 10% significance level critical point is 2.710), so that the hypothesis of zero variance is not rejected. In other words, the effect of neglected heterogeneity is not significantly present in our reduced form model.

²¹ In this respect, it should be noted that empirical studies of unemployment duration using continuous hazard functions usually show a steadily decreasing hazard rate during the first period (see for example, Gorter et al., 1991).

| | | |
|---------|---|--|
| 1990-1 | B. Vogelvang | Testing For Co-Integration with Spot Prices of Some Related Agricultural Commodities |
| 1990-2 | J.C.J.M. van den Bergh P. Nijkamp | Ecologically Sustainable Economic Development Concepts and Model Implications |
| 1990-3 | J.C.J.M. van den Bergh P. Nijkamp | Ecologically Sustainable Economic Development in a Regional System: A Case Study in Agricultural Development Planning in the Netherlands |
| 1990-4 | C.Gorter P.Nijkamp P.Rietveld | Employers' Recruitment Behaviour and Re-Employment Probabilities of Unemployed |
| 1990-5 | K.Burger | Off-farm income and the farm-household the case of Kenyan smallholders |
| 1990-6 | H. Visser | Crowding out and the Government Budget |
| 1990-7 | P. Rietveld | Ordinal Data in Multicriteria Decision Making, a Stochastic Dominance Approach to Siting Nuclear Power Plants |
| 1990-8 | G. van der Laan P.H.M. Ruys D.J.J. Talman | Signaling devices for the supply of semi-public goods |
| 1990-9 | F.A.G. den Butter | Labour Productivity Slowdown and Technical Progress: An empirical analysis for The Netherlands |
| 1990-10 | R.W. van Zijp | Neo-Austrian Business Cycle Theory |
| 1990-11 | J.C. van Ours | Matching Unemployment and Vacancies: The Efficiency of the Dutch Labour Market |
| 1990-12 | B. Vogelvang | Hypotheses Testing Concerning Relationships between Spot Prices of Various Types of Coffee |
| 1990-13 | A.F. de Vos I.J. Steyn | Stochastic Nonlinearity: A Firm Basis for the Flexible Functional Form |
| 1990-14 | Y.H. van Emmerik D. de Jong W.W.A. Zuurmond D.N. Dukkers-van Emden | Opereren in overleg: geprotocolleerde samenwerking 1e-2e-lijn bij dagchirurgie |
| 1990-15 | T.J.J.B. Wolters | Mediation and Collective Bargaining: A Diagnostic Approach |
| 1990-16 | E.M.A. Scholten J. Koelewijn | Financieringsproblematiek van startende ondernemingen: een mogelijke verklaring op basis van empirisch onderzoek. |
| 1990-17 | E. Hüner H.P. Smit | Saturation and Model Specification of Passenger car Ownership |
| 1990-18 | F.A.G. den Butter | Sociale zekerheid, de wig en economische groei |