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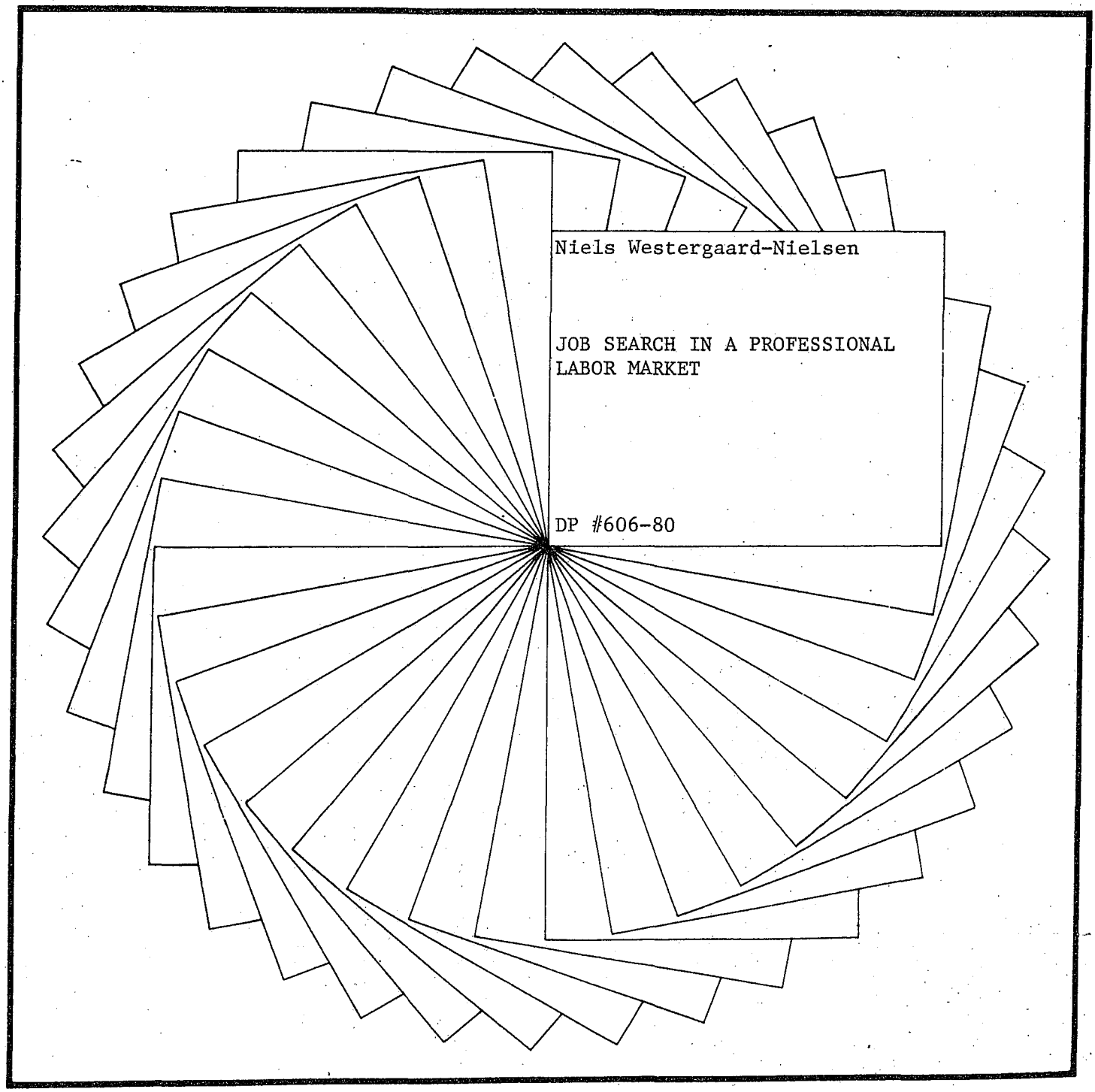

JOB SEARCH IN A PROFESSIONAL LABOR MARKET

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ABSTRACT

This study specifies a variable intensity model of labor market search and investigates its empirical consequences.

The present work differs from that undertaken so far (see, for example, Barron, 1975; and Kiefer and Neuman, 1979) in several ways, two of which are mentioned here. First, a more complete model of professional job search is developed which allows for workers to vary search intensity and takes into account the effect of employers' screening. Second, the data employed overcome many difficulties encountered in previous data sets.

The study shows that background characteristics such as grades, sex, age, and previous working experience play a significant role in determining intensity of search, the reservation income level and thus the expected duration of search. The most interesting finding is that the job searchers compensate for deficiencies in background characteristics by intensifying their search in such a way that the expected differences in duration of search are reduced. This important point has been overlooked in other studies.

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INTRODUCTION

This study specifies a variable intensity model of labor market search and investigates its empirical consequences. A considerable amount of empirical research on the determinants of the duration of unemployment has been generated in recent years (see, for example, Barron, 1975; and Kiefer and Neuman, 1979). The theoretical models of job search utilized in the previous studies characterize the market for manual labor reasonably well. Nevertheless, many common aspects of job search in markets for professionals, such as interviewing and screening by employers, are not included.

The present work differs from that undertaken so far in several ways, two of which are mentioned here. First, a more complete model of professional job search is developed which allows for workers to vary search intensity and takes into account the effect ef employers' screening. Second, the data employed overcome many difficulties encountered in previous data sets. For example, the data used in this study specifies how many times an individual applied for a job, how many interviews were obtained, and how many offers were received for each individual in the sample.

We show that background characteristics such as grades, sex, age, and previous working experience play a significant role in determining intensity of search, the reservation income level, and thus the expected duration of search. The most interesting finding is that the job searchers compensate for deficiencies in background characteristics

by intensifying their search in such a way that the expected differences in duration of search are reduced. This important point has been overlooked in other studies.

JOB SEARCH MODELS

In the following text, a model of the hiring process will be constructed. The model will be formulated within the job-search theory as it is framed by Stigler (1962), Mortensen (1970), Lippman and McCall (1976), Burdett (1977), and Kiefer and Neumann (1979). Although none of these models describe the job market in question, elements of each will be incorporated.

These authors have constructed either models which describe nonsequential search (Stigler, 1962), where the number of firms to be visited is determined before search begins, or models where the search is of a sequential type, where the searcher after each offer decides whether to accept employment or to continue search--with or without recall.

The problem facing the job searcher in the simple job-search model with sequential search (Burdett, 1977) is whether to maximize his discounted future income by accepting a job offer and then remaining employed indefinitely or to continue to search for another period. It is assumed that he knows the probability distribution of income offers, $f(y)$, which is supposed to be invariable over time. The problem can then be formulated as one of finding a reservation income, y^*, which is the minimum acceptable income offer.

For every income offer, the optimal policy has the form

accept job if offer $\geq y^*$

continue search if offer $< y^*$.

It is assumed that the job seeker receives unemployment insurance (UI) payments, z_t, throughout the search period. It is further assumed that the UI payment, once obtained, is constant. The direct out-of-pocket cost of search is c, which is assumed to be proportional to the job-search effort. It follows that at this stage, where there is only one search effort made per period, the costs are constant per period.

Let $V_t(y)$ denote the expected discounted future income of time t of searching for one period given the reservation income y*. If employment is obtained, i.e., the offered income is y* or above y*, the employment is assumed to start at the end of the period.

The discounting factor is then $\frac{1}{1+r}$, where r is the appropriate time preference. Because the search costs and the UI payment are both paid in the beginning of the period, the expected discounted future income of searching for one more period is

$$V_t(y) = z_t - c + \Pr\ (\text{receiving an acceptable offer in this period})\ (\text{expected discounted future income})\ \frac{1}{1+r} + \Pr\ (\text{receiving no acceptable offer})\ (\text{expected discounted future income with future search})\ \frac{1}{1+r}$$

This can be rewritten as

$$V_t(y) = z_t - c + \frac{1}{1+r}\int_{y^*}^{\infty} f(y)dy \cdot \frac{\int_{y^*}^{\infty} yf(y)dy}{\int_{y^*}^{\infty} f(y)dy} + \frac{1}{1+r}F(y^*)V_{t+1}(y) \qquad (1)$$

where $F(Y^*) = \int_0^{y^*} f(y)dy$.

The reservation income is the income which maximizes (1), so

$$\frac{dV_t}{dy} = -\frac{y^*f(y^*)}{1+r} + \frac{f(y^*)}{1+r} \cdot V_{t+1} = 0$$

$$y^* = V_{t+1}.$$

Since $V_t = V_{t+1}$, as nothing changes in the function (1) when the time passes, it follows that $y^* = V_t$. (Throughout the rest of this study it is assumed that $V_t = V_{t+1}$.) Hence, y^* can be found as the solution to the following expression derived from the above.

$$c = z_t - y^*\left(\frac{r}{1+r}\right) + \frac{r}{1+r}\int_{y^*}^{\infty}(y - y^*)f(y)dy. \qquad (2)$$

The probability of obtaining an acceptable job offer in a period, M, can then be written as

$$M = \int_{y^*}^{\infty} f(y)dy.$$

Thus the expected duration of unemployment is $\frac{1}{M}$.

A Variable Intensity Job Search Model

In the job market in question the proposed search method is a mixed nonsequential and sequential one because job openings in a professional market are normally announced on a monthly or biweekly basis (i.e., in periodicals) and it takes some time before the job searcher eventually gets a reply to his application. If the job searcher gets one or more offers, he has to decide whether to accept one offer or to continue to search for another period. If he continues the search, he also must decide how many applications he will send in the next period.

The simple model can be extended by increasing the number of possible job offers from 1 to n per period, each obtained by a cost c. At the same time it is assumed that the searcher can retain a job offer for the period so he has the opportunity to choose the best job offer among n offers per period. If K(n) is the expected maximum income after n searches and F(y) is the income distribution, which is bounded and continuous so that there is a density function f(y) so that $\int_o^B f(y)dy = 1$, then

$$K(n) = \int_o^B y dF(y)^n = B - \int_o^B F(y)^n dy.^1$$

Hence,

$$\lim K(n) = B \text{ for } n \to \infty, \quad \frac{dK}{dn} = -\int_o^B F(y)^n \ell n F(y) dy > 0$$

$$\text{and } \frac{d^2K}{dn^2} < 0.$$

The stopping rule applied to this case with a variable number of job offers implies that the value of search is given by

$$V(y, n) = z - cn + \frac{1}{1+r} \int_y^B y d[F(y)^n] + \frac{1}{1+r} F(y)^n V(y, n). \qquad (3)$$

Other Alterations of the Simple Model

So far we have dealt mostly with a standard search model which normally is applied to the manual labor market. Because the labor market and search situation in question differ from the premises of these models, it is necessary to adapt the model to the labor market used here.

In the standard search models it is taken for granted that the life-cycle earnings profiles are alike and are consequently formulated in current wages. But when we look at the wages of a group of professionals, it would probably be misleading to use current wages because the expected lifetime patterns of income[2] as well as benefits[3] vary for different occupations.

To deal with these problems we will change the wage income concept to the discounted, expected life-time income including these benefits. Although more theoretically satisfactory, the empirical work with such a concept is complicated.

Most of the models assume that the job searchers are homogeneous in ability. Mortensen (1970) and Barron (1975), however, assume that the job searchers are heterogeneous, which implies that only a fraction of all vacant jobs are open to an individual (depending on his qualifications). In this way the heterogeneous qualifications effect heterogeneous wages and durations of search.

Kiefer and Neumann (1979) go a step further and assume that every individual searches in a distribution of income offers, which depends on the job searchers' characteristics. But none of those authors are dealing with the effects of employers' screening. Only Lippman and McCall's survey (1976) deals with employers' search as such.

In this study we attempt to introduce employers' search into the search process. In this way we may achieve testable hypotheses on how the employers perform the search process and on how their behavior affects the

reservation income, the search intensity, and the duration of search for individuals.

In the following section we will focus on how employers may perform search and on how this affects the job searchers.

Employers' Search for Employees

It is still assumed that the employer who is searching for a new employee somehow publicly announces the vacancy. At the same time he indicates that the job is for people with a specific education or set of qualifications. In this way the employer receives a number of applications from a relatively homogeneous group. How will he choose among them?

The profit-maximizing employer will hire the person with the greatest difference between value of marginal productivity (mp) and salary. And given that at least the initial salary depends on the job and not on some unmeasurable marginal productivity of the individual,[4] the only thing the employer can do to maximize his profit is to hire the individual who is expected to have the highest mp or else hire no one. What he needs is a screening device which can tell him in a simple way how to rank the applicants.

Akerlof (1970), Arrow (1973), Spence (1973), and Stiglitz (1975) have pointed out that education screening will most likely be used by the employers because the information is easy and inexpensive to obtain; and the education system itself provides the most thorough screening. Furthermore, Arrow (1973) stresses that failures as a result of using this factor as a

screening device are not likely to show up immediately because individual productivity in most nonmanual jobs is very difficult to measure. Thus education might be retained as a screening device even if it is not always efficient.

If the jobs in question all somehow require a specific education, and if the education system gives grades according to performance, these grades are most likely going to be used as screening devices. But other characteristics such as sex, previous working experience, age, and duration of study also may be expected to be used.

Following this method, the employer will decompose the population of applicants according to specific characteristics so that each subgroup consists of applicants among whom he is not able to discriminate.[5] If, for example, the employer believes that grades are positively correlated with marginal productivity (together with other characteristics), the grades are used as the main screening device.

The job searchers on their side will learn very soon which are the characteristics the employers rely on most. Consequently, they will give that information on their applications to increase the likelihood of being invited for an interview. This can be considered of social value as it lowers the total costs of search, given that the signal on mp is correct. On the other hand, there might also exist an incentive to devote more resources to improve these characteristics even though the searchers productivity is not increased. In this case there is a social loss, as Spence (1973) has pointed out.

Following the decomposing rule, the employer will decompose the applicants according to their average grades and other characteristics in such a way that each subgroup consists of applicants with mp's that are not anticipated to be significantly different.[6] By interviewing the group with the highest anticipated marginal productivity, the employer can now get more information on the potential mp. He might here follow a stopping rule. There are, however, at least two occasions where the rational employer would not do so, but rather interview the whole group and on that basis make a priority list. The first is where the time costs in performing only one interview at a time could be high in relation to the costs of interviewing the whole group. For example, suppose that the first person who gets an offer rejects it and before the next one can be called for an interview he has received other offers. The second case arises when the employer does not know the distribution of the mp's of the subgroup.

If all employers follow this scheme whether or not they use a stopping rule and use the same or nearly the same characteristics as screening devices and if all the applicants apply for a random selection of jobs (they do not make any prior selection of jobs), the consequences for the individuals are that those with better background characteristics have a higher probability of being invited for an interview (given they have sent an application and given the total number of vacant jobs to the total number of applicants). A larger number of vacant jobs to the number of job openings means that the probability of obtaining an interview increases because it is more likely that there will be fewer competing applications for a job opening.

Accordingly, the probability of getting an interview, given an application, may be written as

$$\alpha_i = \alpha(\bar{B}_i, A_t, T_t)$$

where $\frac{\partial \alpha_i}{\partial (\text{grades})} > 0$, $\frac{\partial \alpha_i}{\partial A_t} < 0$, $\frac{\partial \alpha_i}{\partial T_t} > 0$

where $\bar{B}_i$ is a vector of background characteristics for individual no. i. A_t is the total number of applicants in time t as a proxy variable for the number of applications, and T_t is the number of job openings.

After an interview, the probability of an individual getting an offer depends on how the employer values the outcome of the interview. This probability is assumed to be independent of the factors in the B vector as these characteristics already are evaluated. What matters, instead, are such factors as personal performance and behavior. If $\bar{Q}_i$ represents those factors, the probability of getting an offer given an interview is

$$\beta_i = \beta(\bar{Q}_i).$$

At first when the graduate has received an offer he has the possibility of rejecting or accepting it.

Optimal Search When Employers Also Search

As a result of employers search, the optimal search rule (3) must be modified. First, only a fraction of α_i of the number of applications n_i are efficient in the way the applicant is invited for an interview and second, only a fraction β_i of all interviews ends in an offer. Consequently (3) is changed into (4).

The value of search is now

$$V(n_i,y_i) = z_t - cn_i + \frac{1}{1+r}\int_{y_i}^{B} y\,d[F(y)^{n_i\alpha_i\beta_i}] \tag{4}$$

$$+ \frac{1}{1+r}[1 - \int_{y_i}^{B} d(F(y)^{n_i\alpha_i\beta_i})]V(y_i, n_i)$$

$$= z_t - cn_i + \frac{1}{1+r}[B + (V(y_i, n_i) - y)F(y_i)^{n_i\alpha_i\beta_i}$$

$$- \int_{y_i}^{B} F(y)^{n_i\alpha_i\beta_i}\,dy.$$

After this, search is clearly individualized.

The set (y_i^*, n_i^*) that optimizes $V(y_i, n_i)$, given an interior solution, may be found as the solution to

$$\frac{\partial V(y_i,n_i)}{\partial y_i} = \frac{\tau[(V(y_i,n_i) - y_i^*)n_i^*\alpha_i\beta_i F(y_i^*)^{n_i^*\alpha_i\beta_i - 1} \cdot f(y_i)]}{1 - \tau F(y_i^*)^{n_i^*\alpha_i\beta_i}} = 0 \tag{5}$$

and

$$\frac{\partial V(y_i,n_i)}{\partial n_i} = \frac{-c + \tau\alpha_i\beta_i[(V(y_i,n_i) - y_i^*)F(y_i^*)^{n_i^*\alpha_i\beta_i}\ell nF(y_i^*) - \int_{y_i^*}^{B} F(y)^{n_i^*\alpha_i\beta_i}\ell nF(y)dy]}{1 - \tau F(y_i^*)^{n_i^*\alpha_i\beta_i}} = 0 \tag{6}$$

where, for convenience, $\tau = \frac{1}{1+r}$.

From (5) we get that given $\alpha_i n_i \beta_i F(y^*)^{\alpha_i n_i - 1} f(y^*) \neq 0$, $V(y_i,n_i) = y_i^*$. This says that the value of search for another period in optimum[7] is equal to the reservation income.

And from (6) it follows that

$$\frac{c}{\alpha_i\beta_i} = -\tau \int_{y_i^*}^{B} F(y)^{n_i^*\alpha_i\beta_i}\ell nF(y)dy$$

According to the above findings of y_i^* and n_i^*, the following two equations must be fulfilled in optimum:

$$y_i^* + cn_i^* - z_t - \tau[B - \int_{y_i^*}^{B} F(y)^{n_i^*\alpha_i\beta_i}\, dy] = 0 \qquad (7)$$

and

$$c + \alpha_i\beta_i\tau\int_{y_i^*}^{B} F(y)^{n_i^*\alpha_i\beta_i} \ln F(y)\, dy = 0 \qquad (8)$$

To see how changes in α_i, β_i, c, z_t and r affect y_i^* and n_i^* it is necessary to investigate how the total differentials as changes in the exogenous variables will affect both n_i^* and y_i^*.

As a result of this investigation we can conclude that

$$\frac{dy_i^*}{d\alpha_i} > 0,\ \frac{dy_i^*}{d\beta_i} > 0,\ \frac{dy_i^*}{dc} < 0,\ \frac{dy^*}{dz} > 0,\ \text{and}\ \frac{dy^*}{dr} < 0.$$

This means that, as expected, the reservation incomes goes up where α_i and β_i are higher, and that lower costs and higher UI payment result in a higher reservation income.

When we consider the derivatives of the optimal number of applications, n_i^*, the results are more ambiguous. Both $\frac{dn_i^*}{d\alpha_i}$ and $\frac{dn_i^*}{d\beta_i}$ are not clearly signed, but are suspected to be negative. Nevertheless,

$$\frac{dn_i^*}{dc} < 0,\ \text{and}\ \frac{dn_i^*}{dz} < 0.$$

This indicates that higher application costs and higher UI payments both have a negative effect on the search effort measured by n_i^*. Consequently,

the reservation income and the search effort for the individual may be written as functions of the exogenous variables.

$$y_i^* = f(\alpha_i, \beta_i, c, z_t, r). \tag{9}$$

$$n_i^* = g(\alpha_i, \beta_i, c, z_t, r). \tag{10}$$

Duration of Search

Since we have found n_i^* and y_i^*, the probability per period of getting an acceptable offer can be expressed as

$$\gamma_i = \int_{y^*}^{B} dF(y)^{n_i^* \alpha_i \beta_i} \tag{11}$$

From this the expected duration of search is

$$DS_i = \frac{1}{\gamma_i} = \left[\int_{y_i^*}^{B} dF(y)^{n_i^* \alpha_i \beta_i} \right]^{-1} \tag{12}$$

It is clear that the probabilities α_i and β_i influence DS_i in three ways. First directly, second via y_i^*, and third via n_i^*. The variables t, c, r only influence DS_i indirectly.

From earlier discussion it is also clear that the influences might be of different directions. Thus we have that $\frac{\partial DS_i}{\partial \alpha_i} < 0$, $\frac{\partial DS_i}{\partial n_i^*} < 0$ and $\frac{\partial DS_i}{\partial y_i^*} > 0$. To find the net effect, the total differentials, i.e., $\frac{dDS_i}{d\alpha_i}$, must be calculated. Unfortunately except for one the signs are all ambiguous. Thus

$\frac{dDS_i}{dz} > 0$, while $\frac{dDS_i}{d\alpha_i}$, $\frac{dDS_i}{d\beta_i}$ and $\frac{dDS_i}{dc}$ are suspected to be negative[8] and finally $\frac{dDS_i}{dr}$ which is suspected to be positive.

Consequently, the expected duration of search can be written as a function of the parameters.

$$DS_i = \Omega(\alpha_i, \beta_i, c_t, z_t, r). \tag{13}$$

This means that the individual expected duration of search is a function of the probability of getting an interview, the probability of receiving an offer, the costs of search, the unemployment benefit, and the interest rate. And as α_i and β_i both are functions of some background characteristics and of c, z_t, r, the functions (9), (10) and (13) also can be expressed as functions of these background characteristics.

$$y_i^* = \Gamma(\bar{B}_i, \bar{Q}_i, A_t, T_t, c, z_t, r). \tag{14}$$

$$n_i^* = G(\bar{B}_i, \bar{Q}_i, A_t, T_t, c, z_t, r). \tag{15}$$

$$DS_i = \Delta(\bar{B}_i, \bar{Q}_i, A_t, T_t, c, z_t, r). \tag{16}$$

THE DATA

The data which will be utilized in estimating the model come from a survey done by the author on new graduates of the social sciences from Danish universities in the period 1974-1977. Among others the survey

consists of 852 law graduates. Because of its relative homogeneity, this group was selected for the estimations of the model.

The data were collected via postal questionnaires between 11 and 27 months after the final examinations of the graduates. About 80% of the graduates responded. The questionnaires covered individual background characteristics, job search behavior, and various characteristics of the obtained job. The data are described in more detail in Westergaard-Nielsen (1977 and 1978).

The graduates studied from five to seven years for their degrees. As they began their study as young as 19-20 years old, they were typically 25-27 years old when they graduated from law school. There are only two law schools in Denmark, and because they have nearly identical programs of study, examinations and grade systems cannot be expected to vary much in quality among the graduates.

In the Danish unemployment program graduates from all disciplines are eligible for a substantial unemployment benefit from the time they graduate until they start in a job. The unemployment benefit can be obtained for a maximum period of four years. The jobs these graduates obtain are professional jobs such as lawyers' assistants, public administrators, assistants for attorneys, and university teachers.

The data include those who get their jobs immediately after graduation and those who find one after some search. Although both groups probably have done some search before graduation, there are no data on the duration of pregraduation search. But the fact that the final examinations are

Table 1

Summary Statistics for Groups with Different Duration of Search

	DS = 0	0 > DS ≤ 11	DS > 11
Grades (0-13)[a]	8.73 (0.79)	8.36 (0.66)	7.97 (0.76)
No. of applications	7.37 (8.47)	18.54 (14.65)	29.26 (15.88)
No. of interviews	2.47 (1.91)	4.44 (4.01)	4.31 (4.49)
No. of jobs offered	1.45 (0.77)	1.42 (0.83)	1.06 (1.09)
Percentage of grad. who used public accessible job information[b]	63	80	25
Average duration of search	0	4.74 (3.02)	17.68 (6.52)
Number in sample	302	413	101

Note: Standard deviations are in parentheses.

[a]Grades are given throughout the studies on a scale (0-13) where 13 is the best. The students get around 30 grades of which an average is calculated. This average must be 6.00 or above to pass.

[b]Based on a smaller sample.

Table 2

Summary Statistics for Those with
Duration of Search
between 0 and 11 months

	min	mean	max
Average grades	6.10	8.36	10.40
Percentage having worked before studying	0.00	.21	1.00
Percentage having worked during studies	0	.67	1.00
Age	23.00	27.63	53
Incidence of another degree	-	0.04	-
No. of applications	3	18.54	45
No. of interviews	1	4.44	35
No. of offers	0	1.42	5
Intensity of search, n_i	0.3	4.61	15.00
α_i	0.02	0.35	1.00
β_i	0.00	0.50	1.00
Duration of search, months	1	4.74	11
Number of observations		413	

very intense and that there are some differences in the search methods used by those who have not experienced unemployment and those who have had some[9] indicates that this last group does most of the search after graduation.

Table 1 further indicates that the group with some duration of search ($0 < DS \leq 11$) also searches most regularly with respect to number of applications, number of interviews, and especially with respect to utilized sources of information.[10] While the group with no unemployment in about 40% of the cases gets information on future jobs through their previous employment as students, through relatives, or through other more private channels (informal search methods), only less than 20% of the group with some unemployment experience does this. Because the regular search by use of accessible public information must be regarded as the most time-consuming process, this suggests that the group with some unemployment ($0 < DS \leq 11$) also performs most of the search after graduation. But it must be admitted that this is not a complete exemption of uncontrolled search before graduation or before unemployment occurs. This deficiency is common in empirical research on job search (see, for example, Kiefer and Neuman, 1979).

To obtain the most homogeneous group with respect to search method and timing of search, the testing of the model will be limited to the group with some search ($0 < DS \leq 11$ months) and for some purposes further limited to those who have obtained employment.

Table 2 presents the summary statistics for this group. Remarkable in both Table 1 and Table 2 is that the graduates on average turn down about 0.5 offers, so they are indeed doing search in the sense of the model.

EMPIRICAL RESULTS

In the following section the functions deduced above will be estimated on the available data set. The estimated functions are first, those describing the probability of getting an interview and receiving an offer and second, those describing the intensity of search and duration of search as functions of these probabilities. Finally, the intensity and the duration are estimated on reduced form as functions of the background characteristics.

Because the data are set up on a SPSS file, SPSS is used in the estimations.[11]

The α Function

The probability for individual no. i of getting an interview given an application was derived above as

$$\alpha_i = \alpha(\bar{B}_i, A_t, T_t)$$

where $\bar{B}_i$ is a vector of background characteristics for individual no. i, A_t the total number of applicants at time t, and T_t the number of vacant jobs at time t. The probabiility (α_i) based on N_i draws from a binomial distribution where the job seeker either obtains an interview or does not. Since α_i is a probability, it is confined to the interval from zero to one. There is therefore some merit in using a logistic function as the α-function.[12]

Therefore,

$$\alpha_i = \alpha(\bar{a}_i\bar{B}_i + bA_t + cT_t) \qquad (17)$$

where $\alpha(\cdot)$ is the CDF of a logistic function and where $\bar{a}_i$, b and c are parameters. The probability is estimated by the (observed) proportion of

interviews to applications. Furthermore, it is convenient for the estimation of the parameters to use the logit transformation of the sample proportion, so (17) is changed into:

$$\log\left(\frac{\alpha_i}{1-\alpha_i}\right) = \ell(\alpha_i) = \bar{a}_i B_i + bA_t + cT_t + u_i \qquad (18)$$

where $\ell(\alpha_i)$ is the logit of the probability (α_i), and u_i is the disturbance term.

From Theil (1971, p. 635) we have that the variance and the mean of the asymptotic distribution of the disturbance, u_i are $[N_i \cdot \alpha_i(1 - \alpha_i)]^{-1}$ and zero, respectively. To correct (18) for the embodied heteroskedasticity the variables may be transformed using the following weight:[13]

$$w_i = [N_i \cdot \alpha_i(1 - \alpha_i)]^{\frac{1}{2}}.$$

OLS may then be applied to the weighted function:

$$\ell(\alpha_i) \cdot w_i = \bar{a}_i \bar{B}_i w_i + bA_t w_i + cT_t w_i + u_i w_i.$$

The OLS estimation yields estimates of the parameters which are asymptotic to those obtained by maximum likelihood because the error terms are independent.

$\bar{B}_i$ is, according to the model, specified by individual data on grades, working experience before and during studies, possession of another degree, age, sex, and main geographic area of job search. The last two variables in the regressions are combined, reflecting a possible difference in the attitudes of the employers toward employing females in the Capital and in the Provinces. To allow for increasing or decreasing returns to grades a squared grade is added to the variables.

The last two variables on the right hand side describe the market conditions. Because this information is not directly available, dummy variables for the semesters where the graduates enter the labor market are utilized instead.

Two dummy variables are added to the model which take care of possible different levels of α_i where the job searcher either has had two or more jobs since graduation or has had a temporary position. The hypothesis here is that having been employed in another job might improve α_i in the next job search so the overall α_i will be higher. Because accepting a temporary job may be a result of discouraged search, the anticipated sign to this dummy variable is negative.

In Table 3 the results of the estimation of the weighted α function are shown. It is demonstrated here that higher grades with a slightly decreasing rate increases the probability of obtaining an interview. As expected, the experience variables have positive signs but they are both insignificant at the 95% level. Age shows a significant negative coefficient indicating that higher age is considered to be a disadvantage. But a warning is needed here as the weighted variables for age and experience during the study are positive correlated ($r = .51$). The possession of another degree is highly regarded by the employers. (This effect neutralizes 13 more years in age.) The coefficient to having had a temporary job turns out to be negative as predicted above.

The estimates of the effects of the main job-search area together with the sex of the job seekers indicates that job seekers in the Provinces generally have more difficulties obtaining interviews than those looking for jobs in the Capital. Further, it appears that women have more diffi-

Table 3

Estimation of the Parameters in the Weighted α_i and β_i Functions on Logistic Forms

	α_i-function		β_i-function	
	coefficient	st. error	coefficient	st. error
Constant	- .18	-	.10	-
Grade	.13**	.05	-.13**	0.04
Grade squared	-.001**	.00	.001**	0.00
Experience:				
Before studying	.22	.12	-.08	.12
During studies	.18	.10	.01	.09
Another degree	.82**	.30	.42*	.21
Temporary job	-.32*	.12	-.10	.11
Age	-.06**	.01	-.005	0.012
2 or more jobs since grad.	.10	.11	.18	.09
Sex, main job search area:				
Male, the provinces	-.33**	.13	0.38**	.12
Female, the provinces	-.94**	.24	.76**	.21
Female, Copenhagen	-.22*	.13	.33*	.11
Male, Copenhagen	b	-	b	-
Both sexes, both areas	-.43**	.15	.09	.14
Semester of graduation:				
Winter 74	b	-	b	-
Summer 74	-.32	.17	.15	.16
Winter 75	-.41*	.18	.25	.17
Summer 75	-.47*	.18	.26	.17
Winter 76	-.28	.16	.08	.15
Summer 76	-.12	.17	-.06	.16
N	413		413	
Standard Error	1.48		.69	

Notes: b indicates the basis for dummy variables.
Significance levels 95% and 99% are indicated with * and **.

culty than men, suggesting some discrimination against women. But as seen in the next regression, the situation is remedied when it comes to the probability of getting an offer. It might be interpreted that there are some employers who will not engage women, but those who do, to some extent, prefer employing women.

Finally, two of the time-related dummy variables have significant signs, indicating that it was more difficult to obtain an interview in 1975 than both earlier and later. Since the number of new graduates was at its maximum in winter 1976, the supply side alone can hardly be held responsible. Rather it could be that the number of new job openings was low in this year.

The β Function

The main hypothesis concerning the probability of getting an offer given an interview is that it depends on things other than those which mattered for the probability of getting an interview. The conjecture is, namely, that information transferable in applications is used in deciding whom is invited for interviews. What matters in the interview situation, however, are things like personality, expected ability to cooperate, and the like. Because these things are unobserved, the test of the β relation can merely be an investigation in the relation between β_i and the right-hand-side variable of the α function. Since the functions are similar the same method will be applied in estimating the β function.

The results are shown in Table 3. It must, however, be emphasized that it is not possible to compare the estimated coefficients of the α and the β functions directly, because they are based on different weights. But the different signs may be used in comparisons.

Generally speaking, there are fewer significant estimators in the β function. Some of the coefficients emphasize the effects of the α function. This is the case for the coefficients to "another degree", indicating that this information also has value in the interview. Others in this group have insignificant signs. In addition to the already mentioned estimates of the sex/main job-search area coefficients, the grade effect tends to counteract the effects from the α function.

The conjectured result for the coefficient to grades would have been an insignificant sign. But it turns out that those with low grades have a significantly higher probability of getting an offer once they are interviewed. There may be several ad hoc explanations.

One explanation is simply that the (unobserved) factors that matter in the interview situation are negatively related to grades.

A second tentative explanation is that those with higher grades, who know they have a higher probability of obtaining another interview, tend to be more critical in the interview and more often decline an undesired offer before they actually get it.

And finally, there might be some differences in the search methods employed by those with low and high grades which may contribute to the negative sign. This aspect will be questioned in the following discussion.

Discussion of Differences in Search

Data on utilized search methods shown in Table 4 indicate that the group with lower grades is, in fact, using personal applications more heavily than those with higher grades. Unfortunately, the data are only available for about 1/3 of the survey, so they cannot be utilized directly in the regressions.

Table 4

Percentage Utilizing Different Search Methods in Obtaining the First Job

Grades	Applications After Advertisements	Personal Applications	Private Channels	Other Method	Total	Number
Less than 7.5	48	28	16	8	100	25
7.5 - 8.8	69	7	18	6	100	115
More than 8.9	78	3	17	2	100	36

The explanation for the differences in search methods might be that those with low grades are discouraged with the low probability of getting an interview for which reason they tend to engage in more costly search methods, such as direct personal applications to nonadvertised jobs. Another reason for utilizing other search methods might be that those with low grades, to some extent, are searching only in a part of the labor market where the usual search pattern is less formalized because they know that they have only a small chance of getting a job in another part of the labor market.

The basis for this last hypothesis is that among the graduates it is a well-known fact that the government traditionally does not employ a law graduate with a grade much below 8, on the scale from 6 to 13, whereas no other employer seems to have such a restraint. In both cases those with low grades will probably have a better chance of getting an offer because there is less competition. Accordingly, they will have a low α_i and a relatively high β_i.

The discussion has accordingly produced some support for the conjecture that the higher β for those with lower grades is due to more variation in the use of search methods. But at the same time it has also been shown that there might be some self-selection for this group, who in this sense make a total of 15%.

n_i and DS_i - functions

In order to avoid problems with unfinished search, the data for estimations of the functions describing the intensity and duration of search are limited to those who actually have found employment.

Table 5

OLS Estimations of n_i, Search Intensity and DS_i, Duration of Search as Functions of α_i and β_i and Time Variables

	n_i-function		DS_i-function	
	coefficient	st. error	coefficient	st. error
Constant	10.90	-	6.85	-
α_i	-12.45**	2.50	-9.68**	1.92
α_i^2	6.78**	2.50	6.89**	1.92
β_i	- 4.89**	0.59	-1.73**	0.45
Year of graduation:				
Winter 1974	b	-	6	-
Summer 1974	- 1.58*	0.66	1.21*	0.51
Winter 1975	- 0.28	0.71	0.28	0.55
Summer 1975	- .146*	0.69	0.92	0.53
Winter 1976	0.07	0.65	0.22	0.50
Summer 1976	- 0.41	0.67	0.75	0.52
2 or more jobs since grad.	0.52	0.40	0.51	0.31
R^2 (adjusted)	0.27		0.13	
N	368		368	

Notes: See Table 3.

In Table 5 the results of estimating the intensity of search and the duration of search as functions of α_i, β_i, z_t and c by use of OLS are described. The functions are

$$n_i^* = g(\alpha_i, \beta_i, z_t, c, r) + \varepsilon_n$$

and

$$DS_i = \Omega(\alpha_i, \beta_i, z_t, c, r) + \varepsilon_D$$

where ε_n and ε_D are error terms with mean value 0.

In the period studied there has only been one major change in the relative size of the unemployment benefit, z_t. For those graduating in summer 1976, the unemployment payment was decreased about 15% if they had not worked after graduation at all. One way to implement this is to use semester of graduation as a dummy variable. If summer 1976 is different from other time intervals, the lower payment might have had an effect, but this effect may also have been caused by other time-related factors.

As individual costs and interest rates are not observed, it is assumed that both are uniform and constant throughout the period.

The estimation of the intensity of search shows a relatively high R^2 and significant coefficients to α_i, α_1^2 and β, and to some of the time variables.[14] β_i^2 has also been tried but was insignificant. For the possible values of α_i (α must be below one) the search intensity decreases for increasing values of α_i and β_i. This means that graduates adjust their search intensity to their anticipated probability of getting interviews and offers.

The coefficients to the time variables indicate that the search intensity is lower for the first two summer cohorts, whereas this pattern seems to change for the summer 1976 cohort. When compared with the estimates in the DS function, it appears that the reason seems to be longer DS for the summer cohorts. But this difference in DS is apparently decreasing.

A tentative conclusion is that DS is longer for summer cohorts--and accordingly n_i^* is lower--because the graduates want to have their vacation before starting to do search. As the element of vacation in DS is slowly decreasing it is not possible to determine if the decrease in UI payment has had any effect--as predicted on the DS. On the other hand, if you only look at the intensity, it appears that the decrease in UI payment has had some effect although it can only be a guess.

The estimation of the function describing DS shows the same patterns as the n function concerning α_i and β_i. Higher α_i and β_i values mean less duration of search as partly predicted.

The two functions may also be estimated, however, by OLS as reduced form functions where n_i^* and DS are explained as functions of the background characteristics.

Hence, the regressions in Table 6 are run with all the variables specified so far. The results for the n function show that graduates do indeed vary their intensity of search according to their grades as the model suggests.

The graph of the influence of grades on intensity is depicted in Figure 1. This figure shows that people with grades slightly below the average do engage in the most intensive search. The higher the grade is

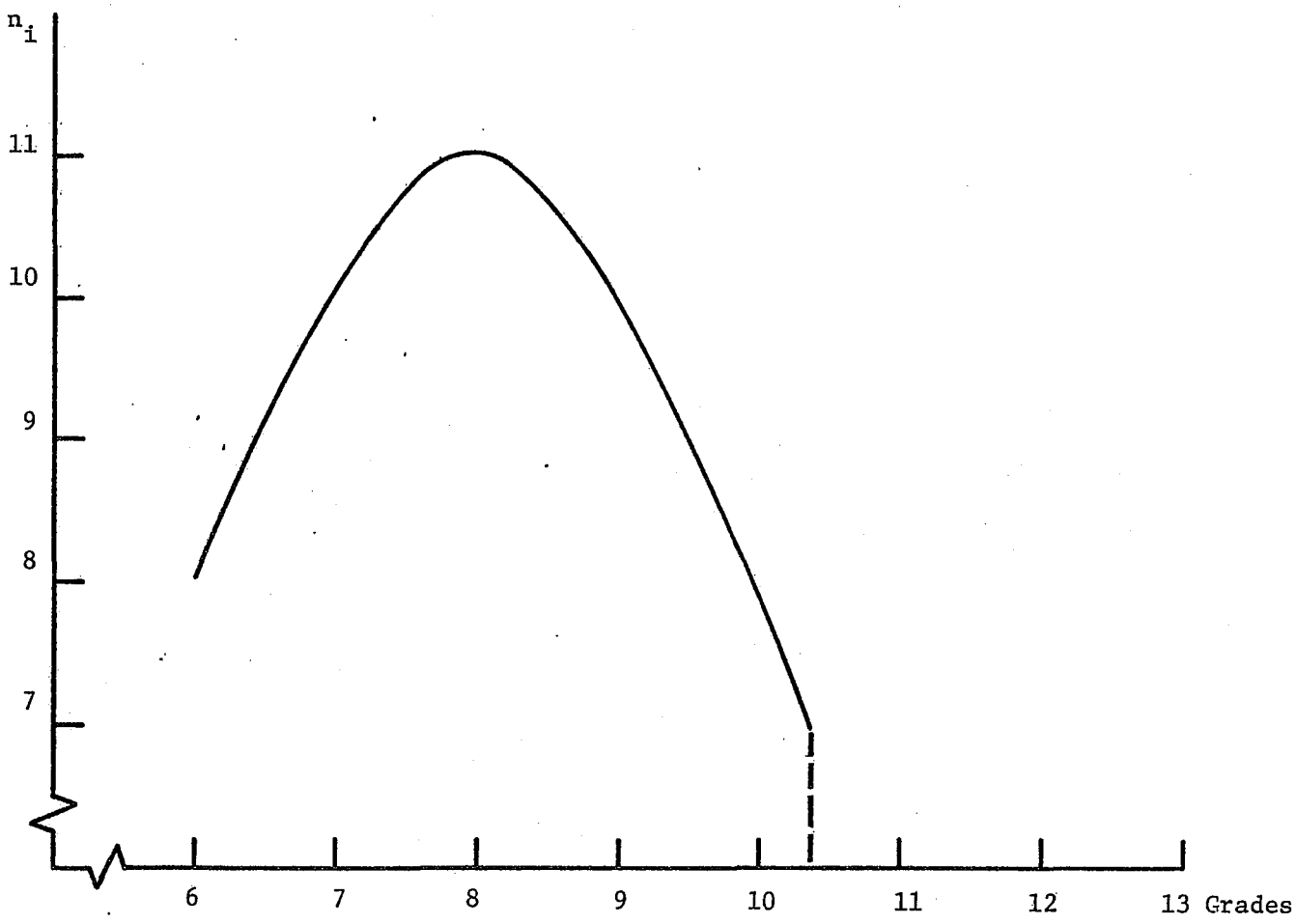


Figure 1. The influence of grades on n_i as a result of the estimation in Table 6--all other things equal.

Table 6

Estimations of n_i and DS_i as Reduced Form Functions of Background Characteristics, etc.

	n_i-function		DS_i-function	
	coefficient	st. error	coefficient	st. error
Constant	-39.01	-	3.39	-
Grade	12.42*	5.68	-0.39	0.23
Grade squared	- 0.77*	0.34	o	o
Experience before studying	- 0.64	0.44	-0.75*	0.38
Experience during studies	0.78	0.54	-0.15	0.31
Another degree	- 1.12	1.02	-1.21	0.71
Temporary job	0.64	0.51	1.05**	0.36
Age	- 0.18*	0.07	0.12*	0.05
2 or more jobs since grad.	0.36	0.50	0.10	0.35
Sex, main job search area:				
Male, the provinces	- 0.49	0.56	-0.10	0.39
Female, the provinces	- 1.40	0.96	1.21	0.67
Female, Copenhagen	- 0.00	0.56	0.68	0.39
Male, Copenhagen	b	-	b	-
Both sexes, both areas	0.41	0.69	0.60	0.48
Semester of graduation:				
Winter 1974	b	-	b	-
Summer 1974	- 1.75*	0.79	1.67**	0.54
Winter 1975	- 0.23	0.84	0.77	0.58
Summer 1975	- 1.52	0.81	1.07*	0.57
Winter 1976	- 0.22	0.77	0.66	0.54
Summer 1976	- 0.54	0.79	0.96	0.55
R^2 (adjusted)	0.05		0.07	
N	368		368	

Notes: See Table 3.

above average the lower the intensity of search. But also the lower the grade is below average the lower the intensity. This pattern can partly be explained by the model and the previous result.

As the costs of sending applications are assumed to be constant for all grade groups, the differences in the marginal expected return to search determine the optimal number of applications per period. The marginal expected return to another application is itself determined as the product of the probability getting an interview, the probability of receiving an offer, and the marginal expected income of the next offer.

For those with high grades the α probability increases with higher grades but the β probability and the expected marginal income offer decreases because the high graders with higher probability will get a first income offer in the upper end of the income scale. The only necessary condition for the model to generate the right hand side of the graph then is that the product of the probabilities and the expected marginal income decreases for increasing grades.

The high intensity search for the around median graders can in a similar way be explained as a product of a relatively lower α probability and a higher β probability and higher expected marginal returns to an offer than for higher graders. Again, here the marginal returns are assumed to be dominant.

And finally the increasing intensity for the low graders may be explained by an increasing product of the probabilities and relative low expected marginal incomes.

The low expected marginal income may occur in various ways. One explanation is that the graduates are discouraged from searching in the entire labor market as a result of grade barriers as pointed out

above. And at the same time the marginal income in the remaining labor market is expected to be relatively low, because of the nature of the jobs there. Another explanation could be that low graders, to some extent, are low achievers and that is why they only search in the lower part of the labor market, again because they do not believe they can get a job in other places.

In addition to the grade effect, a significant negative coefficient to age can be observed. Because age has a significant positive coefficient in the duration of search function, it can be concluded that either the older the graduate is the more he needs a vacation before he starts looking for a job, or the older he is the less search effort. But it is remarkable that age only affects the speed and does not seem to affect the total number of applications.

Finally, there is also in this regression a tendency to reduced search intensity for those graduating in summer months. Again, compared with the duration of search estimates, this is related to longer duration of search in the summers of 1974 and 1975. As there are no such time effects in the estimation of α_i and β_i the pattern of Table 6 might, as discussed above, reflect vacation and the effect of decreased UI payments.

In the DS function the grades do not come out with a significant sign. Besides the form presented in the table, the regression has been run without success with a squared grades element. In addition to the mentioned significant coefficients, holding a temporary job is the only other significant coefficient. This might be interpreted that those having had a longer duration of search are pushed into accepting temporary jobs. Although not significant, the variables which are important in the screening process have the expected signs.

The conclusion of the results in Table 6 is that the graduates tend to vary their search efforts according to their successes or failures in obtaining interviews. This is done in such a manner that the duration of search is not significantly affected by several of the background characteristics influencing the screening process and the probability of getting offers.

CONCLUSION

The empirical results in this study fall in two parts.

The first part consists of the results concerning the screening of applicants. It has been demonstrated what factors the employers in this specific market utilize as screening devices. Pointing out that achievements from university, among other background characteristics, are applied extensively, the findings provide some support for the hypotheses of Arrow (1973), Spence (1973), Stiglitz (1975) and others concerning the role of the education system.

The second part consists of the results of estimating the derived functions for the optimal intensity of search and for the duration of search. The functions are both estimated as functions of the probability of getting interviews and offers and as reduced form functions of the background characteristics. The estimations of the first kind of functions provide evidence that the job searchers adjust their search intensity to these probabilities.

Estimations of the model on reduced form show that the job searchers vary their intensity of search to overcome the deficiencies in their background characteristics. This shows that the introduction of a variable

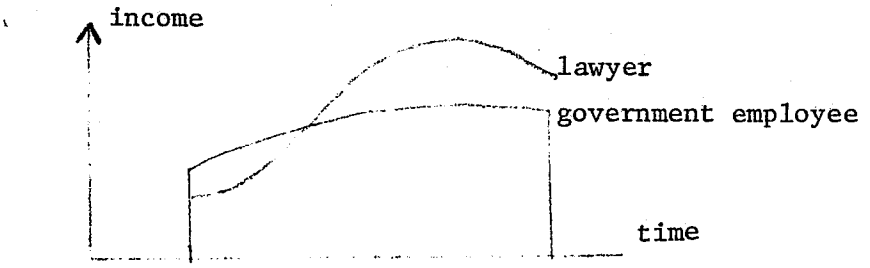
intensity function has enriched the analysis of search compared to previous studies where a constant intensity is either postulated or assumed.

In this study the model has been applied to data describing the workers and the hiring process in a small and relatively homogeneous labor market. Since there are many labor markets with the same or almost the same characteristics (concerning education, job search methods and long terms of notice) it is conjectured that the model may be applicable to a whole array of labor markets.

NOTES

[1]See Diamond and Rothschild (1978, p. 450).

[2]For some jobs the income is relatively low at the time of hiring but the expected rise afterwards is higher than in other jobs. For instance, a lawyers' assistant gets a relatively low income compared to one who is employed by government, but the lawyers' assistant will on the other hand expect a higher income later on, when he is authorized to be called to the bar. But he also has a higher risk as the income variation is higher as a lawyer.



[3]These benefits consist of pensions, career-opportunities, psychic income, working conditions, and the like.

[4]This follows the idea in Thurow (1972) where the job competition model is introduced, and Arrow (1973).

[5]See Lippman and McCall (1976, pp. 181-184).

[6]A grade group now consists of applicants with a specific interval of grades and with different other characteristics such as sex, previous work experience, and age so the employer may not be able to screen this group without interviewing.

[7]The second order conditions for a maximum also hold.

[8]This means that for "normal" values of the parameters and $F(y) > .36$ they have the indicated sign.

[9]This information is unfortunately only available for a part of the data, so it cannot be used directly.

[10]The main part of those performing regular search does react on employers advertising of job openings by sending applications.

[11]The regressions are run on the version of SPSS adapted to UNIVAC. Unfortunately, this SPSS/UNIVAC-version has several shortcomings compared to SPSS/CDC-version, where the computing was started. For example, no standard errors on the constant term are calculated.

[12]A linear specification of the model would perhaps be more simple but would also have the disadvantage that it could not guarantee that the probabilities implied by the model are constrained to the interval from 0 to 1. The simpler model which is linear in the probabilities is estimated in (Westergaard-Nielsen, 1979). The logit approach appears to produce more significant estimates while the signs are the same.

[13]The weight procedure gives more weight to those cases where the sample size is larger given the value of α. Further the weight is 0 in all cases where the sample proportion, α, has a value of either zero or one. In this way it is guaranteed that (18) is computable. Given N_i, the weight is small when α_i is close to 0 or 1. This is reasonable because $\ell(\alpha_i)$ takes very large values and is very sensitive to small changes in α_i.

[14] In estimating the n-function it could be feared that regressing α_i and β_i on n_i might induce spurious correlations between the dependent and independent variables because

$$n_i = \frac{\text{no. of applicants}}{DS} \text{ and } \alpha_i = \frac{\text{no. of interviews}}{\text{no. of applications}}$$

According to Kuh and Meyer (1955) "The question of spurious correlation... does not arise where the hypothesis to be tested has initially been formulated in terms of ratios..." Also Belsley (1972) deals with this problem.

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