DISCUSSION PAPER SERIES

IZA DP No. 399

Using Employer Hiring Behavior to Test the Educational Signaling Hypothesis

James W. Albrecht
Jan C. van Ours

November 2001

Forschungsinstitut
zur Zukunft der Arbeit
Institute for the Study
of Labor

Using Employer Hiring Behavior to Test the Educational Signaling Hypothesis

James W. Albrecht
Department of Economics, Georgetown University, CESifo and IZA, Bonn

Jan C. van Ours
CentER for Economic Research, Tilburg University, CEPR, Institute for Labor Studies (OSA) and IZA, Bonn

Discussion Paper No. 399
November 2001

IZA

P.O. Box 7240
D-53072 Bonn
Germany

Tel.: +49-228-3894-0
Fax: +49-228-3894-210
Email: iza@iza.org

IZA Discussion Paper No. 399
November 2001

ABSTRACT

Using Employer Hiring Behavior to Test the Educational Signaling Hypothesis

This paper presents a test of the educational signaling hypothesis. If employers use education as a signal in the hiring process, they will rely more on education when less is otherwise known about applicants. We find that employers are more likely to lower educational standards when an informal, more informative recruitment channel is used, so we conclude that education is used as a signal in the hiring process.

JEL Classification: I20

Keywords: Recruitment, signaling

Jan C. van Ours
CentER for Economic Research
Tilburg University
P.O. Box 90153
5000 LE Tilburg
The Netherlands
Tel.: +31-13-4662316
Fax: +31-13-4663042
Email: vanours@kub.nl

1 Introduction

This paper tests the educational signaling hypothesis by using information about the hiring behavior of Dutch employers. The idea of the test, based on Albrecht (1981), is that if education is a signal, then employers will rely more on education when less is otherwise known about an applicant. To apply this idea, we use information about the educational requirements attached to vacancies and about the education of the workers ultimately hired into those vacancies. That is, we compare ex ante educational requirements with ex post educational attainments. We also know the recruitment channels that employers used to …ll their vacancies. We distinguish between informal and formal channels, and we assume that informal recruitment channels provide more information about potential new employees than formal recruitment channels do.

We …nd that a newly hired employee is more likely to have less education than originally required if the employer hired that worker through an informal recruitment channel. This pattern obtains in a simple contingency table analysis, and it continues to hold when we use a competing risks framework to take into account the fact that vacancies are …lled at di¤erent rates. In the competing risks analysis, we control for vacancy characteristics that might be associated both with the propensity to relax educational requirements and with the propensity to use an informal recruitment channel. This leads us to conclude that education is indeed used as a signal in the hiring process.

The outline of the rest of the paper is as follows. In Section 2, we sketch a model to connect our test procedure to theory. We use this model to explain our test further and to relate our method to other approaches to testing the signaling hypothesis. In Section 3, we review the literature on search and recruitment methods. The purpose of this section is to convince the reader that our assumption that informal recruitment methods give more information than formal methods do is in fact a reasonable one. Section 4 contains the empirical analysis. In this section, we describe the data, we explain our competing risks framework, and we present our results. We conclude in Section 5.

2 Model

Although our test procedure is intuitive, it is not immediately obvious how to connect it to the standard signaling model (Spence 1974). The problem is that the standard model is too extreme in the sense that in separating equilibrium, education is a perfect predictor of productivity. In this case, there is no value to further information, and the test procedure breaks down. No one would claim, however, that education is a perfect signal of productivity. In order to connect our test procedure to theory, we thus need a model in which education imperfectly signals productivity in separating equilibrium. We now sketch such a model.

Suppose a worker's type is de…ned by her cost of acquiring education. To keep things simple, imagine there are two possible types, high-cost (c_H) and low-cost (c_L). The probability a worker is type c_H is p: Type is private information, but p is common knowledge. The worker is either high-productivity (z_H) or low-productivity (z_L) and does not know her productivity until she actually works. She does, however, know that $P[z_H|c_L] = q_L$ and $P[z_H|c_H] = q_H$; where $q_L > q_H$: These conditional probabilities are also known by the …rm.

The worker chooses either a high or a low level of education, s: If she chooses the high level (s_H), her cost is given by her type; if she chooses the low level (s_L), no cost is incurred. Low-cost types, who are on average (but not always) more productive, thus have the lower cost of acquiring the high level of education. The …rm observes s; so education has the potential to be an (imperfect) signal of productivity. In addition, education may be productivity-enhancing. We model this by assuming that the high level of education transforms a low-productivity worker into one who is high-productivity with probability r: A worker whose productivity is high to begin with remains so, irrespective of her educational choice, and a low-productivity worker who chooses s_L remains low-productivity.

Suppose the …rm also observes another indicator of productivity, x; so the …rm can condition its action on both x and s: Let $\tilde{A}(s;x) = P[z_H|s;x]$: The …rm chooses between two actions, Hire and Not Hire; i.e., $a = H$ or $a = NH$: It chooses $a = H$ if $\tilde{A}(s;x) \geq \tilde{A}^{¤}$ and $a = NH$ otherwise. A cuto¤ rule of this form is optimal for the …rm if delay in

the hiring process is costly. The reservation probability, Ã¤; equates the expected value of accepting a worker to the expected value of continuing the screening process.

We are interested in a separating equilibrium. In such an equilibrium, low-cost workers choose s_H while high-cost workers choose s_L: Of course, so long as x conveys some information, not all workers who choose s_H get the job nor do all workers who choose s_L fail to get the job. Nor is it the case that the …rm only hires the more productive workers. It only does so on average.

Suppose now that we observe a …rm's hiring behavior in two circumstances. In the …rst, x is a relatively uninformative indicator of productivity; in the second, x is relatively informative. By "relatively informative" we mean that for s and x such that $\tilde{A}(s; x)$ is close to Ã¤; a small change in x induces a relatively large change in $\tilde{A}(s; x)$: To see the implications of these two di¤erent informational scenarios, it is useful to consider the polar cases.

First, suppose x is completely uninformative, so the only information the …rm can use in its hiring decision is the applicant's educational attainment. In this case, in separating equilibrium, workers with education s_H are hired with probability one; workers with the low level of education are not hired. The workers who are hired are high-productivity with probability $q_L + r(1 ¡ q_L)$; the workers who are not hired are high-productivity with probability q_H: The …rm's hiring rule is optimal so long as (i) $q_L + r(1 ¡ q_L)$ is su¢ciently large relative to q_H and (ii) p is not too large, so that the …rm does not have to wait too long to meet a "quali…ed" applicant. Worker decisions are optimal so long as the bene…t of being hired is greater than c_L but less than c_H: Note that part of the motivation for the …rm and worker decision rules is that education is a signal ($q_L > q_H$), while part is that education adds to productivity (with probability r).

At the other extreme, suppose x is a perfect predictor of productivity. As in the …rst case, suppose it is optimal for type c_L workers to choose $s = s_H$ and for type c_H workers to choose $s = s_L$: A type c_L worker is then hired with probability $q_L + r(1 ¡ q_L)$ while a type c_H worker is hired with probability q_H: The bene…t of higher education for a type c_L

worker equals $r(1 - q_L)$ times the value of getting the job. So long as this bene…t exceeds c_L, it is optimal for this type to choose $s = s_H$: The bene…t of higher education for a type c_H worker equals $r(1 - q_H)$ times the value of getting the job. So long as this bene…t is less than c_H, it is optimal for this type to choose $s = s_L$: In this second scenario, part of the return to education is due to the fact that on average workers who are ex ante more likely to be productive choose $s = s_H$; while part of the return is due to the productivity-enhancing e¤ect of education (as in the …rst case, because $r > 0$). There is, however, no signaling role for education in this second case since the …rm observes productivity directly.

In the …rst case, with x completely uninformative, education is a signal and the …rm relies exclusively on this signal in its hiring decisions. In the second case, with x completely informative, workers make the same educational decisions as in the …rst scenario, even though education has no signaling value. However, since the more educated workers get the job with probability less than one, data on the …rm's hiring process would indicate that the …rm relies less heavily on education in this case. It is this interaction between the extent to which the …rm relies on education in its hiring decision and the quality of other information about applicants that lies behind our test procedure.

In Albrecht (1981), data were available on all applicants, both the accepted and the rejected, for positions at a single …rm. This made it possible to examine the di¤erential e¤ect of education on the hiring probability for applicants who came via formal versus informal recruitment channels. As in our paper, it was assumed that the …rm had relatively less information about applicants who came via formal recruitment channels. The dataset we analyze does not have information about rejected applicants. We do, however, have information about the stated educational requirements for vacancies, and we know whether the successful applicants for these vacancies had the required education or not. In terms of our model, we expect that the …rm will be more likely to relax its educational requirement for applicants about whom it has more information. That is, we expect that educational requirements are more likely to be relaxed for applicants who are recruited through informal

channels.

The general idea that, when signaling is important, employer behavior with respect to educational credentials should di¤er according to the quality of alternative information available has been used as a basis for other tests of the educational signaling hypothesis. These other tests have focused on wages, however, rather than on the hiring decision. Unfortunately, some of these tests have failed to recognize that signaling does not imply that the coe¢cient on education in a wage regression will change with the quality of alternative information that is available to employers. The reason is simply that employer estimates of productivity conditional on education, even when otherwise ill-informed, should be unbiased. Two tests that distinguish between situations in which employers are well-informed versus ill-informed while avoiding this pitfall are Riley (1979) and Altonji and Pierret (1998). Riley's (1979) informational distinction is between "screened" versus "unscreened" occupations, while Altonji and Pierret (1998) distinguish between new entrants to the labor force versus more experienced workers.[1]

3 Search and Recruitment Methods

Employers use a variety of search methods to try to …ll their vacancies, and workers use several search methods to try to …nd employment. Table 1 shows the use of search channels in the Netherlands in the mid-1980's by employers with vacancies and by job seekers. Informal search methods, advertisements, and the employment o¢ce were the most commonly used methods; of these, advertisements were the most frequently used channel for both workers and employers. Among job seekers, employed workers used informal search channels and the employment o¢ce less frequently than they used advertisements while unemployed workers used the employment o¢ce more than they used informal channels. The average number of search channels used by employers and employed

[1] There are other approaches to testing the signaling hypothesis that are not based on informational distinctions of the sort that we are exploiting. For example, Lang and Kropp (1986) use the fact that compulsory school attendance laws di¤er across states in the U.S. Their idea is that if education is a signal, then an attendance law that forces low-ability workers to increase their educational attainment will lead high-ability workers to undertake further education in order to distinguish themselves.

workers was about two; unemployed workers used approximately three different search channels.

Informal search channels are those that rely on word-of-mouth or some other "informal" method of contact.[2] For workers, informal search methods include checking with friends or relatives. For employers, informal search methods include checking with friends, relatives or incumbent personnel. Employers often strongly prefer informal recruitment channels: they are low cost, they provide good initial screening, and they tend to produce applicants from the neighborhood in which the firm is located. Informal channels also typically give potential applicants more information than an advertisement can, which may improve the quality of the match between worker and job. Formal recruitment channels have their own advantages and disadvantages. State employment services have no direct costs, but there are frequent complaints about sluggishness and poor screening, which suggests that the indirect costs are quite high. Advertising is expensive for the employer but provides low-cost information about the existence and location of a vacancy to a large number of job seekers. Advertisements generally attract many applicants, but often few are suitable for the vacant job.

There have been some studies on the use of particular recruitment channels by employers. Barron and Mellow (1982) focus on the use of the employment office. They conclude that many employers do not use public employment offices because many unemployed workers who register with these offices do so simply because it is a requirement for collecting unemployment benefits. The motivation of workers using this search channel seems to be lower on average than that of workers coming via other channels. Even though the employment office is an inexpensive source of applicants, employers have to spend more to select among these candidates. Roper (1988) finds that informal search is the most productive channel for firms in terms of expected vacancy duration, and Van Ours and Ridder (1992, 1993) find that advertisements attract more applicants but do not fill vacancies more quickly. In a related vein, Van

[2] Montgomery (1991) presents an equilibrium model in which both workers and firms choose between formal and informal hiring channels. According to Montgomery, employee referral serves as a useful screening device.

Ours and Ridder (1991) study the relationship between hiring standards and characteristics of new employees. They conclude that employers stick closer to educational requirements than to experience requirements and that education and experience requirements are not substitutes in the hiring process.

>From our point of view the most important di¤erence between formal and informal search methods is that informal search generates more information to employers. This is consistent with results from several studies using Dutch data. In particular, Lindeboom, Van Ours and Renes (1993) …nd that informal search channels are very e¤ective in matching workers and vacancies. Russo, Rietveld, Nijkamp and Gorter (2000) …nd that informal recruitment channels have the capacity to screen candidates on the grounds of their ability.

4 Empirical Analysis

4.1 Data and Empirical Framework

The data we use are from a Dutch vacancy survey, which is described in detail in Van Ours and Ridder (1992). The vacancy survey was held in two stages. First, employers were asked about the characteristics of their vacancies. About four months later, employers were questioned about the vacancies that were …lled in the meantime. Our sample contains information about 621 vacancies, of which 444 were …lled between the dates of the two stages while 177 were still open at the second date. For every vacancy, we know the duration at the …rst date and either the date at which it was …lled or the duration at the second date. From the …rst stage of the survey, we know the size of the …rm and some characteristics of the vacancy, such as education and experience requirements, the occupation to which the vacancy pertains, and whether or not the vacancy was for a full-time job. For the vacancies that were …lled, we know the educational level of the newly hired worker and we know which recruitment channel was used. A description of all the variables we use is given in the Appendix.

We assume that educational requirements have been adjusted downward if the educational level of a newly hired employee is lower than

the educational level originally required for the vacancy …lled by this employee. A …rst impression of the relationship between recruitment channel and adjustment of educational requirements can be derived from the contingency table presented as Table 2. The educational standard was adjusted downward for 24% of the 126 …lled vacancies for which an informal recruitment channel was used. Such an adjustment was made for only 13% of the 318 …lled vacancies for which a formal recruitment channel was used. The null hypothesis of independence between recruitment channel and adjustment of educational requirements is rejected at the 5% level. The $\hat{A}^2$ from the contingency table is equal to 7.53 (critical $\hat{A}^2$=3.84). At …rst glance, it thus appears that education is indeed a signal that is less relevant when other information is available.

However, the relationship between recruitment channel and adjustment of educational standards may also be caused by di¤erences in observed or unobserved characteristics of …rms or vacancies. If, for example, large …rms are more likely to use formal recruitment channels and are more strict about their hiring standards, then there is no causal relationship between recruitment channel and the adjustment of educational standards. To correct for the e¤ects of observed and unobserved characteristics we estimated a competing risks duration model with four risks: adjustment and informal recruitment, adjustment and formal recruitment, non-adjustment and informal recruitment and non-adjustment and formal recruitment.

The hazard rates are speci…ed as

$$\mu_{j;k}(t; x; v) = \exp(x\beta_j + \gamma_j d_1 + v_{j;k}); \; k = 1; 2; \qquad (1)$$

where x is a vector of explanatory variables, d_1 is a dummy variable which is one in the time interval after 1 month[3], v an unobserved component, β is a vector of coe¢cients, γ a coe¢cient for duration dependence and j is an indicator of type of exit (risk), j = 1,..,4.[4]

[3] Van Ours and Ridder (1992, 1993) conclude that employers use a non-sequential search strategy. Employers form a pool of applicants just after the vacancy has been posted and they select a suitable applicant from this pool. To account for this we allow the hazard rates to have a di¤erent value after the …rst month.

[4] 1 = Required education downward adjusted, informal recruitment channel; 2 =

We assume the heterogeneity components follow a discrete distribution with two points of support:

$$h(v_{j;1}) = p \text{ and } h(v_{j;2}) = 1 - p: \tag{2}$$

The points of support and the probability p are parameters to be estimated. We reparametrize p as $\exp(\cdot)/[1 + \exp(\cdot)]$:

The firms that provided information about their vacancies were approached twice. The first time all vacancies were open, with incomplete vacancy durations t_1. After about four months the firms were approached for a second interview. From this second interview we know whether the vacancy was filled in these four months and, if so, when it was filled. Furthermore, we know which recruitment channel was used and we know whether or not the level of education of the hired worker was equal to or lower than the required education. The date at which the vacancy was filled is given by t_2 (so the total duration is $t_1 + t_2$). In constructing the likelihood, we use the conditional distribution of the residual vacancy duration t_2 given the incomplete duration t_1 and the type of exit j: The likelihood contribution if a vacancy is filled at a known date t_2 through exit j is

$$\frac{\sum_{k=1}^{2} p_k \mu_{j;k}(t_1 + t_2) \exp[-\int_0^{t_1+t_2} \sum_{j=1}^{4} \mu_{j;k}(s)\, ds]}{\sum_{k=1}^{2} p_k \exp[-\int_0^{t_1} \sum_{j=1}^{4} \mu_{j;k}(s)\, ds]}; \tag{3}$$

and if the vacancy is open at t_2, when the type of exit is not determined yet, the likelihood contribution is

$$\frac{\sum_{k=1}^{2} p_k \exp[-\int_0^{t_1+t_2} \sum_{j=1}^{4} \mu_{j;k}(s)\, ds]}{\sum_{k=1}^{2} p_k \exp[-\int_0^{t_1} \sum_{j=1}^{4} \mu_{j;k}(s)\, ds]} \tag{4}$$

As explanatory variables we use the variables described in the Appendix.

4.2 Parameter estimates

The parameters of the model are estimated by maximum likelihood. The estimation results are shown in Table 3a. Many of the estimates

Required education downward adjusted, formal recruitment channel; 3 = Required education non-adjusted, informal recruitment channel; 4 = Required education non-adjusted, formal recruitment channel.

do not di¤er from zero at conventional levels of signi…cance. None of the estimated coe¢cients on …rm size, full-time, and production workers is signi…cantly di¤erent from zero; that is, these variables appear to a¤ect neither the speed at which vacancies are …lled nor the path by which these vacancies are …lled. Only one of the estimated coe¢cients on experience is signi…cantly less than zero. The interpretation of this coe¢cient estimate is that vacancies for which experience is required are less likely to be …lled through a formal recruitment channel by a worker who has a lower level of education than required. All of the estimated coe¢cients on required education di¤er signi…cantly from zero. Furthermore, it appears that the probability that educational requirements are adjusted is higher if the level of required education is higher. The coef-…cients on the dummy for commercial workers are all positive and are somewhat higher for adjusted education. This suggests that vacancies for commercial workers have shorter durations and are more likely to have educational requirements downward adjusted, but there appears to be no di¤erence in the use of formal or informal recruitment channels. We found some evidence of unobserved heterogeneity but no evidence for duration dependence. The estimate for ° indicates that conditional on the observed characteristics there are two types of vacancies that di¤er in the rates at which they are …lled. The …rst group, which comprises about 20% of the vacancies, is more likely to be …lled via an informal recruitment channel and to adjust educational requirements downward. For the second group, since $v_2 ¡ v_1 = ¡ 1$ for exit 1, the transition rate for this type of exit is zero. The second group of vacancies is more likely to be …lled without adjusting educational requirements and via a formal recruitment channel than is the …rst group.

If we restrict our model to a speci…cation without unobserved heterogeneity and duration dependence, the log likelihood value drops by 4.6 points (Table 3b). From this we conclude that we can ignore both unobserved heterogeneity and duration dependence.[5] A comparison of

[5] A formal Likelihood Ratio test is problematic since one of the parameters (°) is not identi…ed under the null hypothesis. The di¤erence in the values of the log-likelihoods is rather small considering there are 4 duration dependence parameters and, apart from °; there are 4 unobserved heterogeneity parameters ($v_{j;2}$): Note that the Likelihood Ratio test statistic is 9.2, while the critical $Â^2$ ¡ value for 8 degrees of

Tables 3a and 3b shows that the estimates of the coe¢cients on the …rm and vacancy characteristics are hardly a¤ected. Table 3c shows the parameter estimates if we drop the four variables with mostly insigni…cant coe¢cients. The log likelihood value drops by 7.5 points. Since the Likelihood Ratio statistic is 15.0 and the critical Â^2-value for 16 degrees of freedom is 26.3 we cannot reject the hypothesis that these variables do not a¤ect the process by which vacancies are …lled.

The most interesting question is whether there is a relationship between adjusting educational requirements and the recruitment channel through which the vacancy is …lled. We investigated this by imposing independence, using the speci…cation without unobserved heterogeneity or duration dependence and restricting ourselves to the variables with signi…cant coe¢cients:

$$\bar{}_4 \text{ i } \bar{}_3 = \bar{}_2 \text{ i } \bar{}_1$$

$$v_{4;1} \text{ ¡ } v_{3;1} = v_{2;1} \text{ ¡ } v_{1;1} \tag{5}$$

As shown in Table 3d, this restriction causes the log likelihood to drop 5.3 points. The Likelihood Ratio statistic comparing the two results is equal to 10.6, which is signi…cantly larger than the critical Â^2-value of 7.8 for 3 degrees of freedom. Therefore, even conditional on the characteristics of the vacancy, the adjustment of educational standards is not independent of the recruitment channel.

5 Conclusion

We conclude that when employers recruit new employees, they are more likely to deviate from their stated educational requirements if there is information from other sources, in particular, when an informal recruitment channel is used. This supports the view that education is used as a signal.

freedom is 15.5.

References

[1] Albrecht J.W. (1981) A Procedure for Testing the Signalling Hypothesis, Journal of Public Economics, 15, 123-132.

[2] Altonji, J.G. and C.R. Pierret (1998) Employer Learning and the Signalling Value of Education, in: I. Ohasi and T. Tachibanaki, (eds.), Internal Labour Markets, Incentives and Employment, St. Martins Press, 159-195.

[3] Barron, J.M. and W. Mellow (1982) Labor Contract Formation, Search Requirements, and Use of a Public Employment Service, Economic Inquiry, 20, 381-387.

[4] Lang, K. and D. Kropp (1986) Human Capital Versus Sorting: The E¤ects of Compulsory Attendance Laws, Quarterly Journal of Economics, 101, 609-624.

[5] Lindeboom, M., J.C. van Ours and G. Renes (1993) Matching Employers and Workers: an Empirical Analysis on the E¤ectiveness of Search, Oxford Economic Papers, 46, 45-67.

[6] Montgomery, J.D. (1991) Social Networks and Labor Market Outcomes: Toward an Economic Analysis, American Economic Review, 81, 5, 1408-1418.

[7] Ours, J.C. van and G. Ridder (1991) Job Requirements and Recruitment of New Employees, Economics Letters, 36, 213-218.

[8] Ours, J.C. van and G. Ridder (1992) Vacancies and Recruitment of New Employees, Journal of Labor Economics, 10, 138-155.

[9] Ours, J.C. van and G. Ridder (1993) Vacancy Durations: Search or Selection?, Oxford Bulletin of Economics and Statistics, 55, 187-198.

[10] Riley, J.G. (1979) Testing the Educational Screening Hypothesis, Journal of Political Economy, 87, S227-S252.

[11] Roper, S. (1988) Recruitment Methods and Vacancy Duration, Scottish Journal of Political Economy, 35, 1, 51-64.

[12] Russo, G., Rietveld, P., Nijkamp, P. and C. Gorter (2000) Search Channel Use and Recruitment Behaviour, De Economist, 3, 373-393.

[13] Spence, A. M. (1974) Market Signalling: Informational Transfer in Hiring and Related Screening Processes, Harvard.

6 Appendix: Description of variables

All variables are related to individual vacancies. The variables are de…ned as follows:

- Firm size: natural logarithm of the number of employees at the …rm
- Experience: dummy variable equal to 1 if work experience is required and 0 otherwise
- Full-time job: dummy variable equal to 1 if the vacancy is advertised for a full-time job and 0 otherwise
- Required education: level of required education; value 1 if no education is required, value 2 if lower vocational or lower general education is required, value 3 if intermediate vocational or intermediate general education is required, value 4 if higher vocational or academic education is required. If no education is required, there can be no downward adjustment, so we remove this type of vacancy from the sample
- Production workers: dummy variable equal to 1 if the vacancy was for a production worker and 0 otherwise
- Commercial workers: dummy variable equal to 1 if the vacancy was for a service, clerical or commercial job and 0 otherwise

Table A1 Minima, maxima and means

	Minimum	Maximum	Mean
Firm size	2	9	5.1
Experience	0	1	0.78
Full-time	0	1	0.93
Required education	2	4	3.1
Production workers	0	1	0.06
Commerical workers	0	1	0.38

The questionnaire distinguishes among the following recruitment channels:

1. Internal recruitment
2. Recruitment with help of incumbent employees
3. Recruitment with help of relations of the …rm
4. Recruitment through a temporary employment agency
5. Recruitment through the public employment o¢ce

6. Advertisement in newspaper
7. Recruitment through open applications
8. Recruitment through school/education
9. Other recruitment channels

We consider recruitment channels 1-4 to be informal recruitment channels, whereas the remaining channels are considered to be formal recruitment channels.

Table 1 - Search channels used by employers and job seekers[a)]

	Employers	Employed workers	Unemployed workers
Informal	63%	29%	50%
Advertisement	66%	85%	78%
Employment office	44%	12%	52%
Others	33%	33%	27%
Average # of channels	2.1	1.8	2.8

a) The information about employers' search is from the OSA vacancy survey of November 1986; the information about job search is from the OSA labor force panel survey of October 1986.

Source: Lindeboom, Van Ours and Renes (1993)

Table 2 - Filled vacancies by recruitment channel and adjustment of educational requirements

a. Numbers

Educational requirements	Recruitment channel		
	Informal	Formal	Total
Adjusted downwards	30	42	72
No downward adjustment	96	276	372
Total	126	318	444

b. Column percentages

Educational requirements	Recruitment channel		
	Informal	Formal	Total
Adjusted downwards	23.8	13.2	16.2
No downward adjustment	76.2	86.8	83.8
Total	100.0	100.0	100.0

Table 3 - Parameter estimates[a)]

a. Full model

Required education	Adjusted downward		No downward adjustment	
Recruitment channel	Informal	Formal	Informal	Formal
	(1)	(2)	(3)	(4)
Type of job				
Firm size	-0.20 (1.0)	-0.12 (0.8)	-0.04 (0.4)	0.06 (0.9)
Experience	0.95 (1.5)	-0.08 (0.1)	-0.28 (1.0)	-0.49 (2.4)¤¤
Full-time	-0.10 (0.1)	0.14 (0.1)	-0.31 (0.7)	-0.35 (1.2)
Required education	0.86 (1.8)¤	0.73 (1.7)¤	-0.72 (4.4)¤¤	-0.38 (3.2)¤¤
Production workers	-[b)]	-0.08 (0.1)	-0.25 (0.4)	0.48 (1.3)
Commercial workers	0.91 (1.7)¤	0.72 (2.0)¤¤	0.42 (1.8)¤	0.38 (2.3)¤¤
Duration e¤ects				
1+ months	0.27 (0.3)	-0.13 (0.2)	-0.06 (0.1)	0.40 (1.3)
Heterogeneity				
v_1	-5.78 (2.5)¤¤	-5.67 (3.2)¤¤	-0.58 (0.7)	-2.38 (2.6)¤¤
v_2 ¡ v_1	¡ 1	-1.12 (0.7)	0.35 (0.5)	1.70 (2.7)¤¤
°	-1.34 (1.9)¤			
-Log likelihood	1436.2			

b. No duration dependence or unobserved heterogeneity

	(1)	(2)	(3)	(4)
Firm size	-0.07 (0.4)	-0.07 (0.6)	-0.04 (0.4)	0.04 (0.9)
Experience	0.17 (0.3)	-0.33 (0.8)	-0.22 (0.9)	-0.32 (2.1)¤¤
Full-time	-0.27 (0.3)	-0.03 (0.0)	-0.25 (0.6)	-0.18 (0.8)
Required education	0.24 (0.7)	0.72 (2.6)¤¤	-0.60 (4.2)¤¤	-0.17 (1.9)¤
Production workers	-[b)]	-0.23 (0.2)	-0.24 (0.4)	0.54 (2.1)¤¤
Commercial workers	0.75 (1.9)¤	0.66 (2.1)¤¤	0.42 (1.9)¤	0.50 (3.7)¤¤
v_1	-4.61 (3.4)¤¤	-5.68 (4.1)¤¤	-0.57 (0.9)	-1.28 (3.4)¤¤
-Log likelihood	1440.8			

c. Restricted number of variables

	(1)	(2)	(3)	(4)
Required education	0.20 (0.7)	0.65 (2.6)¤¤	-0.66 (4.9)¤¤	-0.22 (2.6)¤
Commercial workers	0.75 (2.0)¤¤	0.70 (2.2)¤¤	0.48 (2.2)¤¤	0.47 (3.7)¤¤
v_1	-4.97 (4.7)¤¤	-6.11 (6.8)¤¤	-1.03 (2.6)¤¤	-1.28 (4.8)¤¤
-Log likelihood	1448.3			

d. Independence imposed

	(1)	(2)	(3)
Required education	0.21 (1.0)	0.54 (2.8)¤¤	-0.57 (4.6)¤¤
Commercial workers	0.74 (2.7)¤¤	0.71 (2.8)¤¤	0.50 (2.5)¤¤
v_1	-5.44 (7.4)¤¤	-5.53 (7.9)¤¤	-1.18 (3.1)¤¤
-Log likelihood	1453.6		

a) absolute t-statistics in parentheses;

b) because of lack of observations we could not estimate this coe¢cient

¤ (¤¤) = signi…cantly di¤erent from zero at 10% (5%) level

IZA Discussion Papers

No.	Author(s)	Title	Area	Date
385	A. Ichino R. T. Riphahn	The Effect of Employment Protection on Worker Effort: A Comparison of Absenteeism During and After Probation	1	11/01
386	J. Wagner C. Schnabel A. Kölling	Threshold Values in German Labor Law and Job Dynamics in Small Firms: The Case of the Disability Law	3	11/01
387	C. Grund D. Sliwka	The Impact of Wage Increases on Job Satisfaction – Empirical Evidence and Theoretical Implications	1	11/01
388	L. Farrell M. A. Shields	Child Expenditure: The Role of Working Mothers, Lone Parents, Sibling Composition and Household Provision	3	11/01
389	T. Beissinger H. Egger	Dynamic Wage Bargaining if Benefits are Tied to Individual Wages	3	11/01
390	T. Beissinger	The Impact of Labor Market Reforms on Capital Flows, Wages and Unemployment	2	11/01
391	J. T. Addison P. Teixeira	Employment Adjustment in Portugal: Evidence from Aggregate and Firm Data	1	11/01
392	P. Tsakloglou F. Papadopoulos	Identifying Population Groups at High Risk of Social Exclusion: Evidence from the ECHP	3	11/01
393	S. M. Fuess, Jr.	Union Bargaining Power: A View from Japan	2	11/01
394	H. Gersbach A. Schniewind	Awareness of General Equilibrium Effects and Unemployment	2	11/01
395	P. Manzini C. Ponsatí	Stakeholders, Bargaining and Strikes	6	11/01
396	M. A. Shields S. Wheatley Price	Exploring the Economic and Social Determinants of Psychological and Psychosocial Health	5	11/01
397	M. Frondel C. M. Schmidt	Evaluating Environmental Programs: The Perspective of Modern Evaluation Research	6	11/01
398	M. Lindeboom F. Portrait G. J. van den Berg	An Econometric Analysis of the Mental-Health Effects of Major Events in the Life of Elderly Individuals	5	11/01
399	J. W. Albrecht J. C. van Ours	Using Employer Hiring Behavior to Test the Educational Signaling Hypothesis	1	11/01